How do PhD candidates experience the working relationship with their supervisor?

Authors: Lien Wille[1], Tinneke Van Hecke[1], Katia Levecque[1], Anneleen Mortier[1]

[1] ECOOM–Ghent University, Department Work, Organisation and Society

The work relationship between PhD candidates and their supervisor significantly determines the success of PhD candidates and how PhD candidates experience their PhD trajectory (Sverdlik et al., 2018). International research highlights that a favorably perceived working relationship significantly contributes to the advancement and satisfaction of PhD candidates (Ives & Rowley, 2005). Conversely, a negatively perceived working relationship more often leads to the discontinuation of the PhD (Castelló et al., 2017). In line with the latter, ECOOM-Brief 20 shows that 55% of PhD candidates in Flanders state the lack of support received from their supervisor(s) as a reason of thinking about quitting their PhD. In this ECOOM-Brief, we map how PhD candidates in Flanders experience the working relationship with their supervisor. More specifically, we ask the following questions:

1. *How do PhD candidates experience the working relationship with their supervisor? We look at perceived support in competency, network and career development as well as the extent to which the supervisor communicates clear expectations and provides feedback on PhD candidate's work.*
2. *Does the perceived working relationship differ according to gender, science cluster, PhD stage and nationality?*
3. *Does the perceived working relationship differ according to the work and organizational context?*

METHODOLOGY

To answer these questions, we use the 2018 Survey of Junior Researchers (SJR). This survey was organized by ECOOM-UGent and addressed to all junior researchers at the five Flemish universities. For the current analyses, we limit ourselves to those junior researchers who are pursuing a PhD at the time of the survey (*N*=3359). For more information about the survey, we refer to ECOOM-Brief 17.

In the present ECOOM-brief, we look at how PhD candidates perceive the working relationship with their supervisor. For a quarter of the PhD candidates, there is only one supervisor, while three quarters of the PhD candidates have at least two supervisors. When multiple supervisors are involved, PhD candidates are asked to describe the working relationship with the main supervisor. The working relationship is captured through ten items. Eight of these ten items are from the scale developed by Waaijer and colleagues (2015) in their study of the labor market position of PhD candidates. There are five response options for each item: 1 = not at all, 2 = somewhat, 3 = moderate, 4 = a lot and 5 = extremely.

We measure four different aspects of the working relationship. Three items measure **support offered in competency development** (α = 0.84): "My supervisor helps me develop my communication skills (including presenting, writing)", "My supervisor helps me develop my management skills" and "My supervisor helps me develop social skills (including working in teams)".

Support offered in network development (α = 0.85) is also measured by three items: "My supervisor helps me build my reputation by introducing me to his/her networks", "My supervisor encourages me to build my own professional networks" and "My supervisor helps me socialize in the immediate area".

Support offered in career development is administered by two items (α = 0.75): "My supervisor gives me advice on how to combine my career with my personal life" and "My supervisor gives me career advice".

Finally, two items (α = 0.74) provide an idea of how PhD candidates perceive the **communication by the supervisor**: "My supervisor is always clear in the expectations he/she sets for me" and "My supervisor gives me feedback on work-related issues".

In the analyses in this ECOOM-Brief, we use PhD candidates' scale scores. For each work relationship dimension, the scale score consists of the average of the scores on the items that make up the scale. In Appendix 1, interested readers can find the distribution of PhD candidates' scores for these items. We group the mean scale scores according to the original response options in the survey: "not at all to somewhat", "a little to moderate", "moderate to a lot" and "a lot to extremely".

HOW DO PHD CANDIDATES EXPERIENCE THE WORKING RELATIONSHIP WITH THEIR PROMOTOR?

Figure 1 shows how PhD candidates perceive the working relationship with their supervisor in terms of support offered for competency, network, and career development as well as in terms of communication.

