

# PHD-SURVEY VUB 2019

## REPORT

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# Table of Contents

INTRODUCTION .....	4
<b>1. METHODOLOGY .....</b>	<b>5</b>
1.1 POPULATION .....	5
1.2 RESPONSE .....	6
1.3 INSTRUMENT .....	7
1.4 WEIGHT BY GENDER.....	7
<b>2. PERSONAL CHARACTERISTICS .....</b>	<b>9</b>
2.1 GENDER .....	9
2.2 GENDER OF THE SUPERVISOR.....	9
2.3 NATIONALITY.....	10
2.4 DOCTORAL SCHOOLS.....	11
2.5 PHASE OF PHD .....	11
2.6 PREVIOUS WORK SITUATION .....	12
2.7 TYPE OF CONTRACT.....	13
2.8 SELF-EFFICACY .....	14
2.9 MOTIVATION.....	16
2.9.1 FREQUENCIES .....	16
2.9.2 SIX TYPES OF MOTIVATION .....	18
2.9.3 MOTIVATION BY BACKGROUND CHARACTERISTICS .....	18
2.10 TIME-PRESSURE .....	24
2.11 CULTURE: LEVEL OF COMPETITION .....	27
2.12 PASSIONATE ABOUT PHD.....	30
2.13 EXPECTING TO WORK IN ACADEMIA IN THE FUTURE .....	32
2.14 WORK FAMILY BALANCE .....	34
2.15 HAVING A RESEARCH PLAN .....	37
<b>3. CONSTITUENT VARIABLES OF JOB SATISFACTION .....</b>	<b>40</b>
3.1 SATISFACTION WITH WORK ENVIRONMENT .....	40
3.1.1 WARMTH OF THE WORKING ENVIRONMENT .....	42
3.1.2 LABOUR CONDITIONS .....	46
3.1.3 STRUCTURAL ISSUES.....	50
3.2 SATISFACTION WITH SUPERVISOR .....	53
3.2.1 SUPPORT OF SUPERVISOR.....	54
3.2.2 FREEDOM OF SUPERVISOR.....	58
3.3 PERCEIVED OBSTACLES .....	61
3.3.1 PERSONAL OBSTACLES .....	62
3.3.2 RESEARCH RELATED OBSTACLES.....	66
3.4 PHD ON THE RIGHT TRACK .....	69
3.5 SUBMITTING PHD SUCCESSFULLY .....	73

4.	<u>INTEGRATED APPROACH: LATENT CLASS ANALYSIS .....</u>	<u>78</u>
4.1	CLUSTER DETERMINATION.....	78
4.2	CLUSTER IDENTIFICATION .....	81
	<u>CONCLUSION .....</u>	<u>92</u>
	<u>REFERENCES .....</u>	<u>95</u>
	<u>APPENDIX .....</u>	<u>96</u>
	APPENDIX 1: PRINCIPAL COMPONENT ANALYSES .....	96

# Introduction

In 2017, the Researcher Training & Development Office (RTDO) of the Vrije Universiteit Brussel (VUB) organized a pilot study to measure the working conditions and job satisfaction of PhD candidates enrolled at the VUB. Two goals were central in this study. Firstly, the RTDO aimed at **gaining more insight into the needs of the PhD candidates** and wanted to measure to what extent these needs were met. Furthermore, the study was meant to **identify PhD candidates that potentially needed some help** to improve their work quality and increase the probability to successfully complete their PhD. This pilot study comprised three faculties. In 2018, the same study was conducted but this time on a bigger scale: PhD candidates of all faculties at the VUB were included. In addition to that, a third goal of the PhD survey was delineated. The results of the survey are meant as **a self-evaluation tool for the respondents**. After completing the survey, the respondents were able to look into their personal results and compare their position to those of their peers.

In 2019, the study was organized again. The three main goals remained the same. However, this report intends to give a deeper and analytically stronger insight in the experience of PhD candidates, contrary to the two previous reports which were rather descriptive. More emphasis will be put on the variables that directly influence the work satisfaction of the respondents, while discarding the descriptive overview of background characteristics that do not contribute to this. Moreover, the cluster analysis will be accentuated: what different types of respondents can be distinguished when it comes to job satisfaction and what characterizes these groups in terms of background variables?

In the first chapter of the report, the methodology of the study is elaborated. Next, the background characteristics of the respondents are discussed. In the third chapter, the constituent variables of job satisfaction are explained and analysed in terms of the background characteristics discussed in the previous chapter. The fourth chapter covers the clustering. The construction of the clusters based on the constitutive variables of job satisfaction is stated, as well as the background variables that characterize each different cluster.

# 1. Methodology

## 1.1 Population

This research was conducted among a segment of the PhD candidates enrolled at the VUB. All eight faculties were included in the study:

- The faculty of Arts and Philosophy
- The faculty of Economic and Social sciences & Business Solvay School
- The faculty of Engineering sciences
- The faculty of Law & Criminology
- The faculty of Medicine & Pharmacy
- The faculty of Psychology & Educational sciences
- The faculty of Sciences & Bio-science Engineering
- The faculty of Physical Education & Physiotherapy

Some of the respondents are doing an interdisciplinary PhD and do not belong exclusively to one faculty. It has to be noted that this group only consists out of 6 PhD candidates. Consequently, the percentages of these doctoral candidates can fluctuate easily and are not always representative.

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 doctoral candidates were invited via email to participate. In total, 1586 PhD candidates were invited.

## 1.2 Response

Of the 1586 invited PhD candidates, 713 (45%) started to fill out the survey. In table 1.2.1 the response rate is presented. 665 respondents (41,9%) finished the survey entirely. 48 candidates (3%) filled it out only partially. Note that three respondents follow a non-PhD track, so these respondents are not taken into account for every analysis. 387 of the respondents (54,3%) already took part in the survey of last year. The distribution of these PhD candidates over the different faculties can be found in the Appendix.

*Table 1.2.1: Partial and complete response*

	<b>N</b>	<b>In %</b>
<b>Partial</b>	48	3,0
<b>Complete</b>	665	41,9
<b>Total</b>	713	45,0

The response rates between the different faculties are presented in table 1.2.2. The faculty of Physical Education and Physiotherapy has the highest response rate with 60,3%. The faculty with the lowest response rate is the faculty of Law and Criminology (30,2%). The doctoral school of Natural Sciences & (bioscience) Engineering (NSE) has that highest response rate (48,9%), whereas the doctoral school of Human Sciences (DSh) has the lowest (42,0%).

*Table 1.2.2: Total response rate per faculty and doctoral school (based on student administration data)*

	<b>N</b>	<b>In %</b>
<b>Human Sciences (DSh)</b>	<b>266</b>	<b>42,0</b>
Arts & philosophy	70	42,9
Economic & social sciences & business Solvay school	110	42,8
Law and criminology	29	30,2
Psychology & educational sciences	57	48,3
<b>Natural Sciences &amp; (bioscience) Engineering (NSE)</b>	<b>305</b>	<b>48,9</b>
Sciences & bio-science engineering	138	47,3
Engineering sciences	167	50,3
	<b>142</b>	<b>43,2</b>

## Life Sciences & Medicine (LSM)

Medicine & pharmacy	104	39,1
Physical education & physiotherapy*	38	60,3
<b>Total</b>	<b>713</b>	<b>45,0</b>

\* The faculty of Physical education & Physiotherapy belongs both to DSh and LSM, depending on the research subject. Since respondents can only be divided in one Doctoral Schools, this faculty was fully assigned to LSM, as the biggest group is doing more medical-related research.

### 1.3 Instrument

The research consisted of one single questionnaire (see technical report for more detail on the questions). The questionnaire was available on the MOTUS-website ([www.motusresearch.io](http://www.motusresearch.io)). The respondents received an invitation email in which they could find a link to the website. In the same email, they were provided with their personal username and password with which they could login. Upon logging in, the respondent got directed to an information page. Here they could read the basic information about the study and could find the links to more specific pages, such as a FAQ-page, a page about the privacy concerns and page with contact information. Except for the basic information, this additional information was only shown on demand. After finishing the questionnaire, the respondents were shown a thank you-page. Moreover, they were sent an email to confirm their successful participation. This online information can be found in the technical report.

### 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 analyses of the PhD survey in 2017 and 2018 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.

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 slightly overrepresented in our sample and, as a result, were assigned a lighter weight than their male colleagues. Table 1.4.1 gives an overview of the detailed numbers.

*Table 1.4.1: Weight variables by gender*

	<b>% in population</b>	<b>% in sample</b>	<b>Weight</b>
<b>Female</b>	46,7	48,0	0,97
<b>Male</b>	53,2	51,9	1,03

There was one respondent in the sample whose gender was undefined. To avoid any biases and to ensure that the data of this respondent is fully included in the analyses, they were assigned with a weight of value 1. As a result, the total number of weighted respondents in the analyses will be 714, whereas in reality there were 713 unweighted respondents.



## 2. Personal characteristics

This section zooms in on the background characteristics of the PhD candidates. Apart from personal characteristics, such as gender and nationality, the stage of the PhD trajectory was also taken into account, as well as the way in which the respondent is affiliated to the VUB. Furthermore, this section considers more intrinsic aspects such as the self-efficacy and motivation. The variables described in this chapter will function as the backbone for the next chapters, in which the different aspects that contribute to job satisfaction and the cluster membership will be explained and tested against these background variables.

### 2.1 Gender

There are slightly more male participants than female participants in our survey. This corresponds with the gender-ratio that can be found in the whole population of PhD candidates at the VUB. However, there is a slight overrepresentation of female respondents and an underrepresentation of male respondents. A weight variable was created and will correct for this in the analyses of the data (see section 1.4). In this survey, 48,0% of the respondents is female and 51,9% of the respondents is male. One respondent was indicated as undefined.

*Table 2.1.1: Respondents by gender*

	<b>N</b>	<b>In %</b>
<b>Female</b>	342	48,0
<b>Male</b>	370	51,9
<b>Undefined</b>	1	0,001
<b>Total</b>	713	100

### 2.2 Gender of the supervisor

A newly introduced variable in this survey is the gender of the supervisor. Since this might be an influential factor in the job satisfaction of the PhD candidates, this information was retrieved from the student administration data and included in the survey. The majority of the PhD candidates has a male supervisor (73,4%). 78,1% of the male PhD candidates has a male

supervisor. 21,9% of them has a female supervisor. Among the female PhD candidates there is a higher percentage of female PhD supervisors (31,6%). 68,4% has a male supervisor.

Table 2.2.1: Gender of supervisor by gender of PhD candidate

	Male supervisor		Female supervisor	
	N	%	N	%
Male PhD candidate	289	78,1	81	21,9
Female PhD candidate	234	68,4	108	31,6
<b>Total</b>	<b>523</b>	<b>73,4</b>	<b>189</b>	<b>26,6</b>

$\chi^2=8,5$  df=1 p<0,01

In the analyses, it was not only tested whether having a male or a female supervisor is a significant factor in job satisfaction, but also whether the combination between the gender of the PhD candidate and the gender of the supervisor plays a role in the job satisfaction. However, this interaction effect did not show any significant effect.

### 2.3 Nationality

The majority of the respondents has the Belgian nationality (51,1%). Almost one third of the sample have their roots outside of Europe (31,4%) and a smaller portion (17,5%) is European but not Belgian. There is a slight underrepresentation of the Belgian PhD candidates and a slight overrepresentation of the European (non-Belgian) PhD candidates. The non-European PhD candidates are also overrepresented in this sample. The faculty of Medicine and Pharmacy has the highest percentage of Belgian PhD candidates (72,8%). The faculty of Psychology and educational sciences has the largest share of non-European candidates (46,4%). All the data on nationality is based on student administration data.

Table 2.3.1: Respondents by nationality

	participated		In population
	N	In %	In %
Belgian	364	51,1	52,4
European, non-Belgian	125	17,5	18,8
Non-European	224	31,4	28,8
<b>Total</b>	<b>713</b>	<b>100</b>	<b>100</b>

## 2.4 Doctoral Schools

The VUB has three doctoral schools: the Doctoral School of Human Sciences (DSh), the Doctoral School of Natural Sciences & (bioscience) Engineering (NSE) and the Doctoral School of Life Sciences and Medicine (LSM). The doctoral school of NSE is represented the most in our sample, with 42,2% of the respondents. The second biggest group is the DSh (37%). The smallest doctoral school is LSM (19,9%), which is in line with the actual percentage of the total population. Six respondents are interdisciplinary and do not belong to a specific faculty or doctoral school. As mentioned before, it should be kept in mind that the outcomes of this small group might not be representative and can fluctuate easily.

*Table 2.4.1: Respondents by doctoral school*

	N	In %
DSH	264	37,0
NSE	301	42,2
LSM	142	19,9
Interdisciplinary	6	0,80
<b>Total</b>	<b>713</b>	<b>100</b>

## 2.5 Phase of PhD

Completing a PhD is a long process that takes several years. During the trajectory, the PhD candidate goes through several phases. These phases are not clearly defined but are rather intuitive. The trajectory was divided in three stages: the starting phase (developing the research plan and design, reading about the subject), the executing phase (executing the research plan, working on experiments, gathering data...) and the finalizing phase (the writing up phase). The respondents were asked in which phase they felt like they currently are. The majority indicated to be in the executing phase (52 %). This is normal, considering that this stage takes the longest and is the core phase of the PhD process. 30,8% is in the finalizing phase. The smallest portion of the respondents is currently in the starting phase of their PhD (17,2%).

Compared to the PhD survey of last year, there are less PhD candidates in the starting phase (20,3% in 2018) and more in the finalizing phase (27,8% in 2018). The number of respondents in the executing phase remained approximately the same (51,9% in 2018).

*Table 2.5.1: Respondents by phase in the PhD trajectory*

	<b>N</b>	<b>In %</b>
<b>Starting phase</b>	117	17,2
<b>Executing phase</b>	354	52,0
<b>Finalizing phase</b>	210	30,8
<b>Missing</b>	32	
<b>Total</b>	713	100

## 2.6 Previous work situation

Table 2.6.1 shows us that the majority of the PhD candidates does not have any prior work experience (57,2%). 35,6% did have another job prior to their PhD, usually for about 1 to 3 years (10,4%) or more than three years (9,1%). A smaller portion (7,2%) still has another job while working on their PhD. Most of them have been doing this job for over three years (5,3%).

*Table 2.6.1: Respondents by previous work experience*

	<b>N</b>	<b>In %</b>
<b>No</b>	<b>407</b>	<b>57,2</b>
<b>Yes</b>	<b>253</b>	<b>35,6</b>
Less than 6 months	20	2,8
Between 6 months and 1 years	52	7,3
Between 1 years and 3 years	74	10,4
More than 3 years	65	9,1
<b>I still have another job</b>	<b>51</b>	<b>7,2</b>
Less than 6 months	4	0,6
Between 6 months and 1 year	1	0,1
Between 1 year and 3 years	8	1,2
More than 3 years	38	5,3
<b>Missing</b>	<b>2</b>	
<b>Total</b>	<b>713</b>	<b>100</b>

## 2.7 Type of contract

The majority of the PhD candidates has funding (58,5%): 25,1% is funded through a personal mandate (the funding was assigned to them personally) and 33,4% is funded through project funding (the funding was assigned to their supervisor). Furthermore, 14,2% of the PhD candidates is a teaching assistant. 14,4% doesn't have a contract and 8,6% has an "other" type of contract.

*Table 2.7.1: Respondents by type of contract*

	<b>N</b>	<b>In %</b>
Teaching assistant	101	14,2
Personal mandate	179	25,1
Project funding	238	33,4
I don't have a contract	103	14,4
Other	61	8,6
Don't know	31	4,3
<b>Total</b>	<b>713</b>	<b>100</b>

Table 2.7.2 zooms in on the respondents that are funded through project funding. 67,9% says their funding is related to their doctoral research. More than one fifth of the respondents (22,4%), however, indicates that they are also involved in other projects next to their doctoral (funded) project. Almost 10% of the respondents says that their funding is not related to their PhD project (9,7%).

*Table 2.7.2: Project funding related to doctoral research*

	<b>N</b>	<b>In %</b>
<b>Yes</b>	161	67,9
<b>Yes, but I'm also involved in other projects</b>	53	22,4
<b>No</b>	23	9,7
<b>Missing</b>	1	
<b>Total</b>	<b>237</b>	<b>100</b>

## 2.8 Self-efficacy

Self-efficacy is an important factor to take into consideration when talking about job satisfaction. Self-efficacy can be defined as “the belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations” (Bandura, 1977). Note that in the two previous reports, self-efficacy was treated as a variable that actively contributed to job satisfaction. In this report, it was decided to treat self-efficacy as a background variable. The level of self-efficacy someone has is an intrinsic asset and not an aspect of the job. The level of job satisfaction may of course differ between people with different levels of self-efficacy (just like for example it may differ between women and men), but self-efficacy on itself does not constitute to the level of job satisfaction. This is why in this report it is treated as a (passive) background variable instead of as an active, constituent variable of job satisfaction.

To measure the level of self-efficacy, the respondents were presented with eight items with which they could agree or disagree on a 5-point Likert scale. Table 2.8.1 shows the answers given on each of the items.

*Table 2.8.1: Scores (in %) on different items of self-efficacy (N=679)*

	Strongly/ rather disagree	Neutral	Strongly/ rather agree
In general, I think I can obtain outcomes that are important to me	3,5	14,3	82,2
I will be able to successfully overcome many challenges	4,4	19,9	75,7
I will be able to achieve most of the goals that I have set for myself	7,2	20,2	72,6
I am confident that I can perform many different tasks effectively	7,7	22,1	70,3
I believe I can succeed at almost any endeavour to which I set my mind	11,5	24,0	64,5
When facing difficult tasks, I am certain that I will accomplish them	8,4	27,4	64,2
Even when things are tough, I can perform quite well	8,1	29,9	62,0
Compared to other people, I can do most tasks very well	12,5	40,9	46,5

A principal component analysis was used to reduce the number of variables and compute one variable: self-efficacy. The results of this can be found in de Appendix. In order to look at the level of self-efficacy against some background variables, a sum scale for self-efficacy was computed. The level of self-efficacy varies significantly between men and women. Male PhD candidates report a higher level of self-efficacy (7/10) than female candidates (6,7/10). In terms of nationality there is a difference as well: non-European PhD candidates score higher on self-efficacy (7,3/10) than their Belgian (6,5/10) and other European colleagues (6,9/10). PhD candidates that have another job next to their doctoral research have a significantly higher rate of self-efficacy (7,5/10) than respondents with no prior work experience (6,7/10) and respondents who did have a previous job, but currently don't anymore (7/10). The type of contract PhD candidates have also has an impact on self-efficacy. People without a contract score higher on self-efficacy (7,2/10) than respondents with project funding (6,7/10) or a personal mandate (6,5/10). Moreover, PhD candidates with an "other" type of contract also show more self-efficacy (7,3/10) than respondents with a personal mandate (6,5/10). There is no significant effect between the self-efficacy and the phase of the PhD, and self-efficacy and the doctoral school. On average, PhD candidates score 6,8/10 on self-efficacy.