Figure 1. PhD candidates ' perceived working relationship with the supervisor: distribution of PhD candidates on the scale scores by working relationship dimension, Flanders 2018 ($N_{support\ in\ competency\ development}$=3222; $N_{support\ in\ network\ development}$ =3221; $N_{support\ in\ career\ development}$ =3215; $N_{communication}$=3219)
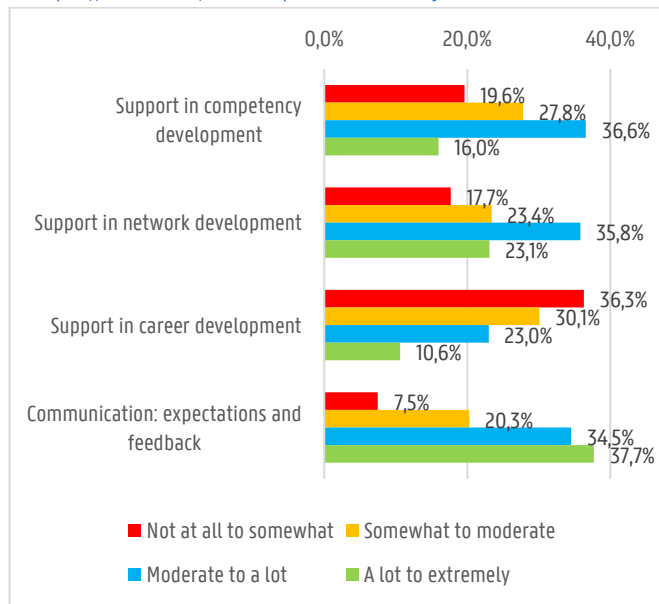

Figure 1 shows that the proportion of PhD candidates who are "a lot to extremely" supported in their **competency and network development** is 16.00% and 23.10%, respectively. In most cases PhD candidates experience their supervisor's support regarding competency and network development as "moderate to a lot". Nevertheless, just under 20% of the PhD candidates also report that they experience no support at all to some support from their supervisor when it comes to developing their competencies and network.

Looking at PhD candidates' responses regarding perceived **support** from their supervisor when it comes to their **career development**, 36.30% experiences that there is no such support at all, or only a little. Another 3 in 10 PhD candidates report a score in the range "a little to moderate". Only 1 in 10 PhD candidates says "a lot to extremely" for support from their supervisor in developing their career.

Finally, looking at the extent to which the supervisor clearly **communicates expectations and provides feedback**, nearly 2 in 5 PhD candidates report "a lot to extremely". Another 1 in 3 PhD candidates evaluates this aspect of the working relationship as "moderate to a lot". One in five PhD candidates evaluates the communication as "a little to moderate" and 7.5% as "not at all to somewhat".

DOES THE PERCEIVED WORKING RELATIONSHIP DIFFER ACCORDING TO GENDER, SCIENCE CLUSTER, PHD PHASE AND NATIONALITY?

In Table 1, we examine whether there are differences in the experienced working relationship with the supervisor according to gender, science cluster, PhD phase and nationality. To check whether differences are significant, we performed both a one-way ANOVA F-test and the Welch test. Both tests check whether group averages differ significantly but make different assumptions about the distribution of response options by group. Since both tests lead to the same conclusions, we report only the F-test in Table 1.

Looking at **gender**, we find that male and female PhD candidates do not differ significantly from one another in how they perceive the working relationship with their supervisor.

We do note significant differences between **science clusters** for the support offered in network and career development as well as communication of expectations and feedback. Post-hoc comparisons (p<0.01) show that on average PhD candidates in the humanities and the social sciences report higher scores on communication and support in developing their careers compared to PhD candidates in the exact, biomedical, and applied sciences. In terms of support in developing one's network, PhD candidates in the humanities experience more support than PhD candidates in the exact, biomedical, and applied sciences. PhD candidates in the social sciences report more support from their supervisor in developing their network compared to PhD candidates in the exact and applied sciences.

When we focus on the **PhD phase**, again we note significant differences in how PhD candidates perceive the working relationship with their supervisor. Post-hoc comparisons (p<0.01) for competency development, network development and communication indicate that PhD candidates in the initiating phase perceive these aspects of the working relationship with their supervisor as better than PhD candidates in the executing or finishing phase. In turn, PhD candidates in the executing phase perceive these aspects as better than PhD candidates in the finishing phase. Looking at perceived support in career development, PhD candidates in the initiating phase report significantly more support than PhD candidates in the executing or finishing phase.

And what about **nationality**? Again, we note significant differences. Post-hoc comparisons with a stricter significance level (p<0.01) indicate two patterns. First, PhD candidates from outside the EU report significantly higher scores for competency development, career development and communication compared to PhD candidates from Belgium and countries within the EU-28. Second, PhD candidates from outside the EU experience more support in network development compared to Belgian PhD candidates.

	Support in competence development (*N*=3222)	Support in network development (*N*=3221)	Support in career development (*N*=3215)	Communication: expectations and feedback (*N*=3219)
Mean	2.80	2.97	2.29	3.32
Gender	n.s.	n.s.	n.s.	n.s.
Male	2.82	3.00	2.31	3.32
Female	2.78	2.94	2.27	3.31
Science cluster	n.s.	***	***	***
Exact sciences	2.74	2.87	2.11	3.23
Biomedical sciences	2.84	2.93	2.20	3.22
Applied sciences	2.78	2.88	2.20	3.24
Humanities	2.83	3.22	2.62	3.57
Social sciences	2.79	3.08	2.45	3.45
PhD phase	***	***	***	***
Initiating	2.99	3.30	2.48	3.50
Executing	2.80	2.94	2.24	3.34
Finishing	2.62	2.76	2.23	3.11
Nationality	***	***	***	***
Belgian	2.72	2.92	2.18	3.26
EU28	2.82	3.02	2.31	3.27
Non-EU28	3.02	3.11	2.59	3.51

(§) significance based on an Anova F-test
n.s.=not significant   *=p<0.05   **=p<0.01   ***=p<0.001

DOES THE PERCEIVED WORKING RELATIONSHIP DIFFER ACCORDING TO WORK AND ORGANIZATIONAL CONTEXT?

Table 2 shows that PhD candidates experience more **support** from their supervisor **regarding the development of their competencies** (1) when the job demands are high (e.g., high workload and/or high work pace), (2) within the biomedical sciences compared to the exact sciences, (3) when their supervisor is an inspirational leader (i.e., a supervisor who articulates an attractive vision, gives meaning and purpose to PhD candidates' work, and leads by example), (4) when they perceive the likelihood of an academic career as high, and (5) when they have a positive perception of the value of a PhD for the non-academic job market.

We see that the reported support in competency development is lower (1) among PhD candidates who do not know their type of appointment compared to PhD candidates who are an assistant, (2) when the team decision-making process is more closed (and thus less democratic), and (3) when PhD candidates are older.

Looking at perceived **support in network development**, we find that it is higher (1) when the job demands are high, (2) when there is a high degree of job control (i.e. a high degree of variety and autonomy in the job), (3) within the humanities and the social sciences compared to the exact sciences, (4) when the supervisor is an inspirational leader, (5) when the perceived likelihood of an academic career is high, and (6) when the PhD candidate has a positive perception of the value of a PhD for the non-academic job market.

Network development support is lower (1) among PhD candidates who do not know their type of appointment compared to PhD candidates who are an assistant, (2) during the executing and finishing phase compared to the initiating phase, (3) when the team decision-making

process is more closed (and thus less democratic), and (4) when PhD candidates are older.

PhD candidates further report more **support offered when it comes to their career development** (1) when the job demands are high, (2) within the humanities and the social sciences compared to the exact sciences, (3) when the supervisor is an inspirational leader, (4) when there is high interest in an academic career, (5) when the perceived likelihood of an academic career is high, (6) when the PhD candidate has a positive perception of the value of a PhD for the non-academic job market, (7) when PhD candidates have children in their household, and (8) when there is a family-work conflict. This is an internal conflict where the demands of family life make it difficult to adequately perform the work role in addition to the family role.

In contrast, perceived support in career development is lower (1) when the team decision-making process is more closed (and thus less democratic), (2) when PhD candidates are older, and (3) when there is a work-family conflict. This is an internal conflict in which the demands of work make it difficult to adequately exercise the family role in addition to the work role.

Finally, the score for **communication** is higher (1) when the job demands are high, (2) within the humanities and the social sciences compared to the exact sciences, (3) when the supervisor is an inspirational leader, (4) when the perceived likelihood of an academic career is high, (5) when PhD candidates have a positive perception of the value of a PhD in the non-academic job market, and (6) when PhD candidates have children in their household.