*Table 2.8.2: Self-efficacy by gender, nationality, previous work experience and type of contract (N=651-679)*

		Level of self-efficacy (on 10)
<b>Gender</b>	Male	7,0 *
	Female	6,7 *
<b>Nationality</b>	Belgian	6,5 *
	European, Non-Belgian	6,9 °
	Non-European	7,3 *°
<b>Previous work experience</b>	No	6,7 *
	Yes	7,0 °
	I still have another job	7,5 *°
<b>Type of contract</b>	Teaching assistant	7,0
	Personal mandate	6,5 *°
	Project funding	6,7 •
	I don't have a contract	7,2 *•
	Other	7,3 °
<b>Total</b>		6,8

\*/°/• indicates a significant difference between two or more categories of one indicator (p<0.05)

## 2.9 Motivation

### 2.9.1 Frequencies

Items to measure the level of motivation were newly introduced in the survey of 2019. In the two previous surveys, there were no variables that took into account the motivation PhD candidates have to do doctoral research. This was later regarded as a shortcoming, because this information could possibly be relevant when talking about work satisfaction. The satisfaction with the PhD trajectory is more than a product of external circumstances; the intrinsic ambition to complete a PhD might be a crucial factor in understanding why people are (not) satisfied with the trajectory.

19 items were included in the survey to get insight in the motivation of PhD candidates. The items were borrowed from a validated scale (Litalien, Guay, & Morin, 2015). The respondents were asked to indicate to what extent these statements correspond to them on a 5-point Likert scale. The results are presented in table 2.9.1.1. The respondents are the most motivated by the will to improve their skills in their field of study (84,7%). 79,5% agreed with the statement that their doctoral studies are consistent with their values. The same percentage is motivated simply by the fact that they really enjoy their field of study. The statement the respondents disagreed with the most is "Because my supervisor will be disappointed if I gave up". Only 12,4% indicated this as a reason to stay motivated for their doctoral studies.



Table 2.9.1.1: Scores (in %) on different items of motivation (N=683)

	Does not correspond at all/corresponds somewhat	Corresponds moderately well	Corresponds well/exactly
Because I want to improve my skills in my field of study	4,5	10,8	84,7
Because doctoral studies are consistent with my values (e.g. curiosity, ambition, success)	6,3	14,2	79,5
Because I really enjoy my field of study	4,9	16,0	79,0
For the pleasure of doing research	9,2	16,7	74,1
For the satisfaction I feel when I surpass myself in my learning activities (e.g. work, presentations)	9,1	17,7	73,2
Because it's important for me to advance knowledge in my field of study	8,9	21,0	70,0
Because I want to improve things	10,5	21,1	68,5
Because my doctoral studies meet my goals and my objectives in life	13,4	21,8	64,8
Because I want to help science move forward	13,2	22,2	64,6
For the satisfaction I have in facing challenges in my studies	12,5	25,0	62,5
Because I have the opportunity to take my first steps in research (e.g. publications, collaborations) while benefitting from supervision	20,8	23,1	56,1
To find a job with good working conditions	21,4	24,0	54,7
Because I want to make the world a better place	26,4	24,5	49,1
Because my doctoral studies are a fundamental part of who I am and my identity	30,4	27,9	41,6
To get a better paying job after graduation	38,6	21,7	39,7
Because I do not want to be perceived as a quitter	48,8	19,4	31,8
Because I have made commitments that I must fulfil (e.g. with funding agencies, employers, collaborators, a research director)	59,6	20,1	30,3
Because I will lose some privileges (e.g. salary, fellowship, etc.) if I quit	66,8	14,8	18,3
Because my supervisor would be disappointed or angry if I gave up	73,1	14,5	12,4

### 2.9.2 Six types of motivation

By using a principal component analysis, 16 items of the scale were reduced to six new variables, each one comprising a specific dimension of motivation. The following three items were not included in the principal component analysis because they did not load strongly enough on any of the newly computed variables: “Because I really enjoy my field of study”, “For the pleasure of doing research” and “Because I will lose some privileges if I quit”. The factor loadings and construction of each variable can be found in Appendix 1.

In table 2.9.2.1, the average scores on each type of motivation are presented. The identified motivation is the most important form of motivation amongst the PhD candidates (7,1/10). After this comes the intrinsic motivation (6,9/10). The external motivation (5,4/10) and introjected motivation (3,5/10) are the least important for the PhD candidates.

*Table 2.9.2.1: Average score on the different types of motivation (N=683)*

		Score on 10
<b>Identified motivation</b>	Improving skills and knowledge	7,1
<b>Intrinsic motivation</b>	For the satisfaction of facing challenges and surpassing myself	6,9
<b>Integrated motivation</b>	Doctoral studies are consistent with values and goals	6,6
<b>Larger contribution</b>	Improving things in science and society	6,5
<b>External motivation</b>	Getting a good job with good working conditions	5,4
<b>Introjected motivation</b>	Not wanting to break commitments or being perceived as a quitter when giving up doctoral studies	3,5

### 2.9.3 Motivation by background characteristics

To get a deeper insight in the motivation of the PhD candidates, the different types of motivation were examined in relation to several background characteristics. Table 2.9.3.1 shows that the **intrinsic motivation** varies significantly between people with different previous work experiences. PhD candidates that have another job while working on their PhD are more motivated by facing challenges and surpassing themselves during their studies (7,7/10) than people without any previous job experience (6,8/10). The level of self-efficacy is also positively correlated: the higher the self-efficacy, the higher PhD candidates score on intrinsic motivation

and vice versa. Other variables that were also tested for are gender, the phase of the PhD, doctoral schools, the type of contract and nationality, but there was no significant effect of these variables on the intrinsic motivation.

*Table 2.9.3.1: Intrinsic motivation by previous work experience and self-efficacy (N=675-681)*

		Intrinsic motivation (on 10)
<b>Previous work experience</b>		
	No	6,8 *
	Yes	6,9
	I still have another job	7,7 *
<b>Self-efficacy</b>		
	Low	6,3 *
	Median	7,0 *
	High	7,6 *
<b>Total</b>		6,9

\* / ° indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

Table 2.9.3.2 zooms in on the **integrated motivation**, meaning the extend in which PhD candidates see their doctoral studies as a part of their identity and consistent with their values and goals in life. This varies significantly between people with different nationalities. Non-European PhD candidates score higher on integrated motivation (7,2/10) than their Belgian colleagues (6,2/10) and other European respondents (6,5/10). Considering the work experience, the same trend as with the intrinsic motivation appears: PhD candidates who currently have another job score higher on integrated motivation (7,7/10) than the other two groups (6,5/10). Moreover, the higher the level of self-efficacy, the higher the PhD candidate scores on integrated motivation. Other variables that were also tested for are gender, the phase of the PhD, doctoral schools and the type of contract, but there was no significant effect of these variables on the integrated motivation.

*Table 2.9.3.2: Integrated motivation by nationality, previous work experience and self-efficacy (N=675-683)*

		Integrated motivation (on 10)
<b>Nationality</b>		
	Belgian	6,2 *
	European, Non-Belgian	6,5 °
	Non-European	7,2 *°

<b>Previous work experience</b>			
	No	6,5	*
	Yes	6,5	°
	I still have another job	7,7	*°
<b>Self-efficacy</b>			
	Low	5,8	*
	Median	6,8	*
	High	7,3	*
<b>Total</b>		6,6	

\*/° indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

When it comes to **identified motivation**, there is a similar trend as with the integrated motivation. Non-European PhD candidates are significantly more motivated because they want to gain skills and knowledge in their field of study (7,7/10) than Belgian (6,7/10) and other European PhD candidates (7,1/10). Moreover, respondents that combine their PhD with another job score higher on identified motivation (7,7/10) than people who never had another job before (7,0/10). The higher the score on self-efficacy, the more identified motivation the PhD candidate has. Other variables that were also tested for are gender, the phase of the PhD, doctoral schools and the type of contract, but there was no significant effect of these variables on the identified motivation.

*Table 2.9.3.3: Identified motivation by nationality, previous work experience and self-efficacy (N=675-683)*

		<b>Identified motivation (on 10)</b>	
<b>Nationality</b>			
	Belgian	6,7	*
	European, Non-Belgian	7,1	°
	Non-European	7,7	*°
<b>Previous work experience</b>			
	No	7,0	*
	Yes	7,3	
	I still have another job	7,7	*
<b>Self-efficacy</b>			
	Low	6,5	*
	Median	7,2	*
	High	7,8	*
<b>Total</b>		7,1	

\*/° indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

Female PhD candidates score higher on **introjected motivation** (3,8/10) than their male colleagues (3,3/10). This means that the negative consequences of quitting, such as being perceived as a quitter or disappointing the supervisor or other people, is a more important reason to stay committed to their PhD for female candidates than it is for male candidates. Also, non-European PhD candidates score higher on this variable (4,0/10) than the Belgian (3,4/10) and other European respondents (3,0/10). Moreover, the further the candidates have progressed within the PhD trajectory, the higher they score on introjected motivation. This is logical in a way, because PhD candidates in the finalizing phase have invested more time and energy in their PhD than people in earlier stages, so there is more at stake when they would quit their PhD. Respondents without a contract score significantly lower on introjected motivation (2,9/10) compared to candidates with a personal mandate (4,0/10). Finally, the PhD candidates that score the lowest on self-efficacy have a significantly higher score on introjected motivation (4,1/10) than those with an average (3,2/10) and high (3,4/10) level of self-efficacy. Between these two last groups, there is no significant difference when it comes to introjected motivation. Other variables that were also tested for are doctoral schools and previous work experience, but there was no significant effect of these variables on the introjected motivation.

*Table 2.9.3.4: Introjected motivation by gender, nationality, phase of the PhD, type of contract and self-efficacy (N=655-683)*

		Introjected motivation (on 10)
<b>Gender</b>	Male	3,3 *
	Female	3,8 *
<b>Nationality</b>	Belgian	3,4 *
	European, Non-Belgian	3,0 °
	Non-European	4,0 *°
<b>Phase of PhD</b>	Starting phase	2,9 *°
	Executing phase	3,5 *
	Finalizing phase	4,0 °
<b>Type of contract</b>	Teaching assistant	3,2
	Personal mandate	4,0 *
	Project funding	3,6
	I don't have a contract, I'm self-financed	2,9 *
	Other	3,6

Self-efficacy			
	Low	4,1	*°
	Median	3,2	°
	High	3,4	*
<b>Total</b>		3,5	

\*/° indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

Table 2.9.3.5 tells us how the amount of **external motivation** varies between several background characteristics. The Belgian PhD candidates are the least motivated by externalities (4,7/10), the non-European respondents the most (6,6/10). Furthermore, the PhD candidates that never had another job before are more motivated by the prospect of being able to acquire a good job after graduating (5,7/10) than the respondents who currently have another job (4,5/10). Zooming in on the doctoral schools, respondents in de Doctoral School of Social Sciences appear to be less motivated by external motives (5,1/10) than the respondents in the Doctoral School of Natural Sciences and (bioscience) Engineering (5,8/10). Respondents with the lowest level of self-efficacy score lower on external motivation (4,9/10) than those with an average (5,7/10) and high score on self-efficacy (5,7/10). Other variables that were also tested for are gender, the phase of the PhD and the type of contract, but there was no significant effect of these variables on the external motivation.

*Table 2.9.3.5: External motivation by nationality, previous work experience, doctoral school and self-efficacy (N=675-683)*

		External motivation (on 10)	
<b>Nationality</b>			
	Belgian	4,7	*
	European, Non-Belgian	5,6	*
	Non-European	6,6	*
<b>Previous work experience</b>			
	No	5,7	*
	Yes	5,3	
	I still have another job	4,5	*
<b>DS</b>			
	DSh	5,1	*
	NSE	5,8	*
	LSM	5,5	
	Interdisciplinary	5,5	

<b>Self-efficacy</b>	Low	4,9	*°
	Median	5,7	°
	High	5,7	*
<b>Total</b>		5,4	

\*/° indicates a significant difference between two or more categories of one indicator (p<0.05)

Lastly, table 2.9.3.6 says something about the motivation found in the **contribution to the greater good**. Male PhD candidates score higher on this type of motivation (6,7/10) than their female colleagues (6,3/10). Non-European PhD candidates are more motivated by the larger contribution of their PhD (7,2/10) than the Belgian respondents (6/10). Furthermore, the respondents that currently have another job next to their PhD show a higher level of this type of motivation (7,3/10) than PhD candidates without any previous work experience (6,3/10). The higher PhD candidates score on self-efficacy, the more motivated they will be due to what they can contribute to the greater good with their PhD. Other variables that were also tested for are the phase of the PhD, doctoral schools and the type of contract, but there was no significant effect of these variables on the motivation through larger contribution.

*Table 2.9.3.6: Motivation through larger contribution by gender, nationality, previous work experience and self-efficacy (N=675-683)*

		<b>Larger contribution (on 10)</b>	
<b>Gender</b>	Male	6,7	*
	Female	6,3	*
<b>Nationality</b>	Belgian	6,0	*
	European, Non-Belgian	6,6	
	Non-European	7,2	*
<b>Previous work experience</b>	No	6,3	*
	Yes	6,7	
	I still have another job	7,3	*
<b>Self-efficacy</b>	Low	5,8	*
	Median	6,4	*
	High	7,5	*
<b>Total</b>		6,5	

\*/° indicates a significant difference between two categories of one indicator (p<0.05)

## 2.10 Time-pressure

Nine items in the questionnaire measured the respondents' experience of time pressure. They were asked to indicate to what extent they agree with the several statements. In table 2.10.1, the results are presented. Almost half of the respondents (48,5%) agrees with the fact that there are not enough hours in the day for them. One third (32,7%) feels as if they can never catch up with their work. Almost 25% says not having the time to do all the things they have to do. However, 70,5% of the respondents (strongly) disagrees with the statement that they frequently have to cancel arrangements they have made.

*Table 2.10.1: Scores (in %) on different items of time pressure (N=670)*

	Strongly/ rather disagree	Neutral	Strongly/ rather agree
There are not enough hours in the day for me	32,1	19,5	48,5
I never catch up with my work	43,4	23,9	32,7
I have no time to do the things I have to do	48,5	26,8	24,6
I have to do more than I want to do	51,4	24,8	23,7
Too much is expected of me	40,6	36,0	23,4
I never have time for myself	59,0	22,1	18,8
More is expected from me than I can handle	57,0	26,4	16,6
I frequently have to cancel arrangements I have made	70,5	18,7	10,8

The nine items on time pressure are strongly linked with one another and have a Cronbach's alpha of 0,90. The principal component analysis can be found in the Appendix.

Table 2.10.2 takes a closer look at the bivariate effects between the background characteristics and time pressure. PhD candidates in the finalizing phase have an average score of 4,6/10 on time pressure. This is significantly more than the candidates in the starting phase, who have a score of 3,9/10. Non-European respondents give their perceived time pressure a score of 3,7/10, whereas the Belgian PhD candidates perceive more time pressure than this group (4,3/10). The same is true for other European respondents (4,4/10). Respondents with a low level of self-efficacy score higher on time pressure (4,8/10) than those with an average (4/10)



and a high (3,5/10) level of self-efficacy. The introjected motivation also plays a role: the higher the level of introjected motivation, the more time pressure a PhD candidate will experience. Finally, PhD candidates with a high level of identified motivation experience significantly less time pressure (3,8/10) than those with an average (4,3/10) or a low (4,3/10) level of identified motivation. Other variables that were also tested for are gender, previous work experience, doctoral schools, the type of contract and the other types of motivation, but there was no significant effect of these variables on the time pressure. In total, the average score on time pressure is 4,2/10

*Table 2.10.2: Time pressure by PhD phase, nationality, self-efficacy, introjected motivation and identified motivation (N=667-671)*

		Time pressure (on 10)
<b>PhD phase</b>		
	Starting phase	3,9 *
	Executing phase	4,0 °
	Finalizing phase	4,6 *°
<b>Nationality</b>		
	Belgian	4,3 *
	European, Non-Belgian	4,4 °
	Non-European	3,7 *°
<b>Self-efficacy</b>		
	Low	4,8 *
	Medium	4,0 *
	High	3,5 *
<b>Introjected motivation</b>		
	Low	3,6 *
	Medium	4,1 °
	High	4,7 *°
<b>Identified motivation</b>		
	Low	4,3 *
	Medium	4,3 °
	High	3,8 *°
<b>Total</b>		4,2

\* / ° indicates a significant difference between two categories of one indicator (p<0.05)

The tasks a doctoral candidate performs play a significant role in the amount of time pressure they perceive. Respondents that said to assist in other projects, next to their own research, score 4,5/10 on time pressure, which is significantly higher than the PhD candidates who do not assist in other projects (3,9/10). In the same line, PhD candidates that cooperate with the

industry or other sectors perceive more time pressure (4,7/10) than the ones who don't (4,1/10). There is no significant difference on the experienced time pressure between PhD candidates who teach and those who don't.

Table 2.10.3: Time pressure by tasks performed (N=670)

		Time pressure (on 10)
<b>Teaching</b>		
	Yes	4,3
	No	3,9
<b>Assisting in other projects/third party services (not related to own research)</b>		
	Yes	4,5 *
	No	3,9 *
<b>Cooperation with industry/other sectors</b>		
	Yes	4,7 *
	No	4,1 *
		Total
		4,2

\* indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

There is a positive correlation between the time of day on which PhD candidates work and the level of time pressure they perceive. There is no significant effect between time pressure and the frequency of working during office hours. People who work during the evening score higher on time pressure (4,6/10) than those who rarely work during the evening (3,7/10). The same is true for people who work at night: those who work after midnight experience more time pressure (4,9/10) than those who don't work after midnight (4/10). PhD candidates that work during the weekend score higher on time pressure (4,6/10) than those who don't work during the weekend (3,7/10) and those who occasionally work during the weekend (4/10). Finally, PhD candidates that are used to working before 8 AM also experience more time pressure (5,2/10) than those who occasionally (4,5/10) or never (3,9/10) do it.

Table 2.10.4: Time pressure by work times (N=644-668)

		Time pressure (on 10)	%
<b>During office hours (8AM-6PM)</b>			
	Never/seldom	3,8	3,4
	Occasionally	4,1	5,1
	Usually/always	4,2	91,5

<b>In the evening (6PM-midnight)</b>				
	Never/seldom	3,7	*	23,7
	Occasionally	4,1		44,6
	Usually/always	4,6	*	31,7
<b>At night (after midnight)</b>				
	Never/seldom	4,0	*	76,8
	Occasionally	4,5		17,8
	Usually/always	4,9	*	5,4
<b>During weekends</b>				
	Never/seldom	3,7	*	25,2
	Occasionally	4,0	°	43,1
	Usually/always	4,6	*°	31,8
<b>In the morning (before 8AM)</b>				
	Never/seldom	3,9	*	72,9
	Occasionally	4,5	*	15,7
	Usually/always	5,2	*	11,4
	Total	4,2		

\*/° indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

## 2.11 Culture: level of competition

In this section, the culture of the work environment is taken into account. Seven statements were incorporated in the questionnaire to measure the respondent's opinion on this matter. 59% agrees with the fact that the emphasis lies on realizing individual goals. 58% thinks the emphasis lies on good relationships with colleagues. A portion of 45,4% feels as if everyone's opinion is taken into account when decisions are made. Even though the majority agrees with the statement that the emphasis lies on realizing individual goals, only 16,6% feels there is a competitive atmosphere in the workplace and barely 8% says colleagues consider each other as competitors.

*Table 2.11.1: Scores (in %) on different items of culture (N=668)*

	Strongly/rather disagree	Neutral	Rather/totally agree
<b>The emphasis lies on realizing individual goals</b>	12,7	27,8	59,4
<b>The emphasis lies on good relationships with colleagues (-)</b>	12,1	30,4	57,5
<b>When decisions are made, everyone's opinion is taken into account (-)</b>	17,2	37,4	45,4

More decisions are made informally than during formal meetings	18,4	45,4	36,2
There are only a limited number of people involved in the decision-making process	25,1	40,6	34,3
There is a competitive atmosphere within the research team	53,7	29,3	16,9
Colleagues consider each other as competitors	66,5	25,4	8,1

Further analysis to construct a scale on 'work culture' based on these items showed that all items except one can be included. The item – “the emphasis lies on realizing individual goals” – was excluded from the analysis because it did not load strongly enough on the component. Based on this analysis, a new variable was created. The newly created variable says something about the **competitiveness** of the culture of the workspace. The higher a respondent scores on this variable, the more competition they experience in the work culture. The principal component analysis can be found in the Appendix.

Table 2.11.2 says something about how the perceived competitiveness in the working culture varies between different background characteristics. Respondents in the NSE report a lower level of competitiveness (3,9/10) than the PhD candidates in the doctoral school DSh (4,3/10) and LSM (4,4/10). Moreover, Belgian PhD candidates experience more competition (4,4/10) than their non-European colleagues (4/10). PhD candidates with a low score on self-efficacy experience more competition in the working culture (3,7/10) than those with an average and those with a high score (4/10). PhD candidates with a high score on identified motivation will perceive the working culture as less competitive (3,8/10) compared to those with an average (4,3/10) or low (4,5/10) score on identified motivation. Having a low score on integrated motivation results in a higher level of experienced competition (4,5/10) than having an average (4,1/10) or high score (4,0/10) on integrated motivation. A high score on intrinsic motivation leads to less perceived competition (4,1/10) than a low score (4,4/10). Respondents who are not that motivated by the fact that they can contribute something with their PhD rate the level of competitiveness in their working culture higher (4,4/10) than those who are averagely (4/10) or highly (4,1/10) motivated through the larger contribution of their PhD. Finally, a high score on introjected motivation generates a higher sense of competition (4,4/10) than a low score on this variables (4/10). Other variables that were also tested for are gender, previous work

experience, the phase of the PhD, the type of contract, nationality and the other types of motivation but there was no significant effect of these variables on the perceived competition.

*Table 2.11.2: Competition by background variables (n=665-669)*

		Competition (on 10)
<b>Doctoral School</b>		
	DSh	4,3 *
	NSE	3,9 *°
	LSM	4,4 °
	Interdisciplinary	4,7
<b>Nationality</b>		
	Belgian	4,4 *
	European, non-Belgian	4,1
	Non-European	4,0 *
<b>Time pressure</b>		
	Low	3,7 *
	Medium	4,1 *
	High	4,6 *
<b>Self-efficacy</b>		
	Low	4,5 *°
	Medium	4,0 °
	High	4,0 *
<b>Identified motivation</b>		
	Low	4,5 *
	Medium	4,3 °
	High	3,8 *°
<b>Integrated motivation</b>		
	Low	4,5 *°
	Medium	4,1 *
	High	4,0 °
<b>Intrinsic motivation</b>		
	Low	4,4 *
	Medium	4,0
	High	4,1 *
<b>Motivation through larger contribution</b>		
	Low	4,4 *°
	Medium	4,0 *
	High	4,1 °
<b>Introjected motivation</b>		
	Low	4,0 *
	Medium	4,1
	High	4,4 *
	<b>Total</b>	<b>4,2</b>

\*/° indicates a significant difference between two categories of one indicator (p<0.05)

## 2.12 Passionate about PhD

The PhD candidates were asked to what extent they are passionate about their research on a scale from one to ten. The answers were divided in three groups. The majority of the candidates gives their level of passion a score of eight or higher (66,3%). 28,4% is situated in the intermediate group and rates their level of passion as either six or seven out of ten. 5,3% has a low level of passion and gave a score of five or lower.

*Table 2.12.1: Respondents by level of passion for the research*

	Passionate about PhD research	
	N	In %
High level of passion (8-10)	453	66,3
Intermediate level of passion (6-7)	194	28,4
Low level of passion (0-5)	36	5,3
Missing	30	
<b>Total</b>	<b>713</b>	<b>100</b>

Table 2.12.2 compares the level of passion by several background characteristics. People who combine their doctoral studies with another job are more likely to be passionate about their research (8,6/10) than respondents without any previous work experience. Furthermore, non-European PhD candidates indicate a higher level of passion (8,4/10) than Belgian PhD candidates (7,6/10). PhD candidates with a low level of time pressure are more passionate about their research (8,2/10) than those who experience a lot of time pressure (7,7/10). The more self-efficacy one has, the more passionate they are about their research. The same effect is true for the identified motivation, intrinsic motivation, integrated motivation and motivation through larger contribution. For the introjected motivation there is an opposite effect: the group with the lowest score on integrated motivation has more passion (8,3/10) than those with an average (8,0/10) or high score on integrated motivation (7,6/10). On average, doctoral candidates give their passion a 7,9 on 10. Other variables that were also tested for are the phase of the PhD, doctoral schools, the type of contract, external motivation and the perceived competition, but there was no significant effect of these variables on the level of passion for the research.

Table 2.12.2: Level of passion for the research by significant background variables (N=667-684)

		Passionate about PhD research (on 10)	
<b>Previous work experience</b>			
	No	7,8	*
	Yes	8,0	°
	I still have another job	8,6	*°
<b>Nationality</b>			
	Belgian	7,6	*
	EU, non-Belgian	8,0	
	Non-EU	8,4	*
<b>Time pressure</b>			
	Low	8,2	*
	Medium	7,9	
	High	7,7	*
<b>Self-efficacy</b>			
	Low	7,3	*
	Medium	8,0	*
	High	8,6	*
<b>Identified motivation</b>			
	Low	7,0	*
	Medium	8,0	*
	High	8,8	*
<b>Intrinsic motivation</b>			
	Low	7,1	*
	Medium	7,7	*
	High	8,4	*
<b>Motivation through larger contribution</b>			
	Low	7,2	*
	Medium	8,0	*
	High	8,7	*
<b>Integrated motivation</b>			
	Low	7,0	*
	Medium	7,9	*
	High	8,8	*
<b>Introjected motivation</b>			
	Low	8,3	*°
	Medium	8,0	°
	High	7,6	*
<b>total</b>		7,9	

\* indicates a significant difference between two categories of one indicator (p<0.05)

### 2.13 Expecting to work in academia in the future

To gain insight in the future plans of the PhD candidates, they were asked to what extent they expect to work in academia (at the VUB or any other academic institution) after obtaining their PhD. 35,6% expect to work in academia. This is a slightly bigger group than the ones who indicated not expecting to work in academia (33,5%). 30,8% is undecided.

*Table 2.13.1: Respondents by expectation to work in academia after graduation*

	Expecting to work in academia	
	N	In %
Not at all	81	12,2
Rather not	141	21,3
Somewhat	204	30,8
To a large extend	149	22,5
Definitely	87	13,1
Missing	51	
<b>Total</b>	<b>713</b>	<b>100</b>

Since the opinions are scattered between expecting to work in academia, not expecting to work in academia and being undecided about it, it can be interesting to look at how the responses are related to some background characteristics. As shown in table 2.13.2, 31,2% of all the respondents with no prior work experience expects to work in academia after obtaining their PhD. This is a significantly lower amount than the group of respondents with previous job experience, where 37,8% expects to work in academia. Amongst the PhD candidates that combine their doctoral studies with another job, 59,2% expects to work in academia thereafter. It is striking that among the respondents who currently don't have another job, the answers are rather divided between the answer categories, whereas the doctoral candidates with another current job are clearly more inclined to expecting to work in academia.

There is also a significant difference between the nationalities. Almost half of the Belgian candidates does not expect to work in academia after graduating (46,7%). Other European PhD candidates are more undecided: the biggest group (39,7%) says to 'somewhat' expect to work in academia. One in three does expect to work in academia. 62,3% of the non-European candidates expects to work in academia after obtaining their PhD. PhD candidates with a low



level of self-efficacy tend not to expect to work in academia (40,8%), whereas half of the respondents with a high level of self-efficacy does expect an academic career (50%). When PhD candidates have a low level of integrated motivation, they are more inclined to not expecting to work in academia later on (54,4%). A higher score on integrated motivation on the other hand means a higher expectation to work in academia (54,9%). The opinion of people with an average level of integrated motivation is more divided. For the identified and intrinsic motivation, the same tendency as with the integrated motivation occurs. The same is true for the motivation through larger contribution. Other variables that were also tested for are gender, the phase of the PhD, doctoral schools, the type of contract, the other types of motivation, time pressure, the level of passion for the research and the perceived of competition but there was no significant effect of these variables on the expectation to work in academia.

Table 2.13.2: Expecting to work in academia after PhD (in %) by background variables (n=661-663)

		Not at all/ rather not	Somewhat	To a large extend/ definitely
<b>Previous work experience</b>				
	No	37,1	31,7	31,2
	Yes	31,5	30,7	37,8
	I still have another job	14,3	26,5	59,2
$\chi^2=17,5$ df=4 p<0,001				
<b>Nationality</b>				
	Belgian	46,7	32,9	20,4
	EU, non-Belgian	28,1	39,7	32,2
	Non-EU	15,5	22,2	62,3
$\chi^2=110,6$ df=4 p<0,001				
<b>Self-efficacy</b>				
	Low	40,8	35,0	24,2
	Medium	35,8	29,1	35,0
	High	21,5	28,5	50,0
$\chi^2=32,7$ df=4 p<0,001				
<b>Integrated motivation</b>				
	Low	54,4	28,2	17,5
	Medium	32,4	34,0	33,6
	High	14,9	30,2	54,9
$\chi^2=92,2$ df=4 p<0,001				

<b>Identified motivation</b>				
	Low	50,4	28,1	21,5
	Medium	34,4	34,4	31,2
	High	14,6	30,2	55,2
$\chi^2=80,4$ df=4 p<0,001				
<b>Intrinsic motivation</b>				
	Low	42,8	29,4	27,9
	Medium	39,4	26,3	34,3
	High	26,9	33,0	40,2
$\chi^2=17,8$ df=4 p<0,05				
<b>Motivation through larger contribution</b>				
	Low	44,5	31,4	24,0
	Medium	35,5	29,4	35,3
	High	18,7	32,3	49,0
$\chi^2=40,5$ df=4 p<0,001				

#### 2.14 Work family balance

Five statements were presented to the respondents to measure how satisfied they are with the work-family balance. The PhD candidates were asked to indicate whether or not they agree with these statements. The results are presented in table 2.14.1. The respondents mainly agree with the statement “I have enough influence on my working hours” (81,3%). Moreover, the majority of the respondents does not feel as if they have difficulties matching their work meetings with their family life (78,6%). The aspect that the respondents are the least satisfied with is the opportunity to take time off whenever it suits them. 15,5% of the respondents does not agree that they have enough opportunities to do so, 19,1% is neutral about it.

Table 2.14.1: Scores (in %) on different items of work family balance (N=660-667)

	<b>Strongly/rather disagree</b>	<b>Neutral</b>	<b>Rather/totally agree</b>
<b>I have enough influence on my working hours</b>	6,5	11,1	81,3
<b>I often have meetings at times that are difficult to match with my family situation (-)</b>	78,6	15,1	6,3
<b>The VUB/my supervisor offers sufficient opportunities for employees to adjust their tasks depending on their private situation</b>	7,6	19,4	73,0

I can adjust my working time to my family life	10,5	20,7	68,8
I have ample opportunities to take time off whenever that suits me	15,5	19,1	65,4

Using principal component analysis, the five statements were reduced to one new variable: work-family balance. The results of this analysis can be found in the Appendix.

Table 2.14.2 zooms in on the significant bivariate effects between the work-family balance and some background characteristics. Respondents in the LSM are less satisfied with the work-family balance than the PhD candidates in the NSE. People who combine their doctoral studies with another job are significantly less satisfied with the work family balance of their doctoral studies (6,9/10) compared to people with no prior job experiences (7,9/10) and respondents who did have another job before their doctoral studies (7,7/10). The lower the PhD candidates score on time pressure, the more satisfied they are with the work family balance. The same is true for the competition they perceive in the work culture: the lower they score on this scale, the more satisfied they are with the work family balance. PhD candidates that teach next to doing their research are more satisfied with the work family balance (7,9/10) than those who don't teach (7,5/10). Other variables that were also tested for are the previous work experience, the phase of the PhD, doctoral schools, the type of contract, nationality, self-efficacy, the six types of motivation, the level of passion for the research and the expectation to work in academia but there was no significant effect of these variables on the work-family balance.

*Table 2.14.2: Work-family balance by previous work experience, time pressure and competition (N=667-669)*

		Work-family balance (on 10)	
<b>DS</b>	DSh	7,8	
	NSE	7,9	*
	LSM	7,4	*
	Interdisciplinary	8,2	
<b>Previous work experience</b>	No	7,9	*
	Yes	7,7	°
	I still have another job	6,9	*°

<b>Time pressure</b>	Low	8,5	*
	Medium	7,8	*
	High	7,0	*
<b>Competition</b>	Low	8,2	*
	Medium	7,8	*
	High	7,3	*
<b>Task performed: Teaching</b>	Yes	7,9	*
	No	7,5	*
	Total	7,7	

\*/\* indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

In table 2.14.3, the satisfaction with the work-family balance is compared between the different doctoral schools in relation to the number of children the PhD candidates have. PhD candidates in the doctoral school of LSM with one child are significantly less satisfied with the work-family balance (5,9/10) compared to the childless respondents in the DSh (7,8/10) and the doctoral school of NSE (8/10). The doctoral students in the school of LSM have significantly less children than the other two doctoral schools.

*Table 2.14.3 Work-family balance by DS and having children (N=669)*

		<b>Work-family balance (on 10)</b>	
<b>DSh</b>	No	7,8	*
	1 child	7,9	
	2 or more children	7,3	
<b>NSE</b>	No	8,0	°
	1 child	7,5	
	2 or more children	7,2	
<b>LSM</b>	No	7,6	
	1 child	5,9	*°
	2 or more children	6,9	
<b>Interdisciplinary</b>	No	8,4	
	1 child	-	
	2 or more children	7,9	
Total		7,7	

\*/\* indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

## 2.15 Having a research plan

In this section we look deeper into what portion of the PhD candidates has a research plan and what kind of research plan they have. 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. As shown in table 2.15.1, 43,6% of the PhD candidates has an extensive research plan with short-term as well as long-term milestones. 22,9% has a research plan with solely long-term milestones. The same percentage of PhD candidates indicated to have a research plan with only short-term milestones. 10,6% does not have a research plan at all.

*Table 2.15.1: Respondents by type of research plan*

	N	In %
<b>Research plan with short-term (max. up to 6 months) and long-term (more than 6 months) milestones</b>	299	43,6
<b>Research plan with short-term milestones (max. up to 6 months)</b>	157	22,9
<b>Research plan with long-term milestones (more than 6 months)</b>	157	22,9
<b>No research plan</b>	73	10,6
<b>Missing</b>	27	
<b>Total</b>	713	100

Table 2.15.2 presents how having a research plan is related to background characteristics. Non-European respondents are more inclined to have a research plan (91,5%) compared to the Belgian PhD candidates (81,3%) and the other Europeans (89,6%). Moreover, respondents with an intermediate level of self-efficacy are more likely to have a research plan (93,1%) compared to those with a high level of self-efficacy (90,5%) and a low level of self-efficacy (83,3%). Furthermore, there is a negative correlation between experiencing time pressure and having a research plan. The more motivated PhD candidates are, the more chance they have to have a research plan. This is true for integrated motivation, identified motivation and motivation through larger contribution. The opposite effect appears for introjected motivation: when PhD candidates experience this, they are also less likely to have a research plan. The most passionate PhD candidates do have a research plan. Finally, the more a PhD candidate expects to work in academia after graduating, the more likely they are to also have a research plan.

Table 2.15.2: Having a research plan (in %) by nationality, self-efficacy, time pressure, motivation, level of passion and expecting to work in academia (n= 661-687)

		Having a research plan	Not having a research plan
<b>Nationality</b>			
	Belgian	81,3	14,3
	European, non-Belgian	89,6	8,0
	Non-European	91,5	4,9
$\chi^2=15,6$ df=4 p<0,01			
<b>Self-efficacy</b>			
	Low	83,3	16,7
	Medium	93,1	6,9
	High	90,5	8,9
$\chi^2=15,5$ df=4 p<0,01			
<b>Time pressure</b>			
	Low	92,1	7,9
	Medium	91,3	8,7
	High	83,4	16,1
$\chi^2=11,7$ df=4 p<0,05			
<b>Integrated motivation</b>			
	Low	84,3	15,7
	Medium	90,8	9,2
	High	92,8	6,7
$\chi^2=12,0$ df=4 p<0,05			
<b>Identified motivation</b>			
	Low	82,3	17,7
	Medium	91,8	7,8
	High	94,6	5,4
$\chi^2=22,8$ df=4 p<0,001			
<b>Introjected motivation</b>			
	Low	90,4	9,6
	Medium	92,8	6,8
	High	85,2	14,8
$\chi^2=10,1$ df=4 p<0,05			
<b>Motivation through larger contribution</b>			
	Low	83,3	16,7
	Medium	91,8	8,2
	High	93,7	5,9
$\chi^2=17,9$ df=4 p<0,001			

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**Level of passion for the research**

Low	77,8	22,2
Medium	86,1	13,9
High	91,8	7,9

$\chi^2=11,4$  df=4 p<0,05

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**Expecting to work in academia**

Low	83,8	16,2
Medium	90,7	9,3
High	92,8	6,8

$\chi^2=13,0$  df=4 p<0,05

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### 3. Constituent variables of job satisfaction

In this chapter, five variables that contribute to the job satisfaction of PhD candidates will be discussed:

- The satisfaction with the work environment
- The satisfaction with the supervisor
- The perceived obstacles
- Being on the right track with the PhD
- Expecting to submit the PhD successfully

After describing the frequencies of each variable, a multiple regression analysis of the relationship with the background characteristics is presented. The multiple regression analyses exist out of three models. The **first model** comprises all background characteristics except the six types of motivation and the variable on work family balance. These variables were added in the **second model**. The **third model** only includes the background variables with a significant effect. Significant effects of the final model are investigated more thoroughly by looking at the bivariate relationship between the variable and the background characteristic. A variable that was also tested for is the interaction effect between the gender of the PhD candidate and the gender of the supervisor. This did not show any significant effects, so this was not included in any of the models.

#### 3.1 Satisfaction with work environment

The respondents were presented with nine statements about the working environment and one statement about the overall support they receive within the university. The PhD candidates were asked to indicate to what extent they are satisfied with these several aspects. In table 3.1.1, the percentages of each statement are presented. The respondents are the most satisfied with the possibility they get to take time off (82%), the available space in the office (79,2%) and the salary they receive (77,7%). The overall support received within the university is the aspect the PhD candidates are the most dissatisfied with (14,1%). Compared to the results of 2018, the majority of the items gets a higher rate of satisfaction. Please note that



these statements were only presented to the 539 respondents who indicated having a physical workspace at the VUB.

*Table 3.1.1: Scores (in %) on different items of satisfaction with work environment (N=539)*

	Not at all/rather not satisfied	Undecided	Rather/very satisfied
The possibility to go on vacation/take some time off	4,1	13,9	82,0
The available space in the office	13,4	7,4	79,2
Income	7,8	14,5	77,7
The introduction to the research group/department	11,5	12,1	76,4
The training opportunities offered within the university	6,9	21,5	71,6
The available expertise in the department	9,5	18,2	72,4
The infrastructure (lab, materials, programs) to perform your research in a suitable manner	13,5	17,6	68,8
Opportunities to present results to the department	13,0	18,7	68,3
Is the overall support you receive within the university sufficient to develop your research?	14,1	18,7	67,2
The available funding to go to conferences/summer schools	13,4	25,2	61,4

The 10 items on satisfaction with the working environment can be reduced to three new variables: satisfaction with the **warmth of the working environment**, satisfaction with the **labour conditions** (such as wage, holidays etc.) and **the structural issues** of the working environment (infrastructure, available space in the office etc.). The results of the principal component analysis can be found in the Appendix.

Table 3.1.2 shows the correlations between the three newly created components. There is a negative correlation between “structural issues” and the two other variables. This means that a higher score on “structural issues” means that the respondents are less satisfied with the structural aspects, whereas a higher score on the two other variables means higher satisfaction of these aspects.

Table 3.1.2: Correlation between the different components of satisfaction with work environment

	Warmth working environment	Labour conditions	Structural issues
Warmth working environment	1,0	0,32	-0,39
Labour conditions		1,0	-0,31
Structural issues			1,0

### 3.1.1 Warmth of the working environment

In this section, the satisfaction with the warmth of the working environment is tested against the background characteristics discussed in the previous chapter. In table 3.1.1.1, the three models are presented.

In the first model, the satisfaction with the warmth of the working environment can be explained for 21,5% by the different background characteristics. A higher score on self-efficacy leads to more satisfaction with the warmth of the work environment ( $\beta=0,13$ ). When PhD candidates are involved in other projects next to their PhD, they experience more warmth in their work environment ( $\beta=0,09$ ). The satisfaction with the warmth of the working environment varies significantly between the DSh and the doctoral school of NSE. PhD candidates in the DSh are less satisfied with the warmth of the working environment than doctoral candidates in the school of NSE ( $\beta= -0,10$ ). Another negative effect can be found within the competitiveness of the work culture: the more competition the respondents perceive, the less they are satisfied with the warmth of the work environment ( $\beta= -0,37$ ).

In the second model, the six types of motivation and the work family balance-scale were introduced. The effects of model 1 remain significant and more significant differences can be discerned. The intrinsic and introjected motivation appears to have a positive, significant effect. The higher the score on intrinsic and/or introjected motivation, the more satisfied the PhD candidates are with the warmth of the working environment ( $\beta= 0,11$ ). Also time pressure becomes significant. A higher score on time pressure leads to a lower score on the warmth of the work environment ( $\beta= -0,10$ ).

The third model only includes the background variables that have a significant effect on the perceived warmth of the working environment. The effect of the doctoral school was no longer significant, so it is excluded from the model. The same is true for time pressure. In total, 22,2% of the satisfaction with the warmth of the working environment can be explained by these variables. The perceived competitiveness of the working culture has the strongest effect ( $\beta = -0,41$ ), the introjected motivation has the least strong effect ( $\beta = 0,08$ ).

Table 3.1.1.1: Multiple regression between warmth of the working environment and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	B	Sig.	$\beta$	Sig.
<b>Constant</b>						
Gender of PhD candidate (ref.: Male)	-0,023		-0,029			
Gender of supervisor (ref.: Male)	0,058		0,066			
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	-0,013		-0,001			
Non-EU	0,008		-0,014			
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	0,055		0,050			
Finalizing phase	-0,037		-0,045			
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	-0,062		-0,046		-0,077	
Project funding – PhD is only project	0,060		0,064		0,063	
Project funding – also involved in other projects	0,086	*	0,097	*	0,094	*
I don't have a contract, I'm self-financed	0,007		0,027		-0,029	
Other	0,026		0,035		-0,018	
<b>Previous work experience (ref.: No)</b>						
Yes	0,025		0,021			
I still have another job	-0,038		-0,043			
<b>Doctoral School (ref.: NSE)</b>						
DSh	-0,103	*	-0,102	*		
LSM	-0,020		-0,034			
Interdisciplinary	-0,007		-0,005			
<b>Self-efficacy</b>	0,129	**	0,103	*	0,129	**
<b>Time pressure</b>	-0,050		-0,097	*		
<b>Competition</b>	-0,370	***	-0,364	***	-0,406	***
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	-0,061		-0,055			
To a large extend/definitely	0,069		0,055			
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	-0,027		-0,016			
8 or higher	-0,044		-0,039			
<b>Intrinsic motivation</b>			0,107	*	0,117	**
<b>Integrated motivation</b>			-0,071			
<b>Identified motivation</b>			0,085			
<b>Introjected motivation</b>			0,113	*	0,082	*
<b>External motivation</b>			0,002			
<b>Motivation through larger contribution</b>			-0,007			
<b>Work family balance</b>			-0,030			
N		538		526		537
Adjusted R <sup>2</sup>		0,215		0,228		0,222

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

There is no significant effect between the warmth of the working environment and the doctoral schools in combination with the other significant variables, but the bivariate relationship between the two does show a significant effect. Table 3.1.1.2 shows that PhD candidates in the doctoral school of DSh have an average score of 6,7/10, whereas the respondents in the doctoral school of NSE averagely rate the warmth of the environment 7,4/10. An explanation for this could be found in the approach of each field of research. According to McAlphine and Norton (2006), social sciences often have an individualistic approach to research, while natural and health sciences tend to be more in favour of team-based research. The effect of the doctoral schools is explained when controlled for the amount of experienced competition in work culture.

People with a low level of self-efficacy are less satisfied with the warmth of the working environment (6,7/10) compared to the respondents with an average (7,2/10) and high (7,7/10) score on self-efficacy. Moreover, the less PhD candidate perceive the work culture as competitive, the higher they rate the warmth of the working environment. Respondents with a high score on intrinsic motivation find the working environment warmer than those with a low score on intrinsic motivation. There is no significant bivariate effect for the type of contract and the introjected motivation.

*Table 3.1.1.2: Warmth of working environment by doctoral school, self-efficacy, competition and intrinsic motivation (N=537-539)*

		Warmth of working environment (on 10)	
<b>DS</b>	DSh	6,7	*
	NSE	7,4	*
	LSM	7,1	
	Interdisciplinary	7,1	
<b>Self-efficacy</b>	Low	6,7	*°
	Medium	7,2	°
	High	7,7	*
<b>Competition</b>	Low	8,1	*
	Medium	7,1	*
	High	6,1	*

## Intrinsic

Low	6,6	*
Medium	7,2	
High	7,4	*
Total	7,1	

\* / ° indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

### 3.1.2 Labour conditions

This variable says something about how satisfied the PhD candidates are about the available funding, the income, the opportunities to take time off and the available offer of training within the university. Table 3.1.2.1 presents how this aspect of job satisfaction is related to the different background characteristics. Model 1 shows that the PhD candidate belongs to a department that has a high percentage of female employees, the PhD candidate will be less satisfied with the labour conditions of the job ( $\beta = -0,13$ ). Furthermore, there is a significant difference between Belgian PhD candidates and non-European PhD candidates. The non-European respondents are significantly less satisfied with the labour conditions than the Belgian ones ( $\beta = -0,14$ ). Moreover, respondents in the finalizing phase are more satisfied with the working conditions than the PhD candidates who are in the executing phase ( $\beta = 0,09$ ). Self-financed PhD candidates without a contract also show less satisfaction with the labour conditions than PhD candidates with a personal mandate ( $\beta = -0,19$ ). This is not surprising, given the fact that self-financed PhD candidates have less job benefits compared to people who do have a contract. The more time pressure PhD candidates experience, the less satisfied they are with the labour conditions ( $\beta = -0,31$ ). Finally, the more PhD candidates experience competitiveness in the work culture, the lower they score on satisfaction with the labour conditions ( $\beta = -0,21$ ).

After introducing the six types of motivation and the scale on work family balance, the effect of the work family balance appears to be significant: the more satisfied the PhD candidates are with the work family balance, the more they are also satisfied with the labour conditions ( $\beta = 0,22$ ). The more intrinsic motivation PhD candidates have, the more satisfied they will be with the labour conditions as well ( $\beta = 0,10$ ). After the introduction of these new variables, some of the previously significant effects disappear. This is the case for the effects of nationality and

being in finalizing phase. Being in the starting phase, however, becomes significant: these PhD candidates are less satisfied with the labour conditions than those in the executing phase ( $\beta = -0,08$ ). Moreover, the effect of the percentage of female employees in the department is explained by the work-family balance. The more female employees in the department, the less satisfaction there is with the work-family balance.

In the third model, all the significant variables are included. The intrinsic motivation is no longer significant. 25,7% of the satisfaction with the labour conditions can be explained by the significant variables. The work family balance has the strongest effect on the satisfaction with the labour conditions ( $\beta = 0,25$ ), being in the starting phase has the least strong effect ( $\beta = -0,10$ ).

Table 3.1.2.1: Multiple regression between labour conditions and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	$\beta$	Sig.	$\beta$	Sig.
<b>Constant</b>						
Gender of PhD candidate (ref.: Male)	0,077		0,069			
Gender of supervisor (ref.: Male)	0,079		0,078			
% female employees in department	-0,125	*	-0,081			
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	0,020		0,044			
Non-EU	-0,142	**	-0,071			
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	-0,078		-0,082	*	-0,096	*
Finalizing phase	0,085	*	0,074		0,057	
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	0,062		0,070		0,057	
Project funding – PhD is only project	0,056		0,058		0,061	
Project funding – also involved in other projects	-0,011		-0,014		-0,005	
I don't have a contract, I'm self-financed	-0,193	***	-0,201	***	-0,219	***
Other	-0,065		-0,054		-0,052	
<b>Previous work experience (ref.: No)</b>						
Yes	0,017		0,008			
I still have another job	0,022		0,030			
<b>Doctoral School (ref.: NSE)</b>						
DSh	0,013		-0,031			
LSM	-0,029		-0,032			
Interdisciplinary	0,051		0,029			
<b>Self-efficacy</b>	0,002		-0,002			
<b>Time pressure</b>	-0,309	***	-0,202	***	-0,153	**
<b>Competition</b>	-0,211	***	-0,185	***	-0,176	***
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	-0,032		-0,048			
To a large extend/definitely	-0,058		-0,065			
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	0,042		0,024			
8 or higher	-0,005		0,014			
<b>Intrinsic motivation</b>			0,095	*		
<b>Integrated motivation</b>			-0,073			
<b>Identified motivation</b>			-0,073			
<b>Introjected motivation</b>			0,047			
<b>External motivation</b>			-0,017			
<b>Motivation through larger contribution</b>			0,063			
<b>Work family balance</b>			0,220	***	0,251	***
N		538		526		529
Adjusted R <sup>2</sup>		0,237		0,268		0,257

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05



In table 3.1.2.2, the bivariate effects between significant background variables and the satisfaction with labour conditions are presented. PhD candidates in the starting phase are less satisfied with the labour conditions (6,3/10) than the candidates in the executing phase (6,8/10). The type of contract also plays a role. PhD candidates without a contract are significantly less satisfied with the labour conditions (5,5/10) than their peers with a personal mandate (6,9/10), project funding (6,8/10) and the teaching assistants (6,9/10). A lower score on time pressure means more satisfaction with the labour conditions (7,4/10) than an average (6,5/10) or high (6,1/10) amount of time pressure. Respondents who don't experience a lot of competitiveness in the work culture are more satisfied with the labour conditions (7,2/10) than those who perceive the work culture as rather (6,6/10) or very (6,0/10) competitive. Lastly, the more satisfied the PhD candidates are with the work family balance of their job, the more they are satisfied with the labour conditions. On average, the PhD candidates give the labour conditions a score of 6,6/10.

*Table 3.1.2.2: Satisfaction of labour conditions by background variables (N=517-539)*

		Labour conditions (on 10)
<b>Phase of the PHD</b>	Starting phase	6,3 *
	Executing phase	6,8 *
	Finalizing phase	6,5
<b>Type of contract</b>	Teaching assistant	6,9 *
	Project funding	6,8 •
	Personal mandate	6,9 °
	I don't have a contract, I'm self-financed	5,5 **°
	Other	6,2
<b>Time pressure</b>	Low	7,4 *°
	Medium	6,5 *
	High	6,1 °
<b>Competition</b>	Low	7,2 *
	Medium	6,6 *
	High	6,0 *
<b>Work family balance</b>	Low	5,9 *
	Medium	6,6 *
	High	7,3 *
Total		6,6

\* / ° / • indicates a significant difference between two categories of one indicator ( $p < 0.05$ )

### 3.1.3 Structural issues

The variable on structural issues in the workplace says something about the available space in the office and the condition of the infrastructure that is needed to perform the research. Table 3.1.3.1 presents the results of a multiple linear regression on the structural issues in combination with the several background characteristics. The first model explains 12,6% of the variance. The more time pressure PhD candidates experience, the more structural issues they encounter ( $\beta=0,15$ ). The same relation is true for competition: PhD candidates that experience a lot of competitiveness in the working culture will also perceive more structural issues in their workspace ( $\beta=0,25$ ). The respondents that expect to work in academia after obtaining their PhD encounter less structural issues than the ones that “somewhat” expect a career in academia ( $\beta= -0,13$ ). Moreover, the non-European PhD candidates experience less structural issues than the Belgian ones ( $\beta= -0,12$ ). Moreover

After introducing the six types of motivation and the variable on work family balance, 14% of the variance is explained. The effects of nationality, time pressure and competition stay significant. In the second model, having another job next to the PhD research also plays a role: these respondents experience less structural issues than the ones who never had another job before ( $\beta= -0,10$ ). Also, the experienced work family balance is important. The more PhD candidates feel like it is easy to combine work and family, the less structural issues they will encounter at the job ( $\beta= -0,09$ ). The expectation for a future career in academia is no longer a significant predictor for structural issues.

The final model includes all the variables that significantly determine the encountered structural issues. This model explains 14,2%. The more competition PhD candidates experience in the working culture, the more structural issues they will encounter ( $\beta= 0,25$ ). Non-European PhD candidates experience less structural issues compared to the Belgian ones ( $\beta= -0,16$ ). Moreover, expecting to work in academia after graduation leads to less structural issues, compared to the group that “somewhat” expects a future academic career ( $\beta= -0,11$ ). Lastly, the more satisfied PhD candidates are with the work family balance of the job, the less structural issues they will perceive ( $\beta= -0,15$ ). The previous work experience and the time pressure do no longer explain the variation in the experienced structural issues.

Table 3.1.3.1: Multiple regression between structural issues and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	B	Sig.	$\beta$	Sig.
<b>Constant</b>		*		*		***
<b>Gender of PhD candidate (ref.: Male)</b>	0,051		0,052			
<b>Gender of supervisor (ref.: Male)</b>	-0,052		-0,065			
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	-0,055		-0,059		-0,059	
Non-EU	-0,118	*	-0,121	*	-0,160	***
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	0,015		-0,016			
Finalizing phase	-0,077		-0,049			
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	-0,074		-0,084			
<b>Project funding – PhD is only project</b>	-0,043		-0,040			
<b>Project funding – also involved in other projects</b>	-0,052		-0,041			
<b>I don't have a contract, I'm self-financed</b>	-0,012		-0,011			
<b>Other</b>	-0,050		-0,057			
<b>Previous work experience (ref.: No)</b>						
Yes	-0,032		-0,038		-0,026	
I still have another job	-0,086		-0,103	*	-0,090	*
<b>Doctoral School (ref.: NSE)</b>						
DSh	0,007		0,017			
LSM	0,040		0,048			
Interdisciplinary	-0,020		-0,015			
<b>Self-efficacy</b>	-0,014		-0,005			
<b>Time pressure</b>	0,146	**	0,125	*		
<b>Competition</b>	0,250	***	0,233	***	0,247	***
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	-0,069		-0,062		-0,067	
To a large extend/definitely	-0,131	**	-0,102	*	-0,111	*
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	-0,015		-0,016			
8 or higher	0,044		0,044			
<b>Intrinsic motivation</b>			-0,010			
<b>Integrated motivation</b>			-0,048			
<b>Identified motivation</b>			0,005			
<b>Introjected motivation</b>			-0,051			
<b>External motivation</b>			-0,034			
<b>Motivation through larger contribution</b>			0,022			
<b>Work family balance</b>			-0,094	*	-0,145	**
<b>N</b>		538		526		529
<b>Adjusted R<sup>2</sup></b>		0,135		0,140		0,142

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

Table 3.1.3.2 presents the bivariate effects between the structural issues and significant background characteristics. Belgian PhD candidates give an average score of 3,1/10 on structural issues, whereas the non-European PhD candidates rate the structural issues with 2,2/10, which is significantly lower. There is no significant difference between the European (non-Belgian) respondents and other groups. The PhD candidates that expect to work in academia rate the structural issues 2,2/10 on average, significantly lower than people who do not expect to work in academia (2,9/10) and respondents that “somewhat” expect to work in (3,1/10). When PhD candidates experience a low level of competitiveness in the work culture, they encounter fewer structural issues than those who rate the culture as more competitive. Furthermore, when PhD candidates are satisfied with the work family balance of their job, they experience less structural issues (2,4/10) than those who are not that satisfied with the work family balance (3,2/10). There is no significant bivariate effect between structural issues and previous work experience.

*Table 3.1.3.2: Structural issues by nationality, expecting to work in academia, time pressure, competition and work family balance (N=529-539)*

		Structural issues (on 10)
<b>Nationality</b>		
	Belgian	3,1 *
	European, non-Belgian	2,6
	Non-European	2,2 *
<b>Expecting to work in academia after PhD (on 10)</b>		
	Rather not/not at all	2,9 *
	Somewhat	3,1 °
	To a larger extend/definitely	2,2 *°
<b>Competition</b>		
	Low	2,0 *°
	Medium	3,0 *
	High	3,4 °
<b>Work family balance</b>		
	Low	3,2 *
	Medium	2,8
	High	2,4 *
	Total	2,8

\*/° indicates a significant difference between two categories of one indicator (p<0.05)

### 3.2 Satisfaction with supervisor

In the survey, 10 statements were included that investigate how the respondents feel about their supervisor. Table 3.2.1 presents the scores on each of these items. The PhD candidates are the most satisfied with the freedom they get to develop their own research ideas (82,8%), the possibility they have to attend conferences and courses (80,7%) and the expertise their supervisor has on the subject (77,8%). However, they are the least satisfied with the introduction by their supervisor to other prominent researchers in their field of interest (22,2% is not satisfied). Moreover, 18,3% is not (at all) satisfied with the frequency of meetings with their supervisor. The scores on these items remained more or less the same compared to last year. The satisfaction with the frequency of meetings increased with 4%, which was the biggest change.

*Table 3.2.1: Scores (in %) on different items of satisfaction with supervisor (N=668)*

	Not at all/rather not satisfied	Undecided	Rather/very satisfied
The freedom you get to develop your own research ideas	7,0	10,2	82,8
Is your supervisor involved in your research?	11,0	8,2	80,7
The possibility to attend conferences/specialist training courses	7,9	14,2	77,8
The expertise she/he has on the research subject	10,9	12,7	76,3
The quality of meetings	14,2	14,4	71,4
The frequency of meetings	18,3	12,6	69,2
Stimulation/inspiration to solve research problems/issues	12,7	19,3	68,0
The possibility to attend transferable skills training courses	8,1	24,7	67,2
The support you receive in writing articles	12,4	22,2	65,4
The introduction to other prominent researchers in your field of interest by your supervisor(s)	22,2	27,4	50,4

The ten items were reduced to two new variables, using a principal component analysis: **support of the supervisor** and **freedom of the supervisor**. The factor loadings on each of these components can be found in the Appendix. Table 3.2.2 shows the correlations between the two newly computed variables.

Table 3.2.2: Correlation between the different components of satisfaction with the supervisor

	Support supervisor	Freedom supervisor
Support supervisor	1,0	0,44
Freedom supervisor		1,0

### 3.2.1 Support of supervisor

Table 3.2.1.1 presents the variables that help explain the satisfaction with the support of the supervisor. 23% of it can be explained by the first model. The amount of passion PhD candidates have for their research plays a significant role. PhD candidates that score 8 or higher are more satisfied with the support their supervisor provides compared to the middle group with a score of 6 or 7 ( $\beta=0,09$ ). On the contrary, PhD candidates that give their level of passion a score of 5 or lower feel less supported by their supervisor than the middle group ( $\beta= -0,14$ ). Time pressure is a significant factor as well: the less satisfied they are with the support of their supervisor, the more time pressure PhD candidates experience ( $\beta= -0,13$ ). Moreover, the more they perceive the work culture as competitive, the less they feel supported by their supervisor ( $\beta= -0,32$ ).

After introducing the different types of motivation and the work family balance, the explained variance increases to 25,2%. The identified motivation becomes an extra significant factor. The higher the score on identified motivation, the more supported the PhD candidates feel ( $\beta= 0,13$ ). The same is true for introjected motivation ( $\beta=0,11$ ). Moreover, the more satisfied the PhD candidate are with the work family balance, the more they are also satisfied with the support they receive of their supervisor ( $\beta=0,11$ ).

The final model explains 25,3% of the variance in perceived support of the supervisor. Time pressure remains a significant factor ( $\beta= -0,17$ ), as does competition ( $\beta= -0,31$ ), which has the strongest effect. A low amount of passion means feeling less supported by the supervisor ( $\beta= -0,12$ ) whereas a high amount of passion leads to feeling more supported ( $\beta=0,09$ ) – both compared to the middle group. A higher amount of motivation also results in more perceived

support of the supervisor, this is true for identified motivation ( $\beta=0,14$ ) and introjected motivation ( $\beta=0,11$ ).

Table 3.2.1.1: Multiple regression between support of the supervisor and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	$\beta$	Sig.	$\beta$	Sig.
<b>Constant</b>						
Gender of PhD candidate (ref.: Male)	-0,020		-0,023			
Gender of supervisor (ref.: Male)	0,039		0,034			
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	-0,015		0,000			
Non-EU	0,035		0,034			
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	0,049		0,050			
Finalizing phase	-0,019		-0,041			
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	-0,029		-0,029			
Project funding – PhD is only project	0,041		0,043			
Project funding – also involved in other projects	0,014		0,015			
I don't have a contract, I'm self-financed	0,032		0,056			
Other	0,025		0,028			
<b>Previous work experience (ref.: No)</b>						
Yes	0,071		0,056			
I still have another job	0,024		0,034			
<b>Doctoral School (ref.: NSE)</b>						
DSh	-0,012		-0,022			
LSM	0,009		0,012			
Interdisciplinary	-0,025		-0,030			
<b>Self-efficacy</b>	0,002		0,010			
<b>Time pressure</b>	-0,132	***	-0,099	*	-0,173	***
<b>Competition</b>	-0,319	***	-0,290	***	-0,307	***
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	-0,057		-0,059			
To a large extend/definitely	0,055		0,034			
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	-0,138	***	-0,129	**	-0,121	**
8 or higher	0,085	*	0,077		0,088	*
<b>Intrinsic motivation</b>			0,061			
<b>Integrated motivation</b>			-0,032			
<b>Identified motivation</b>			0,126	*	0,137	***
<b>Introjected motivation</b>			0,114	**	0,105	*
<b>External motivation</b>			0,001			
<b>Motivation through larger contribution</b>			-0,070			
<b>Work family balance</b>			0,108	**		
<b>N</b>		668		648		665
<b>Adjusted R<sup>2</sup></b>		0,230		0,252		0,253

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05



Taking a closer look at the bivariate effect of the level of passion on the perceived support of the supervisor, it can be concluded that the more passionate a PhD candidate is about their research, the more they are satisfied with the support of their supervisor. Respondents that gave a score of 5 or lower, averagely score 5,1/10 on the satisfaction with the support of their supervisor. The middle group scores 6,7/10. PhD candidates that rate their level of passion as 8 or higher averagely score 7,4/10 on the support of the supervisor. The less competitiveness respondents experience in the work culture, the higher they rate the support they receive from their supervisor. A higher score on identified motivation leads to more satisfaction with the support from the supervisor. Moreover, PhD candidates that experience a low level of time pressure are more satisfied with the support of their supervisor (7,7/10) than those with an average (7,1/10) or high (6,6/10) amount of time pressure. The introjected motivation does not show a significant bivariate effect.

*Table 3.2.1.2: Support of supervisor by level of passion for research, competition, identified motivation, time pressure and work family balance (653-669)*

		Support supervisor (on 10)
<b>Passionate about PhD (on 10)</b>	5 or lower	5,1 *
	6-7	6,7 *
	8 or higher	7,4 *
<b>Competition</b>	Low	8,1 *
	Medium	7,1 *
	High	6,2 *
<b>Identified motivation</b>	Low	6,4 *
	Medium	7,2 *
	High	7,7 *
<b>Time pressure</b>	Low	7,7 *°
	Medium	7,1 *
	High	6,6 °
Total		7,1

\*/° indicates a significant difference between two or more categories of one indicator ( $p < 0.05$ )

### 3.2.2 Freedom of supervisor

The next section talks about the freedom PhD candidates get from their supervisor. More specifically, this is about the freedom to attend classes and conferences, the freedom to develop their own ideas and to get in touch with other prominent researchers. Table 3.2.2.1 presents the results of the perceived freedom in relation to the several background characteristics. The first model explains 15,2%. The gender of the supervisor plays a role in the perceived freedom. PhD candidates with a female supervisor experience more freedom than the ones with a male supervisor ( $\beta=0,09$ ). However, the higher the percentage of female employees there are in a department, the less satisfied PhD candidates are with the freedom they get from there supervisor ( $\beta= -0,11$ ). Non-European PhD candidates perceive less freedom of their supervisor than their Belgian colleagues ( $\beta= -0,15$ ). When PhD candidates experience a lot of time pressure, they rate the freedom they get from their supervisor lower ( $\beta= -0,20$ ). The same effect is true for competition: when PhD candidates experience a lot of competition in the work culture, they feel as if they receive less freedom from their supervisor ( $\beta= -0,23$ ). PhD candidates that do not expect to work in academia later on perceive the level of freedom as lower compared to the respondents that “somewhat” expect an academic career ( $\beta= -0,09$ ). Finally, when PhD candidates say to have a low level of passion for their research (5 or less), they feel as if they receive less freedom from their supervisor compared to the PhD candidates in the middle group ( $\beta= -0,10$ ).

In the second model, the gender of the supervisor is no longer a significant variable, and neither is time pressure or the percentage of female employees in the department. All these effects disappear after introducing the variable on work family balance. This variable is a significant predictor for the perceived freedom of the supervisor: the more freedom PhD candidates get from their supervisor, the more satisfied they are with the work family balance ( $\beta=0,23$ ). The third model comprises only the significant variables. Time pressure, the percentage of female employees in the department and nationality are no longer significant. This model explains 18% of the perceived freedom of the supervisor.

Table 3.2.2.1: Multiple regression between freedom from supervisor and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	$\beta$	Sig.	$\beta$	Sig.
<b>Constant</b>						
Gender of PhD candidate (ref.: Male)	0,006		0,010			
Gender of supervisor (ref.: Male)	0,091	*	0,073		0,077	*
% female employees in department	-0,110	*	-0,075			
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	0,008		0,026			
Non-EU	-0,151	**	-0,122	*		
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	0,014		-0,001			
Finalizing phase	0,074		0,046			
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	-0,039		-0,042			
Project funding – PhD is only project	-0,038		-0,036			
Project funding – also involved in other projects	-0,017		-0,020			
I don't have a contract	-0,051		-0,022			
Other	-0,041		-0,034			
<b>Previous work experience (ref.: No)</b>						
Yes	0,048		0,025			
I still have another job	-0,002		-0,009			
<b>Doctoral School (ref.: NSE)</b>						
DSh	0,116		0,090			
LSM	-0,019		-0,027			
Interdisciplinary	0,066		0,056			
<b>Self-efficacy</b>	-0,008		-0,004			
<b>Time pressure</b>	-0,197	***	-0,088			
<b>Competition</b>	-0,227	***	-0,184	***	-0,182	***
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	-0,088	*	-0,104	*	-0,110	*
To a large extend/definitely	0,028		-0,002		-0,015	
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	-0,097	*	-0,093	*	-0,106	**
8 or higher	0,010		-0,012		0,018	
<b>Intrinsic motivation</b>			0,007			
<b>Integrated motivation</b>			0,020			
<b>Identified motivation</b>			0,075			
<b>Introjected motivation</b>			0,032			
<b>External motivation</b>			0,005			
<b>Motivation through larger contribution</b>			-0,023			
<b>Work family balance</b>			0,233	***	0,290	***
<b>N</b>		668		648		653
<b>Adjusted R<sup>2</sup></b>		0,152		0,184		0,180

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

As presented in table 3.2.2.2, PhD candidates with a female supervisor are more satisfied with the freedom they receive from their supervisor. Furthermore, respondents who do not expect to work in academia score the freedom received by their supervisor lower than the respondents who do (somewhat) expect an academic career: 6,7/10 compared to 7,4/10 and 7,5/10. In the same line, people that are less passionate about their research give a lower score on the freedom of their supervisor (5,5/10) compared to respondents that are averagely passionate (7,1/10) or very passionate about their research (7,4/10). The less competition the PhD candidates experience in the work culture, the more satisfied they are with the freedom of their supervisor. Lastly, the more satisfied PhD candidates are with the work family balance of their job, the more freedom they experience their supervisor to give them.

*Table 3.2.2.2: Freedom of supervisor by expecting to work in, level of passion for research, competition, time pressure and work family balance (N=653-669)*

		Freedom supervisor (on 10)
<b>Gender supervisor</b>		
	Male	7,1 *
	Female	7,5 *
<b>Expecting to work in academia</b>		
	Rather not/not at all	6,7 *°
	Somewhat	7,4 *
	To a large extend/definitely	7,5 °
<b>Passionate about PhD (on 10)</b>		
	5 or lower	5,6 *°
	6-7	7,0 *
	8 or higher	7,4 °
<b>Competition</b>		
	Low	7,9 *
	Medium	7,2 *
	High	6,5 *
<b>Work family balance</b>		
	Low	6,6 *
	Medium	7,1 *
	High	7,9 *
Total		7,2

\*/° indicates a significant difference between two or more categories of one indicator ( $p < 0.05$ )

### 3.3 Perceived obstacles

In this section, the obstacles and difficulties PhD candidates encounter during their trajectory will be examined. The biggest obstacle for the PhD candidates is the lack of a stimulating research environment. 36,4% of the PhD candidates agrees with this statement. A little less than that, 34,3%, thinks a lack of results or failed experiments during their research functions as a factor of doubt. One third of the respondents (33,9%) perceives the lack of guidance by their supervisor as an obstacle during their doctoral research. The research topic not being that interesting after all (7,4%) and the fact that they didn't have the ambition to do a PhD in the first place (6,8%) are the least often indicated as obstacles during the PhD studies. The percentage that agrees has increased compared to the study of last year, and this for all of the items of the scale. An additional 16,5% of the PhD candidates considers the "lack of a stimulating research environment" as an obstacle, compared to the data of 2018. Also the "lack of guidance by my supervisor" became a more prevailing obstacle, with an increase of 13,9%.

*Table 3.3.1: Scores (in %) on different items of perceived obstacles (N=676)*

	Not at all/rather not	Undecided	(Rather) yes
<b>Lack of stimulating research environment</b>	48,4	15,2	36,4
<b>Lack of results/failed experiment(s)</b>	45,7	20,0	34,3
<b>Lack of guidance by my supervisor(s)</b>	49,6	16,6	33,9
<b>I doubt my own capabilities</b>	50,9	17,9	31,2
<b>The unbalanced combination of work and family</b>	57,1	16,0	26,9
<b>Uncertainty concerning funding</b>	66,9	10,1	23,1
<b>Personal reasons</b>	54,0	26,8	19,2
<b>The research topic is not that interesting after all</b>	84,2	8,4	7,4
<b>I didn't have the ambition to do a PhD in the first place</b>	83,9	9,3	6,8

In order to reduce the number of variables, a principle component analysis was performed. The results of this can be found in the Appendix. Two items were excluded from this analysis because they did not load strongly enough on either of the two components: "uncertainty concerning funding" and "the research topic is not that interesting after all". Two new variables

were defined: **personal obstacles** and **research related obstacles**. Table 3.3.2 presents the factor loadings of each statement.

As shown in table 3.3.2, the correlation between the two variables is negative. In order to make them both go in the same direction; the component “research related obstacles” was inverted.

*Table 3.3.2: Correlation between the different components of perceived obstacles*

	Personal obstacles	Research related obstacles
Personal obstacles	1,0	-0,30
Research related obstacles	-0,30	1,0

### 3.3.1 Personal obstacles

When looking at the relationship between the personal obstacles and several background variables, 28,9% of the variance can be explained by the first model. PhD candidates that had another job before their PhD research have more personal doubts than the ones who don't have any prior work experience ( $\beta = 0,09$ ). Respondents that are doing an interdisciplinary PhD also perceive more personal obstacles ( $\beta = 0,09$ ), but it has to be kept in mind that this group only exists out of 6 respondents and is not representative. Moreover, when PhD candidates experience a lot of time pressure, they will also score higher on personal obstacles ( $\beta = 0,30$ ). An opposite effect is true for self-efficacy: the higher the level of self-efficacy, the less personal obstacles one will encounter ( $\beta = -0,28$ ). Respondents that expect to work in academia after graduating also experience fewer personal obstacles than the ones who “somewhat” expect it ( $\beta = -0,09$ ). Moreover, a high level of passion about the research generates fewer personal obstacles, compared to the group with only an average level of passion ( $\beta = -0,10$ ).

Motivation plays an important role when it comes to the level of personal obstacles. By adding the different types of motivation and the work family balance to the model, 34,5% of the perceived personal obstacles gets explained. The more identified motivation, the more personal obstacles a PhD candidate perceives ( $\beta = 0,11$ ). In the same line, more introjected motivation leads to more personal obstacles ( $\beta = 0,20$ ). The opposite effect is true for the

intrinsic and integrated motivation: a higher level of intrinsic motivation leads to less personal obstacles ( $\beta = -0,08$ ), as does a higher level of integrated motivation ( $\beta = -0,11$ ). Nationality also becomes a significant variable: non-European respondents score lower on personal obstacles than the Belgian ones ( $\beta = -0,09$ ). The level of passion is no longer significant.

In the last model, only the significant variables are taken into account. 33,3% of the variance is explained by these. Time pressure ( $\beta = 0,28$ ) and self-efficacy ( $\beta = -0,26$ ) have the strongest effects.

Table 3.3.1.1: Multiple regression between personal obstacles and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	$\beta$	Sig.	$\beta$	Sig.
<b>Constant</b>						
Gender of PhD candidate (ref.: Male)	0,043		0,026			
Gender of supervisor (ref.: Male)	0,012		0,009			
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	0,021		0,029			
Non-EU	-0,057		-0,090	*		
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	0,045		0,052			
Finalizing phase	-0,016		-0,028			
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	0,000		0,021			
Project funding – PhD is only project	0,002		-0,004			
Project funding – also involved in other projects	0,016		0,029			
I don't have a contract, I'm self-financed	0,027		0,063			
Other	0,033		0,052			
<b>Previous work experience (ref.: No)</b>						
Yes	0,092	*	0,085	*	0,090	**
I still have another job	0,036		0,030		0,054	
<b>Doctoral School (ref.: NSE)</b>						
DSh	0,008		-0,004		0,038	
LSM	-0,037		-0,050		-0,019	
Interdisciplinary	0,086	*	0,081	*	0,088	**
<b>Self-efficacy</b>	-0,281	***	-0,243	***	-0,255	***
<b>Time pressure</b>	0,300	***	0,252	***	0,279	***
<b>Competition</b>	0,008		0,009			
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	0,014		0,002		0,006	
To a large extend/definitely	-0,087	**	-0,082	**	-0,118	**
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	-0,019		-0,048			
8 or higher	-0,097	*	-0,052			
<b>Intrinsic motivation</b>			-0,080	*		
<b>Integrated motivation</b>			-0,114	*	-0,164	***
<b>Identified motivation</b>			0,105	*	0,087	*
<b>Introjected motivation</b>			0,201	***	0,157	***
<b>External motivation</b>			-0,053			
<b>Motivation through larger contribution</b>			-0,010			
<b>Work family balance</b>			-0,044			

N 665 648 667  
Adjusted R<sup>2</sup> 0,289 0,333 0,307

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05



People who expect to work in academia after obtaining their PhD have an average score of 2,5/10 on personal obstacles. They experience significantly less obstacles than the respondents who do not expect to work in academia in the future (3,7/10) and the ones that somewhat do (3,3/10). Respondents with a low level of self-efficacy experience more personal obstacles (4,2/10) than those with an average (2,8/10) and high (2,4/10) level of self-efficacy. The more time pressure PhD candidates experience, the more personal obstacles they say to encounter. The higher the respondents score on the introjected motivation, the more personal obstacles they perceive. The opposite is true for the other types of motivation: a higher score on integrated and identified motivation results in fewer personal obstacles. Previous work experience does not show a significant bivariate effect.

*Table 3.3.1.2: Personal obstacles by background characteristics (N=663-677)*

		Personal obstacles (on 10)
<b>Expecting to work in academia</b>	Rather not/not at all	3,7 *
	Somewhat	3,3 °
	To a large extend/definitely	2,5 *°
<b>Self-efficacy</b>	Low	4,2 *°
	Medium	2,8 *
	High	2,4 °
<b>Time pressure</b>	Low	2,2 *
	Medium	3,1 *
	High	4,1 *
<b>Introjected motivation</b>	Low	2,5 *
	Medium	3,3 *
	High	3,7 *
<b>Integrated motivation</b>	Low	3,9 *
	Medium	3,2 *
	High	2,5 *
<b>Identified motivation</b>	Low	3,5 *
	Medium	3,2
	High	2,8 *
<b>Total</b>		3,2

\*/° indicates a significant difference between two or more categories of one indicator ( $p < 0.05$ )

### 3.3.2 Research related obstacles

Research related obstacles are obstacles that originate from external conditions; such as the lack of support by the supervisor or failed experiments. The first model, as presented in table 3.3.2.1, explains 14,3% of the variance. Non-Belgian PhD candidates experience more research related obstacles than the Belgian ones. This effect is the strongest for the European, non-Belgian PhD candidates ( $\beta=0,11$ ), but also significant for the non-European PhD candidates ( $\beta=0,10$ ). More time pressure ( $\beta=0,14$ ) and experiencing a lot of competitiveness in the work culture ( $\beta=0,22$ ) also lead to more research related obstacles. Moreover, having a low level of passion for their research causes PhD candidates to encounter more research related obstacles than respondents with an average amount of passion for their research ( $\beta=0,08$ ). Respondents that still have a job next to their PhD research experience less research related obstacles than the ones that never had a job before ( $\beta=-0,10$ ). When PhD candidates expect to work in academia, they also experience less research related obstacles than the ones who “somewhat” expect to work in academia ( $\beta=-0,11$ ).

Model 2 is not as strong as the first one and explains only 13,9% of the variance. After adding the six types of motivation and the scale on work family balance, the significant effect of having another job and being a non-European PhD candidate disappear. The effect of having another job gets explained by the variable on the work family balance. People that combine their PhD with another job are less satisfied with the work family balance. However, the work family balance does not have a significant effect on the experienced obstacles. The effect of being non-European is no longer significant due to the combination of the variables on motivation. Apart from this, no new variables appear significant in the model.

In the third model, only the significant variables were withheld. This model explains 14,7% of the variance. Competition has the strongest effect on the perceived research related obstacles ( $\beta=0,21$ ); having a high level of passion for the research has the least strong effect ( $\beta=0,08$ ).

Table 3.3.2.1: Multiple regression between research related obstacles and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	$\beta$	Sig.	$\beta$	Sig.
<b>Constant</b>						
Gender of PhD candidate (ref.: Male)	-0,008		-0,021			
Gender of supervisor (ref.: Male)	-0,034		-0,018			
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	0,107	*	0,098	*	0,095	*
Non-EU	0,103	*	0,100		0,094	*
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	0,039		0,036			
Finalizing phase	-0,023		-0,014			
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	0,001		0,005			
Project funding – PhD is only project	-0,033		-0,046			
Project funding – also involved in other projects	-0,043		-0,051			
I don't have a contract	-0,007		-0,022			
Other	0,017		0,025			
<b>Previous work experience (ref.: No)</b>						
Yes	-0,042		-0,017		-0,063	
I still have another job	-0,103	*	-0,078		-0,117	**
<b>Doctoral School (ref.: NSE)</b>						
DSh	-0,073		-0,073			
LSM	-0,017		-0,015			
Interdisciplinary	-0,035		-0,026			
Self-efficacy	-0,052		-0,058			
Time pressure	0,138	**	0,152	**	0,152	***
Competition	0,218	***	0,216	***	0,207	***
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	0,064		0,062		0,063	
To a large extend/definitely	-0,112	**	-0,125	**	-0,120	**
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	0,082	*	0,086	*	0,082	*
8 or higher	-0,028		-0,042		-0,041	
Intrinsic motivation			-0,006			
Integrated motivation			0,043			
Identified motivation			0,017			
Introjected motivation			-0,026			
External motivation			0,085			
Motivation through larger contribution			-0,058			
Work family balance			0,006			
<b>N</b>		665		648		666
<b>Adjusted R<sup>2</sup></b>		0,143		0,139		0,147

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

As shown in table 3.3.2.2, respondents that still practice another job during their PhD research score 3,4/10 on research related obstacles, which is significantly lower than the PhD candidates without any prior work experience (4,5/10) and the ones that did have another job before starting their PhD (4,3/10). Respondents that expect to work in academia later on also encounter lower research related obstacles (3,7/10) than those who “somewhat” expect an academic career (4,5/10) and those who don’t expect an academic career (4,9/10). The more passionate PhD candidates are about their research, the less research related obstacles they will encounter. When respondents experience a lot of competitiveness in the work culture, they will score higher on research related obstacles than those with an average or low score on the competitiveness of the work culture. Moreover, the portion of PhD candidates that experiences a low amount of time pressure also reports a fewer amount of research related obstacles than those with an average or high level of time pressure. Nationality does not show any significant bivariate effects.

*Table 3.3.2.2: Research related obstacles by background characteristics (N=663-676)*

		Research related obstacles (on 10)
<b>Previous work experience</b>		
	No	4,5 *
	Yes	4,3
	I still have another job	3,4 *
<b>Expecting to work in academia</b>		
	Rather not/not at all	4,9 *
	Somewhat	4,5 °
	To a large extent/definitely	3,7 *°
<b>Passionate about PhD (on 10)</b>		
	5 or lower	5,9 *
	6-7	4,7 *
	8 or higher	4,1 *
<b>Competition</b>		
	Low	3,7 °
	Medium	4,2 *
	High	5,1 *°
<b>Time pressure</b>		
	Low	3,7 *°
	Medium	4,4 *
	High	4,9 °
		Total
		4,3

\*/° indicates a significant difference between two or more categories of one indicator ( $p < 0.05$ )

### 3.4 PhD on the right track

The respondents were asked to indicate to what extent they feel as if they are on the right track with their PhD. The majority says to be rather or totally on the right track (74%). 14,5% is undecided and 11,5% has the feeling to be 'rather not' or 'not at all' on track with their doctoral studies.

*Table 3.4.1: Respondent by being on the right track*

	<b>N</b>	<b>%</b>
<b>Rather/totally</b>	500	74,0
<b>Undecided</b>	98	14,5
<b>Not at all/rather not</b>	78	11,5
<b>Missing</b>	37	
<b>Total</b>	713	100

Table 3.4.1 presents the results of the effects of background variables on being on the right track or not. The first model explains 25,5% of the variance. Respondents in the starting phase report to be less on the right track than PhD candidates in the executing phase ( $\beta = -0,08$ ). Contrariwise, PhD candidates in the finalizing phase are more on the right track than people in the executing phase ( $\beta = 0,12$ ). The more time pressure PhD candidates experience, the less they feel like they are on the right track with their PhD ( $\beta = -0,14$ ). Competition has the same effect: the more PhD candidates perceive the work culture as competitive, the less likely they are to feel like being on the right track with their research ( $\beta = -0,10$ ). Not having a research plan also shows a significant effect. PhD candidates without a research plan feel less on the right track than PhD candidates who have a research plan with short- and long-term milestones ( $\beta = -0,12$ ). Candidates that are not that passionate about their research feel less like being on the right track compared to respondents that are averagely passionate ( $\beta = -0,18$ ). Candidates that are very passionate on the other hand, feel more like being on the right track ( $\beta = 0,15$ ). The higher the level of self-efficacy, the more they feel as if they are on the right track with their PhD as well ( $\beta = 0,18$ ).

In the second model the types of motivation and the work family balance were added. This model is weaker than the first model and does not show any additional significant effects. In the third model, only the significant variables were withheld. 26,2% of the variance is explained

by them. Additionally to the effects that remain significant from the first model, having a research plan with short term milestones also becomes a significant indicator. Respondents who have a research plan that only includes short term milestones feel less on the right track compared to those who included long term as well as short term milestones in their research plan ( $\beta = -0,09$ ). In this model, being very passionate about the research and the level of self-efficacy have the strongest influence on being on the right track with the PhD ( $\beta = 0,18$ ).

Table 3.4.2: Multiple regression between being on the right track and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	$\beta$	Sig.	$\beta$	Sig.
<b>Constant</b>		***		***		***
<b>Gender of PhD candidate (ref.: Male)</b>	0,003		0,019			
<b>Gender of supervisor (ref.: Male)</b>	0,014		0,025			
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	0,025		0,029			
Non-EU	0,042		0,039			
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	-0,079	*	-0,090	*	-0,092	**
Finalizing phase	0,120	**	0,136	***	0,111	**
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	-0,009		-0,011			
Project funding – PhD is only project	-0,024		-0,023			
Project funding – also involved in other projects	-0,050		-0,062			
I don't have a contract, I'm self-financed	-0,064		-0,066			
Other	-0,025		-0,029			
<b>Previous work experience (ref.: No)</b>						
Yes	0,044		0,034			
I still have another job	0,014		0,007			
<b>Doctoral School (ref.: NSE)</b>						
DSh	-0,071		-0,057			
LSM	-0,020		-0,029			
Interdisciplinary	0,006		0,021			
<b>Self-efficacy</b>	0,181	***	0,156	***	0,178	***
<b>Time pressure</b>	-0,135	***	-0,156	***	-0,145	***
<b>Competition</b>	-0,097	**	-0,092	*	-0,105	**
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	-0,011		-0,015			
To a large extent/definitely	0,002		0,006			
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	-0,180	***	-0,178	***	-0,176	***

8 or higher	0,150	***	0,138	**	0,156	***
Intrinsic motivation			0,006			
Integrated motivation			-0,062			
Identified motivation			0,081			
Introjected motivation			-0,050			
External motivation			0,017			
Motivation through larger contribution			0,057			
Work family balance			-0,019			
Having a research plan (ref.: Research plan with long- and short-term milestones)						
Research plan, short-term milestones	-0,071				-0,088	*
Research plan, long-term milestones	-0,054				-0,065	
No research plan	-0,116	**			-0,129	***
<b>N</b>		664		648		665
<b>Adjusted R<sup>2</sup></b>		0,255		0,240		0,262

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

Table 3.4.3 shows that PhD candidates with an elaborated research plan feel more on the right track with their PhD than those with a more simplistic research plan, and even more so than those without a research plan. Moreover, the portion that says to be “rather” or “totally” on the right track grows throughout the trajectory. The opposite effect is true for the “undecided” category; the further the PhD candidates are in the process, the less they feel undecided about whether or not being on the right track. People who are in a further stage in their PhD trajectory appear to have a clearer vision about the state of their PhD, whereas respondents in an earlier stage don’t have this clear perspective yet. This also mean that the percentage of PhD candidates who are “rather not” or “not at all” on the right track grows the further they are in the PhD process. When it comes to the level of passion about the research, the percentage of being “rather” or “totally” on the right track grows as the level of passion increases. Contrariwise, the portion of people being “rather not” or “not at all” on the right track decreases when the level of passion goes up. When comparing the level of self-efficacy with the feeling of being on the right track, the group that is “rather” or “totally” on the right track grows as the level of self-efficacy increases. The opposite is true for the group that is “rather not” or “not at all” on the right track. Here, the people with a low level of self-efficacy are more represented. Taking into account the effect of time pressure, it appears that the lower the time pressure, the more respondents feel like being on the right track. When PhD candidates experience a high level of time pressure, respondents are more often not on the

right track, or undecided about the matter. A high level of competition also leads to more uncertainty about being on the right track, whereas PhD candidates who experience a low amount of competition more often feel like being on the right track.

*Table 3.4.3: Being on the right track (in %) by phase of the PhD, level of passion for research, self-efficacy, time pressure and competition (N=666-677)*

	Rather not/not at all on the right track	Undecided	Rather/totally on the right track
<b>Having a research plan</b>			
Yes, with long-term and short-term milestones	7,4	10,5	82,1
Yes, with short-term milestones	11,8	20,9	67,3
Yes, with long-term milestones	11,6	14,2	74,2
No	28,2	18,3	53,5
$\chi^2=37,3$ df=6 p<0,001			
<b>Phase of the PhD</b>			
Starting phase	10,3	31,0	58,6
Executing phase	11,7	12,5	75,8
Finalizing phase	12,0	8,6	78,4
$\chi^2=32,7$ df=4 p<0,001			
<b>Level of passion for research</b>			
5 or lower	48,6	17,1	34,3
6-7	17,3	25,1	57,6
8 or higher	6,2	9,8	84,0
$\chi^2=100,5$ df=4 p<0,001			
<b>Self-efficacy</b>			
Low	19,0	24,8	56,2
Medium	6,9	11,9	81,2
High	8,9	5,8	85,3
$\chi^2=59,5$ df=4 p<0,001			
<b>Time pressure</b>			
Low	5,6	6,1	88,3
Medium	8,7	14,3	77,1
High	20,6	22,0	57,4
$\chi^2=57,8$ df=4 p<0,001			
<b>Competition</b>			
Low	5,9	12,2	81,9
Medium	10,3	13,5	76,2
High	18,9	17,1	64,0
$\chi^2=23,7$ df=4 p<0,001			



### 3.5 Submitting PhD successfully

The PhD candidates were asked to indicate on a scale from 0 to 10 to what extent they think that they will be able to submit their PhD successfully. This question differs slightly from the previous surveys, where the respondents were asked to give a score from 1 to 10. When we compare the distribution of this year with the one of last year, we see that this does not cause any drastic changes. The results are presented in table 3.5.1. 64,9% of the PhD candidates thinks there is a high chance that they will submit their PhD successfully and gave a number of eight or higher. 24 respondents (3,6%) gave a score below five.

*Table 3.5.1: Respondents by chances to submit the PhD successfully*

	N	%
High chances (8-10)	439	64,9
Medium chances (5-7)	213	31,5
Low chances (0-4)	24	3,6
Missing	37	
Total	713	100

When a PhD candidate has a supervisor who belongs to a department that has a high percentage of foreign supervisors, the PhD candidate estimates their chances to submit successfully higher ( $\beta=0,15$ ). Nationality plays a significant role in the expectation to submit the PhD successfully. European (non-Belgian) PhD candidates rate the chances to submit successfully higher than their Belgian peers ( $\beta=0,10$ ). The more self-efficacy PhD candidates have, the higher they estimate their chances to submit successfully ( $\beta=0,30$ ). The more passionate people are about their research, the more they also believe they will successfully complete their PhD ( $\beta=0,16$ ). The same trend appears for the phase of the trajectory they are in: Respondents in the finalizing phase estimate their chances higher than those in the executing phase ( $\beta=0,18$ ) and PhD candidates in the starting phase rate their chances lower than the ones in the executing phase ( $\beta= -0,09$ ). Not having a contract leads to a lower expectation to submit the PhD successfully, compared to PhD candidates with a personal mandate ( $\beta= -0,08$ ). The opposite is true for time pressure: more time pressure leads to less

confidence to submit the PhD successfully ( $\beta = -0,16$ ). All these variables explain 37,6% of the variance.

After introducing the several types of motivation and the work family balance in the second model, not having a contract is no longer is a significant predictor for submitting the PhD successfully. Funded PhD candidates on the other hand, who are only involved in their own PhD project, estimate their chances to submit successfully lower than those with a personal mandate ( $\beta = -0,08$ ). Other than that, the introduction of the new variables does not change anything in the model.

In the last model, only the significant variables are taken into account. Together they explain 38% of the variance of submitting the PhD successfully. Self-efficacy has the strongest effect on this ( $\beta = 0,30$ ). Being in the starting phase has the least effect ( $\beta = -0,08$ ).

Table 3.5.2: Regression between submitting the PhD successfully and background variables

	Model 1		Model 2		Model 3	
	$\beta$	Sig.	B	Sig.	$\beta$	Sig.
<b>Constant</b>		***		***		***
Gender of PhD candidate (ref.: Male)	0,031		0,038			
Gender of supervisor (ref.: Male)	0,029		0,029			
% Foreign supervisors in department	0,149	***	0,142	***	0,122	***
<b>Nationality (ref.: Belgian)</b>						
EU, non-Belgian	0,103	**	0,108	**	0,115	**
Non-EU	0,069		0,050		0,077	*
<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	-0,085	*	-0,084	*	-0,090	**
Finalizing phase	0,177	***	0,171	***	0,173	***
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	-0,045		-0,049		-0,052	
Project funding – PhD is only project	-0,071		-0,078	*	-0,070	
Project funding – also involved in other projects	-0,064		-0,067		-0,066	
I don't have a contract	-0,081	*	-0,070		-0,083	*
Other	-0,017		-0,011		-0,017	
<b>Previous work experience (ref.: No)</b>						
Yes	-0,001		-0,002			
I still have another job	0,030		0,033			
<b>Doctoral School (ref.: NSE)</b>						
DSh	-0,009		-0,018			
LSM	0,030		0,017			
Interdisciplinary	0,007		0,004			
<b>Self-efficacy</b>	0,297	***	0,296	***	0,296	***
<b>Time pressure</b>	-0,157	***	-0,161	***	-0,168	***
<b>Competition</b>	-0,056		-0,057			
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all	-0,028		-0,026			
To a large extend/definitely	-0,015		-0,020			
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower	-0,205	***	-0,215	***	-0,210	***
8 or higher	0,162	***	0,165	***	0,173	***
<b>Intrinsic motivation</b>			-0,011			
<b>Integrated motivation</b>			0,059			
<b>Identified motivation</b>			-0,076			
<b>Introjected motivation</b>			0,023			
<b>External motivation</b>			0,041			
<b>Motivation through larger contribution</b>			0,007			
<b>Work family balance</b>			0,027			

N 665 648 668  
Adjusted R<sup>2</sup> 0,376 0,379 0,380

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

Table 3.5.3 presents the bivariate relationships between the extent to which PhD candidates think they will be able to submit their PhD successfully and the significant background characteristics. When there is a high percentage of foreign supervisors in the department, PhD candidates estimate their chances to submit successfully higher (8,2/10) than when there is a low percentage of foreign supervisors (7,8/10). Candidates in the finalizing phase gave an average score of 8,5/10. This is significantly more than the candidates in the starting phase (7,5/10) and the executing phase (7,9/10). The non-European PhD candidates estimate their chances to submit successfully the highest (8,3/10). The European respondents (non-Belgian) give a slightly lower score: 8,3/10. The Belgian PhD candidates estimate their chance the lowest, with 7,6/10 on average. Moreover, the lower the level of passion for the research, the lower PhD candidates estimate their chances to submit successfully. The higher the level of self-efficacy, the higher PhD candidates estimate their chances to submit the PhD successfully. Finally, respondents with a low level of time pressure perceive their chances to submit successfully higher (8,5/10), compared to those with an average (8,1/10) and high (7,4/10) amount of time pressure. The type of contract does not have a significant bivariate effect.

*Table 3.5.3: Submitting PhD successfully by % of foreign supervisors, phase of PhD, nationality, level of passion for research, self-efficacy and time pressure (N=633)*

		Submitting successfully (on 10)
<b>% of foreign supervisors in department</b>		
	Low	7,8 *
	Medium	8,0
	High	8,2 *
<b>PhD phase</b>		
	Starting phase	7,5 *
	Executing phase	7,9 °
	Finalizing phase	8,5 *°
<b>Nationality</b>		
	Belgian	7,6 *°
	European, Non-Belgian	8,3 *
	Non-European	8,5 °
<b>Level of passion for research</b>		
	Low (5 or lower)	5,5 *
	6-7	7,3 *
	High (8 or higher)	8,5 *

<b>Self-efficacy</b>			
	Low	7,0	*
	Medium	8,2	*
	High	8,9	*
<b>Time pressure</b>			
	Low	8,5	*
	Medium	8,1	°
	High	7,4	*°
	Total	8,0	

\*/° indicates a significant difference between two or more categories of one indicator ( $p < 0.05$ )

## 4. Integrated approach: latent class analysis

### 4.1 Cluster determination

The nine variables that contribute to job satisfaction, as discussed in the previous chapter, were used to perform a latent class analysis (LCA). As stated before, self-efficacy and time pressure are no longer part of this LCA, although they were in the two previous reports. In this analysis, both self-efficacy and time pressure are treated as intrinsic background characteristics, rather than as variables that actively contribute to the job satisfaction. This implicates that the clusters in this report are constructed differently than the clusters in the other two reports. However, it is important to note that the composition of the clusters does not only depend on the used variables, but also on the sample. The population of PhD students changes each year because new PhD students come in and other PhD students graduate. This in combination with a certain level of non-response implicates that the sample – and thus the composition of the clusters – will vary over the years. It is important to keep in mind that a cluster analysis is relative to the population at that specific moment and is not the best tool to make comparisons over the years. In other words, changes in the number or size of the clusters do not necessarily indicate an increase or decrease of satisfaction, compared to the years before.

The aim of this analysis is to divide the respondents in groups (clusters) with similar opinions on job satisfaction. Please keep in mind that only respondents with a physical working space are included in the cluster analysis, excluding 130 respondents. The reason for this is that the cluster analysis includes variables on the satisfaction with the work environment, which only people with a physical working space at the VUB could answer. Additionally, the three respondents that follow a non-PhD track are excluded. In total, 538 PhD candidates are included in the analysis. The next step is to look into what background characteristics determine the membership to each certain cluster. As shown in table 4.1.1, the LCA shows support for a three-cluster solution.

Table 4.1.1: Fit statistics per model

2-cluster solution	9569,891
3-cluster solution	9491,020
4-cluster solution	9497,049

Table 4.1.2 presents the proportions of the constituent variables of job satisfaction related to each cluster. The characteristics of each cluster are explained more in depth beneath the table.

Table 4.1.2: Latent Class Analysis

		Cluster1 N=267	Cluster2 N=157	Cluster3 N=115	R <sup>2</sup>
<b>Research related obstacles</b>					<b>0,17</b>
	Low	0,3014	0,5428	0,0896	
	Medium	0,3636	0,3164	0,2734	
	High	0,3350	0,1408	0,6370	
	Mean	2,0335	1,5980	2,5474	
<b>Personal obstacles</b>					<b>0,13</b>
	Low	0,3254	0,1449	0,5413	
	Medium	0,3705	0,3261	0,3212	
	High	0,3042	0,5290	0,1375	
	Mean	1,9788	2,3841	1,5962	
<b>Satisfaction with support supervisor</b>					<b>0,31</b>
	Low	0,2820	0,6340	0,0343	
	Medium	0,4002	0,2912	0,2145	
	High	0,3178	0,0748	0,7512	
	Mean	2,0358	1,4408	2,7170	
<b>Satisfaction with freedom received from supervisor</b>					<b>0,21</b>
	Low	0,3645	0,4615	0,0379	
	Medium	0,3803	0,3590	0,2105	
	High	0,2552	0,1795	0,7516	
	Mean	1,8907	1,7180	2,7137	
<b>Satisfaction warmth working environment</b>					<b>0,32</b>
	Low	0,3697	0,5086	0,0101	
	Medium	0,4092	0,3641	0,1333	
	High	0,2211	0,1273	0,8566	
	Mean	1,8514	1,6186	2,8465	
<b>Structural issues</b>					<b>0,24</b>
	Low	0,2214	0,1891	0,7842	
	Medium	0,3776	0,3671	0,1878	
	High	0,4010	0,4437	0,0280	
	Mean	2,1795	2,2546	1,2438	
<b>Labor conditions</b>					<b>0,15</b>
	Low	0,3646	0,4643	0,0761	
	Medium	0,3653	0,3458	0,2614	
	High	0,2701	0,1899	0,6624	
	Mean	1,9055	1,7256	2,5863	

<b>PhD right on track</b>					<b>0,56</b>
	Not at all/rather not	0,0005	0,4099	0,0052	
	Undecided	0,0254	0,3657	0,0832	
	Rather/totally	0,9741	0,2244	0,9116	
	Mean	2,9736	1,8145	2,9064	
<b>Successfully submitting PhD</b>					<b>0,40</b>
	Low (0-4)	0,0017	0,1154	0,0006	
	Medium (5-7)	0,1723	0,6878	0,1060	
	High (8<)	0,8260	0,1968	0,8934	
	Mean	2,8242	2,0815	2,8928	

### **Cluster 1: The moderate cluster (n=267 – 49,5%)**

The first cluster is a rather moderate cluster. They score averagely when it comes to personal obstacles and obstacles related to their research. They are more or less satisfied with the support they receive from their supervisor. The same is true for the amount of freedom they get from their supervisor; however, they are slightly inclined to feel negative about this. PhD candidates in this cluster have a neutral opinion on the warmth of their working environment and the labour conditions. They experience some structural issues in their workplace. Despite their moderate opinion on several aspects of the job, they are positive about being on the right track with their PhD and estimate their chances to submit successfully as high.

### **Cluster 2: The doubtful, unsatisfied cluster (n=157 – 29,1%)**

PhD candidates who are part of this cluster are rather pessimistic. They experience a lot of obstacles, on a personal level as well as related to their research. They are not satisfied with the support and freedom they receive from their supervisor and don't experience a lot of warmth in their working environment. PhD candidates in this cluster have a negative opinion on the labour conditions of their job and encounter a lot of structural issues. In relation to all of this, they don't feel as if they are on the right track with their PhD and estimate their chances to submit successfully as rather average.

### **Cluster 3: The confident, satisfied cluster (n=115 – 21,3%)**

The last cluster is the most optimistic one. PhD candidates in this cluster experience hardly any research related obstacles and little personal obstacles. They report to be satisfied with the freedom and support they receive from their supervisor. Moreover, they are positive about the warmth of their working environment and their labour conditions. They don't experience



a lot of structural issues. As a result; they feel like they are on the right track with the PhD and have high expectations to complete their trajectory successfully.

#### 4.2 Cluster identification

In this section, the relationship between cluster membership and the background variables is discussed. To investigate this, three logistic regressions were performed, one for each cluster. The dependent variable in each regression is a dummy of the cluster concerned, in other words, either belonging to the cluster or not belonging to the cluster. Every logistic regression was performed five times. In the first model, the most **basic background characteristics** were taken into account. In the second model, the variables on **self-efficacy, time pressure, work family balance and competition** were added. The third model takes into account the background characteristics of the first model together with the **six types of motivation, the level of passion for the research and the expectation to work in academics**. The fourth model combines the three previous models into one. Finally, the fifth model **only holds into account the variables that showed significant effects** in the previous models. The total amount of respondents that were included in the analysis is displayed at the bottom of the tables.

Table 4.2.1 shows the logistic regression that was performed for cluster 1. Being a member of cluster 1 is explained for 6% by the first model. Out of the most basic background characteristics, only having no research plan is of significant importance. Respondents without a research plan are less likely to be part of this mediocre cluster than respondents with an elaborated research plan ( $\exp(\beta)=0,43$ ).

In the second model, four new variables were introduced, and more variance gets explained (8,3%). The self-efficacy has a significant effect. The more self-efficacy a PhD candidate has, the more chance they have to be part of the first cluster ( $\exp(\beta)=1,33$ ). This is logical, because people in this cluster think they have a high chance to submit their PhD successfully and believe they are on the right track with their PhD.

The third model takes into account the different types of motivation, the level of passion for the research and the expectation to work in academia after graduating. Expecting to work in academia is of significant importance. PhD candidates who expect to work in academia after graduating are less likely to be part of the first cluster ( $\exp(\beta)=0,55$ ). The level of passion also has a significant effect. Respondents with a low level of passion have a lower chance to be part of cluster 1 than those with an average level of passion ( $\exp(\beta)=0,28$ ). In the same line, PhD candidates with a high level of passion for their research are more likely to be part of cluster one than those with an average level of passion ( $\exp(\beta)=2,04$ ). When a PhD candidate has a high level of introjected motivation, they are less likely to be part of this cluster ( $\exp(\beta)=0,80$ ). This model explains 14,5% of the variance.

The fourth model comprises all background variables. Here, only the expectation to work in academia and the level of passion for the research remain significant predictors. The effect of not having a research plan is explained by the combination of time pressure and motivation.

The fifth model only includes the significant variables. Not having a research plan, expecting to work in academia and the level of passion for the research are the three predictors that remain significant. The model explains 8,5% of the variance. This is a rather low percentage, which can be dedicated to the heterogeneity of the cluster. PhD candidates in this cluster do not have a very outspoken opinion on their trajectory. All the respondents with this moderate view are grouped together in this cluster, resulting in a very divergent group that cannot be characterized by specific background variables.

*Table 4.2.1: Logistic regression between cluster 1 and background variables*

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.
<b>Constant</b>	0,90		0,84		0,70		0,88		0,86	
<b>Gender of PhD candidate (ref.: Male)</b>	1,27		1,13		1,18		1,10			
<b>Gender of supervisor (ref.: Male)</b>	1,09		1,11		1,06		1,06			
<b>Nationality (ref.: Belgian)</b>										
EU, non-Belgian	1,21		1,25		1,07		1,15			
Non-EU	1,04		0,92		1,05		1,01			

<b>Phase of the PhD (ref.: Executing phase)</b>						
Starting phase	0,64		0,69		0,63	0,66
Finalizing phase	1,25		1,22		1,48	1,40
<b>Type of contract (ref.: personal mandate)</b>						
Teaching assistant	1,00		0,91		0,95	0,94
Project funding						
– PhD is only project	0,83		0,81		0,77	0,77
Project funding						
– also involved in other projects	0,82		0,77		0,79	0,75
I don't have a contract, I'm self-financed	0,92		0,94		0,97	1,03
Other	0,93		0,86		0,85	0,84
<b>Previous work experience (ref.: No)</b>						
Yes	1,02		0,93		1,03	0,97
I still have another job	1,12		0,91		1,19	1,01
<b>Doctoral School (ref.: NSE)</b>						
DSh	0,88		0,82		1,06	0,94
LSM	1,49		1,39		1,65	1,53
Interdisciplinary	0,98		0,94		1,02	0,93
<b>Having a research plan (ref.: Research plan with long- and short-term milestones)</b>						
Research plan, short-term milestones	0,80		0,82		0,82	0,82
Research plan, long-term milestones	1,15		1,21		1,40	1,38
No research plan	0,43	**	0,48	*	0,51	* 0,52
						0,54 *
<b>Self-efficacy</b>			1,33	**		1,22
<b>Time pressure</b>			0,94			0,96
<b>Competition</b>			1,18			1,20
<b>Work family balance</b>			1,00			0,02
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>						
Rather not/not at all					0,82	0,81
To a large extend/definitely					0,55 *	0,53 *
						0,62 *
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>						
5 or lower					0,28 *	0,21 *
						0,22 *

8 or higher			2,04 *	1,86 *	1,92 **
<b>Intrinsic motivation</b>			1,05	1,00	
<b>Integrated motivation</b>			0,84	0,86	
<b>Identified motivation</b>			0,86	0,89	
<b>Introjected motivation</b>			0,80 *	0,82	
<b>External motivation</b>			1,19	1,16	
<b>Motivation through larger contribution</b>			1,17	1,13	
<b>N</b>	415	506	511	504	533
<b>Adjusted R<sup>2</sup></b>	0,060	0,083	0,145	0,156	0,085

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

Table 4.2.2 shows that 12,8% of being part of the doubtful, unsatisfied cluster can be explained by the basic background variables in model 1. PhD candidates with a non-European nationality are less likely to be part of this cluster ( $\exp(\beta)=0,24$ ). Respondents without a research plan ( $\exp(\beta)=3,45$ ) or respondents who have a research plan with solely short-term milestones ( $\exp(\beta)=1,88$ ) are more likely to be part of this doubtful cluster compared to those with an elaborated research plan. Especially not having a research plan increases the chances of belonging to this cluster.

After adding self-efficacy, time pressure, competition and work family balance, 35,9% of the variance in this cluster gets explained. The higher the level of self-efficacy, the lower the chance PhD candidates have to belong to cluster 2 ( $\exp(\beta)=0,44$ ). The opposite is true for time pressure. PhD candidates with a lot of time pressure are also more likely to be part of the second cluster ( $\exp(\beta)=1,78$ ). Moreover, the more respondents perceive the working culture as competitive, the higher the odds to belong to this cluster ( $\exp(\beta)=1,47$ ). The effect of being non-European gets explained by self-efficacy. Non-European PhD candidates have a higher amount of self-efficacy. This is why they are less likely to be part of the second cluster.

The third model is weaker than the second one and explains 29,9% of the variance. The level of passion is a significant predictor. PhD candidates with a high level of passion are less likely to be part of the second cluster ( $\exp(\beta)=0,33$ ). Moreover, when PhD candidates score high on introjected motivation, they also have a higher chance to be part of this cluster ( $\exp(\beta)=1,46$ ).

In the fourth model, not having a research plan, self-efficacy, time pressure, competition and the level of passion for the research remain significant. The introjected motivation is no longer significant – its effect is explained away by time pressure and self-efficacy. 41,5% of the variance gets explained by this model.

In the last model, only the significant effects are taken into account. Together, they explain 37,5% of the variance in this doubtful cluster.

Table 4.2.2: Logistic regression between cluster 2 and background variables

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.
Constant	0,31	**	0,18	***	0,47		0,26	**	0,39	***
<b>Gender of PhD candidate (ref.: Male)</b>	0,87		1,12		0,98		1,15			
<b>Gender of supervisor (ref.: Male)</b>	1,37		1,65		1,55		1,74			
<b>Nationality (ref.: Belgian)</b>										
EU, non-Belgian	0,60		0,61		0,75		0,74			
Non-EU	0,42	***	0,55		0,57		0,67			
<b>Phase of the PhD (ref.: Executing phase)</b>										
Starting phase	1,39		1,25		1,71		1,48			
Finalizing phase	0,80		0,59		0,67		0,56			
<b>Type of contract (ref.: personal mandate)</b>										
Teaching assistant	0,72		0,75		0,79		0,74			
Project funding – PhD is only project	0,75		0,83		0,75		0,85			
Project funding – also involved in other projects	1,14		1,28		1,11		1,30			
I don't have a contract, I'm self-financed	1,38		1,79		1,13		1,40			
Other	0,82		1,03		0,92		1,01			
<b>Previous work experience (ref.: No)</b>										
Yes	0,75		0,70		0,77		0,69			
I still have another job	1,26		1,37		1,98		1,70			
<b>Doctoral School (ref.: NSE)</b>										
DSH	1,58		1,60		1,42		1,51			
LSM	1,19		1,20		1,35		1,36			

Interdisciplinary	1,44		1,72		1,32		1,67	
<b>Having a research plan (ref.: Research plan with long- and short- term milestones)</b>								
Research plan, short- term milestones	1,88	*	2,15	*	1,72		2,01	*
Research plan, long- term milestones	1,54		1,46		1,08		1,19	
No research plan	3,45	***	2,23	*	2,49	**	1,90	
<b>Self-efficacy</b>			0,44	***			0,51	***
<b>Time pressure</b>			1,78	***			1,87	***
<b>Competition</b>			1,47	**			1,42	**
<b>Work family balance</b>			0,97				0,99	
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>								
Rather not/not at all					1,18		1,34	
To a large extend/definitely					0,78		0,99	
<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>								
5 or lower					2,73		2,94	
8 or higher					0,33	**	0,37	***
<b>Intrinsic motivation</b>					0,85		0,98	
<b>Integrated motivation</b>					1,13		1,29	
<b>Identified motivation</b>					0,96		0,96	
<b>Introjected motivation</b>					1,46	**	1,12	
<b>External motivation</b>					0,90		0,95	
<b>Motivation through larger contribution</b>					0,95		0,90	
<b>N</b>		515		506		511		504
<b>Adjusted R<sup>2</sup></b>		0,128		0,359		0,290		0,415
								536
								0,375

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

Table 4.2.3 presents the effect of the background variables on membership of the confident cluster. In model 1, 10,8% of the variance gets explained. Non-European PhD candidates have a higher chance to be part of this positive cluster than their Belgian colleagues ( $\exp(\beta)=2,35$ ). Moreover, PhD candidates in the school of LSM are less likely to be part of this cluster, compared to those in the NSE ( $\exp(\beta)=0,44$ ). When PhD candidates have a research plan with

solely long-term milestones, they have a lower chance to be part of the positive clusters than those with an elaborated research plan ( $\exp(\beta)=0,50$ ).

After adding the four variables in the second model, 35,3% of the membership of the confident cluster gets explained. Nationality is no longer significant after adding self-efficacy to the model. Self-efficacy, time pressure and competition become significant variables. The more self-efficacy a PhD candidate has, the more likely they will be part of the confident cluster ( $\exp(\beta)=1,72$ ). When a PhD candidate experiences a lot of time pressure, they have less chance to be part of this cluster ( $\exp(\beta)=0,59$ ). The same counts for competition: when a respondent experiences a lot of competitiveness in the working culture, they are less likely to be part of the confident cluster ( $\exp(\beta)=0,44$ ).

The third model explains 21,6% of the variance. The expectation for a future career in academia is influential: when a PhD candidate expects to work in academia, they are more likely to be part of the confident cluster ( $\exp(\beta)=2,74$ ). Moreover, PhD candidates with a female supervisor have a lower chance to belong to this positive cluster ( $\exp(\beta)=0,58$ ).

This effect the gender of the supervisor disappears in the fourth model. This is because the level of competition is taken into account. Apart from that, all the other significant variables remain significant and explain 39,2% of the variance.

In the fifth model, only these significant variables are taken into account. 32,6% of the variance gets explained.

*Table 4.2.3: Logistic regression between cluster 3 and background variables*

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.	Exp( $\beta$ )	Sig.
Constant	0,36	**	0,23	**	0,23	**	0,16	**	0,18	***
Gender of PhD candidate (ref.: Male)	0,82		0,65		0,82		0,71			
Gender of supervisor (ref.: Male)	0,64		0,61		0,58	*	0,58			
Nationality (ref.: Belgian)										

EU, non-Belgian	1,40		1,13		1,20		1,26	
Non-EU	2,35	**	1,82		1,65		1,42	
<b>Phase of the PhD (ref.: Executing phase)</b>								
Starting phase	1,27		1,25		1,08		1,12	
Finalizing phase	0,91		1,26		0,76		1,03	
<b>Type of contract (ref.: personal mandate)</b>								
Teaching assistant	1,44		1,39		1,32		1,33	
Project funding								
– PhD is only project	1,73		1,78		1,85		1,92	
Project funding								
– also involved in other projects	1,18		1,47		1,38		1,58	
I don't have a contract, I'm self-financed	0,75		0,53		0,90		0,62	
Other	1,44		1,16		1,36		1,15	
<b>Previous work experience (ref.: No)</b>								
Yes	1,24		1,40		1,19		1,36	
I still have another job	0,48		0,78		0,29		0,55	
<b>Doctoral School (ref.: NSE)</b>								
DSh	0,77		0,90		0,69		0,78	1,00
LSM	0,44	*	0,41	*	0,32	**	0,35	* 0,45 *
Interdisciplinary	0,77		1,22		0,96		1,13	1,80
<b>Having a research plan (ref.: Research plan with long- and short-term milestones)</b>								
Research plan, short-term milestones	0,70		0,72		0,76		0,75	0,67
Research plan, long-term milestones	0,50	*	0,50	*	0,51	*	0,48	* 0,49 *
No research plan	0,65		0,99		0,86		1,11	1,00
<b>Self-efficacy</b>								
			1,72	***			1,60	** 1,58 **
<b>Time pressure</b>								
			0,59	**			0,59	** 0,56 ***
<b>Competition</b>								
			0,44	***			0,45	*** 0,45 ***
<b>Work family balance</b>								
			1,12				1,24	
<b>Expecting to work in academia after PhD (ref.: Somewhat)</b>								
Rather not/not at all					1,06		1,06	0,93
To a large extend/definitely					2,74	**	2,73	** 2,83 **



<b>Passionate about research on a scale from 0 to 10 (ref.: 6-7)</b>					
5 or lower		1,49		1,64	
8 or higher		1,47		1,18	
<b>Intrinsic motivation</b>		1,20		1,09	
<b>Integrated motivation</b>		1,14		0,93	
<b>Identified motivation</b>		1,37		1,26	
<b>Introjected motivation</b>		0,88		1,12	
<b>External motivation</b>		0,87		0,84	
<b>Motivation through larger contribution</b>		0,81		0,83	
<b>N</b>	515	506	511	504	534
<b>Adjusted R<sup>2</sup></b>	0,108	0,353	0,216	0,392	0,326

\*\*\* p<0.001 \*\* p<0.01 \* p<0.05

The previous models investigated what background characteristics decide whether a PhD candidate either belongs or does not belong to a certain cluster. The next analyses zoom in on how the clusters are related to one another in terms of background characteristics. This is a relative approach, in contrast to the absolute approach that was used before. The results are presented in tables 4.2.4 and 4.2.5.

There is a significant effect of self-efficacy. Respondents in the doubtful, unsatisfied cluster have the lowest level of self-efficacy (5,9/10). Those in the confident cluster have the highest score (7,4/10). The same effect is true for the identified motivation. PhD candidates in the doubtful cluster experience the most time pressure (5,2/10), whereas respondents in the confident cluster have the lowest score on time pressure (3,1/10). The same is true for competition: PhD candidates in the doubtful cluster have the highest score on competition (4,7/10), PhD candidates in the confident cluster score the lowest (3,2/10). The moderate cluster scores averagely on competition as well as on time pressure. PhD candidates in the doubtful cluster score lower on intrinsic motivation, integrated motivation and motivation through larger contribution, compared to the respondents in the moderate cluster and in the confident cluster. Contrariwise, PhD candidates in the doubtful cluster have a significantly higher score on the introjected motivation (4,3/10), compared to the scores of respondents in the moderate (3,3/10) and confident cluster (3,5/10). Respondents in the confident cluster are

significantly more satisfied with the work family balance (8,4/10) than the PhD candidates in the moderate (7,8/10) and doubtful cluster (7,6/10). Lastly, respondents in the confident cluster are the most passionate about their research (8,6/10) compared to those in the moderate (8,2/10) and doubtful cluster (7,1/10).

Table 4.2.4: Bivariate effects between clusters and significant background variables

	Cluster 1	Cluster 2	Cluster 3	Total
Self-efficacy	7,0 *	5,9 *	7,4 *	6,8
Time pressure	4,0 *	5,2 *	3,1 *	4,2
Competition	4,2 *	4,7 *	3,2 *	4,1
Intrinsic motivation	7,0 *	6,3 *°	7,4 °	6,9
Integrated motivation	6,6 *	5,9 *°	7,2 °	6,5
Motivation through larger contribution	6,7 *	5,8 *°	6,8 °	6,5
Introjected motivation	3,3 *	4,3 *°	3,5 °	3,6
Identified motivation	7,1 *	6,3 *	7,8 *	7,1
Work-family balance	7,8 *	7,6 °	8,4 *°	7,9
Passionate about research on a scale from 0 to 10	8,2 *	7,1 *	8,6 *	7,9

Table 4.2.5 shows that the majority of the PhD candidates in the first, moderate cluster is Belgian (51,5%). Almost one third is non-European (30,1%). In the second, negative cluster, the portion of Belgian PhD candidates is bigger: 65%. 15,3% is European but non-Belgian and 19,7% is non-European. In the third, optimistic cluster, the non-European PhD candidates represent the biggest group with 41,7%. The Belgian respondents are slightly less represented (39,1%). The European, non-Belgian PhD candidates are the smallest group (19,1%). Within the first cluster, the PhD candidates are almost equally divided between the three gradations of expecting to work in academia after graduating. One in three (32,6%) does not expect to work in academia later on, 34,5% “somewhat” expects an academic career and 33% does expect to work in academia after graduation. In the doubtful cluster, the biggest portion does not expect to work in academia (49,4%). 21,1% does expect an academic career, but this is the smallest group within this cluster. The majority of respondents in the confident cluster expects to work in academia later on (55,7%). One in four (24,3%) expects it “somewhat”. One in five, the smallest portion, does not expect an academic career. In the doubtful cluster, 21% of the respondents does not have a research plan. This is significantly more than in the two other

clusters. In the confident cluster on the other hand, more than half of the respondents (54,8%) does have an elaborated research plan. Other variables that were also tested for are gender, gender of the supervisor, previous work experience, the phase of the PhD, doctoral schools and the type of contract but there was no significant effect of these variables on cluster membership.

*Table 4.2.5: Bivariate effects between clusters and significant background variables (in %)*

	Cluster 1	Cluster 2	Cluster 3	Total
<b>Nationality</b>				
Belgian	51,5	65,0	39,1	52,8
EU, non-Belgian	18,4	15,3	19,1	17,7
Non-EU	30,1	19,7	41,7	29,6
$\chi^2=20,2$ df=4 p<0,001				
<b>Expecting to work in academia after PhD</b>				
Rather not/not at all	32,6	49,4	20,0	34,8
Somewhat	34,5	29,5	24,3	30,8
To a large extend/definitely	33,0	21,1	55,7	34,4
$\chi^2=43,1$ df=4 p<0,001				
<b>Having a research plan</b>				
With short-term and long-term milestones	47,2	31,8	54,8	44,3
With short-term milestones	21,1	26,8	20,0	22,5
With long-term milestones	23,4	20,4	16,5	21,0
No research plan	8,3	21,0	8,7	12,1
$\chi^2=27,1$ df=6 p<0,001				

## Conclusion

In order to investigate the job satisfaction of PhD candidates thoroughly, this report was built out of several parts. Firstly, the background characteristics of PhD candidates were discussed. This gave a deeper insight into the composition of the population, but also formed an introduction to the background variables for which the level of job satisfaction would be controlled in later chapters. In the next chapter, the different variables that constitute the job satisfaction were explained. In the final chapter, these variables were synthesized into three clusters, each representing a certain level of job satisfaction. The cluster membership was tested against the background characteristics discussed previously, in order to get a clear view on what characteristics are related to what kind of job satisfaction.

Within the pool of PhD candidates, three clusters can be distinguished in terms of satisfaction about the PhD trajectory: a moderate cluster that is confident about succeeding and finishing in time, but is only averagely satisfied about the other components of the PhD trajectory; a group of PhD candidates that have a lot of doubts and are not that satisfied about the trajectory; and a cluster of self-confident and satisfied PhD candidates.

What follows is a synthesis of the background variables that are most commonly linked with cluster membership.

### *Research plan*

Having a research plan or not appears to have a significant influence in the satisfaction of PhD candidates with their trajectory. The more elaborated the research plan is, the more PhD candidates indicate to be on the right track with their PhD. When a PhD candidate does not have a research plan they are more likely to be part of the doubtful cluster. Also, when there is a research plan present, but it is rather superficial (with only long- or short-term milestones), PhD candidates have a higher chance to be part of the doubtful cluster and a lower chance to be belong to the confident cluster.

### *Expecting to work in academia*

Not all PhD candidates expect to work in academia later on, but there appears to be a positive correlation between expecting an academic career and the satisfaction with the PhD trajectory. It is interesting to note that especially people with previous work experience expect an academic career. When PhD candidates expect to work in academia, they are more likely to belong to the confident cluster and less likely to be part of the moderate cluster. Respondents in the moderate cluster are confident and passionate about their research, just like those in the confident cluster, but are less satisfied about certain job-aspects, which be linked to the lower interest in an academic career within this group.

### *Passion for research*

The amount of passion PhD candidates feel for their research has an important influence on the satisfaction with their trajectory. The majority of the PhD candidates is passionate about their research. Only 5% reports a low level of passion. Passionate PhD candidates are more satisfied with the support and freedom they get from their supervisor. They perceive less obstacles and feel on the right track with their PhD. When PhD candidates are passionate about their research, they are less likely to be part of the doubtful cluster and more likely to be part of the moderate cluster. There is no significant correlation with the confident cluster.

### *Self-efficacy*

In this report, self-efficacy was treated as a background characteristic of the PhD candidate and not as a constituent variable of job satisfaction like it was last year. Male PhD candidates have a higher level of self-efficacy than their female colleagues. There is also a positive correlation between the amount of self-efficacy and perceiving the work environment as a warm environment. PhD candidates with a high level of self-efficacy will also experience fewer personal obstacles during their research. Moreover, the higher the level of self-efficacy, the more PhD candidates feel like being on the right track with their research and as a result are more self-confident about submitting the PhD successfully at the end of their trajectory. PhD candidates with a high amount of self-efficacy have a higher chance to belong to the moderate or the confident cluster and a lower chance to belong to the doubtful cluster.

### *Time pressure*

Just like self-efficacy, time pressure was treated as a passive background characteristic in this report instead of as a variable that actively contributes to the job satisfaction. This in contrast to the report of 2018. On average, PhD candidates score higher on time pressure than the average Flemish working population. PhD candidates who experience more time pressure work more often outside of office hours (during weekends, in the evening...). Except from during office hours, PhD candidates mostly work in the evening (31,7% does this usually or always) and during the weekends (31,8% does this usually or always). A lot of time pressure results in a feeling of not being on the right track with the PhD and less confidence in submitting the PhD successfully. PhD candidates who experience a lot of time pressure are more likely to be part of the doubtful cluster. When the amount of time pressure is low on the other hand, PhD candidates have a higher chance to be part of the confident cluster.

### *Competition*

The level of competition refers to the perception of the relationship with colleagues, the decision-making process and the competitive atmosphere among the colleagues. This indicator is significantly correlated with many variables that are related to the job satisfaction. When a lot of competition is experienced, the warmth of the working environment is evaluated poorly. The same is true for the labour conditions and the structural aspects of the job. A high amount of competition also results in a lower score on the support and freedom that is received from

the supervisor. It also leads to more research related doubts and lower score on being on the right track with the PhD. PhD candidates that report a high amount of competition have higher chance to be part of the doubtful cluster. When PhD candidates don't experience a lot of competition, they will more likely belong to the confident cluster.

#### *General conclusion*

Overall, the biggest portion of PhD candidates is satisfied and confident when it comes to their job. However, 29,1% is not satisfied and not as confident to finish the PhD trajectory successfully. For this group, some changes should be made on policy level in order to ameliorate their situation. When it comes to the perceived obstacles, more than half of the respondents in the doubtful cluster (54,2%) reports a lack of guidance by their supervisor. More involvement of the supervisor is required. The two main points of concern in terms of satisfaction with the supervisor are the introduction to other prominent researchers in the field of study (37,5% is dissatisfied) and the frequency of meetings with the supervisor (34,8% is dissatisfied). In terms of satisfaction with the work environment, the available funding to attend conference and summer schools was a point of dissatisfaction (20,9% is not satisfied). Also the infrastructure was a big stumble stone (19,6% is not satisfied).

As stated before, next some material aspects of the PhD trajectory, there are also intrinsic characteristics of the PhD candidate that play an important role in their level of satisfaction which should not be ignored. The amount of passion a PhD candidate has, for example, is the characteristic that is the most strongly related with whether or not being a member of the doubtful cluster. Also in terms of perceived obstacles, 60,2% of the members of the doubtful cluster says to doubt their own capabilities. Motivation and self-confidence are thus important factors in the satisfaction of PhD candidates.

## References

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# Appendix

## Appendix 1: Principal Component Analyses

*Table a1.1: Principal component analysis of items on self-efficacy*

	<b>Self-efficacy</b>
I will be able to successfully overcome many challenges	0,831
I believe I can succeed at almost any endeavour to which I set my mind	0,799
When facing difficult tasks, I am certain that I will accomplish them	0,792
I am confident that I can perform many different tasks effectively	0,759
Even when things are tough, I can perform quite well	0,757
In general, I think I can obtain outcomes that are important to me	0,723
Compared to other people, I can do most tasks very well	0,695
I will be able to achieve most of the goals that I have set for myself	0,654
Eigenvalue	4,539
Cronbach's $\alpha$	0,888

*Table a1.2: Principal component analysis of items on intrinsic motivation*

	<b>Intrinsic</b>
For the satisfaction I have in facing challenges in my studies	0,828
For the satisfaction I feel when I surpass myself in my learning activities (e.g. work, presentations)	0,828
Eigenvalue	1,371
Cronbach's $\alpha$	0,539

*Table a1.3: Principal component analysis of items on integrated motivation*

	<b>Integrated</b>
Because my doctoral studies meet my goals and my objectives in life	0,859
Because my doctoral studies are a fundamental part of who I am and my identity	0,796
Because doctoral studies are consistent with my values (e.g. curiosity, ambition, success)	0,733
Eigenvalue	1,908
Cronbach's $\alpha$	0,708



Table a1.4: Principal component analysis of items on identified motivation

	<b>Identified</b>
Because I want to improve my skills in my field of study	0,819
Because it is important for me to advance knowledge in my field of study	0,810
Because I have the opportunity to take my first steps in research (e.g. publications, collaborations) while benefitting from supervision	0,741
Eigenvalue	1,876
Cronbach's $\alpha$	0,685

Table a1.5: Principal component analysis of items on introjected motivation

	<b>Introjected</b>
Because I do not want to be perceived as a quitter	0,794
Because my supervisor would be disappointed or angry if I gave up	0,779
Because I have made commitments that I must fulfil (e.g. with funding agencies, employers, collaborators, a research director)	0,697
Eigenvalue	1,724
Cronbach's $\alpha$	0,622

Table a1.6: Principal component analysis of items on external motivation

	<b>External</b>
To get a better job after graduation	0,928
To find a job with good working conditions	0,928
Eigenvalue	1,722
Cronbach's $\alpha$	0,834

Table a1.7: Principal component analysis of items on motivation through larger contribution

	<b>Larger contribution</b>
Because I want to improve things	0,875
Because I want to make the world a better place	0,819
Because I want to help science move forward	0,809
Eigenvalue	2,090
Cronbach's $\alpha$	0,772

Table a1.8: Principal component analysis of items on time pressure

	Time pressure
Too much is expected of me	0,725
I never catch up with my work	0,725
I never have time for myself	0,779
There are not enough hours in the day for me	0,745
I frequently have to cancel arrangements that I have made	0,713
I have to do more than I want to do	0,779
I have no time to do the things I have to do	0,826
More is expected from me than I can handle	0,836
Eigenvalue	4,711
Cronbach's $\alpha$	0,899

Table a1.9: Principal component analysis of items on work culture

	Level of competition
Colleagues consider each other as competitors	0,705
When decisions are made, everyone's opinion is taken into account	-0,703
There are only a limited number of people involved in the decision-making process	0,689
The emphasis lies on good relationships with colleagues	-0,607
There is a competitive atmosphere within the research team	0,560
More decisions are made informally than during formal meetings	0,414
Eigenvalue	2,320
Cronbach's $\alpha$	0,674

Table a1.10: Principal component analysis of items on work family balance

	Work-family balance
I can adjust my working time to my family life	0,809
I have enough influence on my working hours	0,763
I have ample opportunities to take time off whenever that suits me	0,761
The VUB/my supervisor offers sufficient opportunities for employees to adjust their tasks depending on their private situation	0,703
I often have meetings at times that are difficult to match with my family situation	-0,450
Eigenvalue	2,513
Cronbach's $\alpha$	0,743

Table a1.11: Principal component analysis (with oblique rotation) of items on satisfaction with work conditions

	Warmth working environment	Labour conditions	Structural issues
Opportunities to present results to the department	<b>.840</b>	.188	-.300
The available expertise in the department	<b>.808</b>	.262	-.258
The introduction to the research group/department	<b>.725</b>	.270	-.358
The available funding to go to conferences / summer schools	.317	<b>.771</b>	-.271
The possibility to go on vacation/take some time off Income	.168	<b>.723</b>	-.238
Income	.119	<b>.698</b>	-.108
Is the overall support you receive within the university sufficient to develop your research?	.510	<b>.518</b>	-.489
The training opportunities offered within the university	.380	<b>.495</b>	-.282
The available space in the office	.267	.218	<b>-.887</b>
The infrastructure (lab, materials, programs) to perform your research in a suitable manner	.385	.288	<b>-.872</b>
Eigenvalue	3,441	1,326	1,095
Cronbach's $\alpha$	0,725	0,676	0,738

Table a1.12: Principal component analysis (with oblique rotation) of items on satisfaction with supervisor

	Support of supervisor	Freedom of supervisor
To what extend are you satisfied with: The quality of the meetings	.837	.437
To what extend are you satisfied with: Stimulation/Inspiration to solve research problems/issues	.791	.568
To what extend are you satisfied with: The expertise she/he has on the research subject	.777	.297
To what extend are you satisfied with: The frequency of meetings	.770	.376
Is your supervisor involved in your research?	.752	.170
To what extend are you satisfied with: The support you receive in writing articles	.734	.465
To what extend are you satisfied with: The possibility to attend transferable skills training courses	.352	.862
To what extend are you satisfied with: The possibility to attend conferences/specialist training courses	.345	.852
To what extend are you satisfied with: The freedom you get to develop your own research ideas	.378	.686
To what extend are you satisfied with: The introduction to other prominent researchers in your field of interest by your supervisor(s)	.606	.618
Eigenvalue	4,869	1,351
Cronbach's $\alpha$	0,872	0,769

Table a1.13: Principal component analysis (with oblique rotation) of items on perceived obstacles

	Personal	Research related
Personal reasons	.797	-.136
The unbalanced combination of work and family	.732	-.150
I doubt my own capabilities	.703	-.278
I didn't have the ambition to do a PhD in the first place	.519	-.291
Lack of guidance by my supervisor(s)	.173	-.870
Lack of stimulating research environment	.213	-.833
Lack of results/failed experiment(s)	.376	-.625
Eigenvalue	2,490	1,376
Cronbach's $\alpha$	0,648	0,692