The reported score for communication is lower (1) when the team decision-making process is more closed (and thus less democratic) and (2) when there is a work-family conflict.

DISCUSSION

The purpose of this ECOOM-brief was to identify how PhD candidates experience the working relationship with their supervisor on four dimensions, specifically support in competency development, support in network development, support in career development and communication (i.e., the extent to which the supervisor communicates clear expectations and provides feedback). Four in ten experience a lot to extremely high levels of communication from their supervisor and 1 in 4 reports a lot to extremely for support in developing his/her network. In addition, 16% experiences a lot to extremely high levels of support in developing his/her competencies and 10% reports a lot to extremely for support from their supervisor when it comes to his/her career development.

We note no differences in the perceived working relationship with the supervisor according to gender: male and female PhD candidates experience each of the four dimensions as equally positive or negative. Looking at science cluster, PhD candidates within STEM sciences (exact, applied and biomedical sciences) rate the working relationship with their supervisor lower than PhD candidates within non-STEM sciences (humanities and social sciences) for support in career development, support in network development and communication. PhD candidates within STEM sciences work with companies more often than PhD

candidates within non-STEM sciences (see ECOOM-Brief 45). As a result, these PhD candidates also have contact with individuals outside university. For the development of their network and career, they may also consult these contacts and are therefore less dependent on their supervisor for such support. PhD candidates within non-STEM sciences, on the other hand, may primarily seek and find this support from their supervisor.

Regarding PhD phase, PhD candidates in the initiating phase perceive each work relationship dimension as better compared to PhD candidates in the executing and finishing phase. However, when we include PhD phase in a multiple regression model for each of the working relationship dimensions (see Table 2), PhD phase does not appear to be significant in the model for support in competency development, support in network development support and communication. This means that the differences according to PhD phase for these work relationship dimensions in Table 1 can be explained by the other determinants included in the analysis in Table 2. Our survey does not answer the question of why PhD candidates in the initiating phase experience more support regarding their career development than PhD candidates in the executing and finishing phase. One possible hypothesis is that PhD candidates in the initiating phase need support to start their PhD trajectory and academic career. Since their supervisor has also completed a PhD and established an academic career, they may seek and find this type of support from their supervisor. In the later stages of the PhD trajectory, PhD candidates may also need support in deciding what to do after the PhD or support in preparing the transition to the non-academic job market. PhD candidates may seek and find this support less from their supervisor and more from other people and institutions such as the Doctoral Schools.

Looking at nationality, PhD candidates from outside the European Union appear to experience the working relationship as better than PhD candidates from Belgium in terms of network development and as better than PhD candidates from Belgium and the European Union in terms of communication, support in competency development and support in career development. PhD candidates from outside the European Union may have different expectations from a supervisor than PhD candidates from Belgium and the European Union. As a result, they may perceive the support received as a lot or extremely, while in reality they may receive the same amount of support as PhD candidates from Belgium and the European Union.

So, what makes that PhD candidates have a good working relationship with their supervisor? This ECOOM-briefs points to inspirational leadership as an important recurring lever for what PhD candidates perceive to be a good working relationship. To a lesser extent, job demands and a positive perception of a career outside university also act as levers for a good perceived working relationship with one's supervisor. In contrast, a closed decision-making process in the team is a risk factor: PhD candidates reported lower scores on support in competency, network, and career development as well as communication when there was a more closed and thus less democratic decision-making process in the team.

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Table 2: Predictors of PhD candidates' experienced work relation, Flanders 2018: B, Standard error, β, and significance

	Support in competency development (N = 2536)				Support in network development (N = 2535)				Support in career development (N = 2534)				Communication: expectations and feedback (N = 2535)			
	B	Standard error	β	Sign (S)	B	Standard error	β	Sign (S)	B	Standard error	β	Sign (S)	B	Standard error	β	Sign (S)
Constant	0.726	0.197			0.534	0.210			0.293	0.228			1.185	0.193		
Work context																
Job demands	0.104	0.032	0.064	**	0.120	0.034	0.069	***	0.107	0.037	0.061	**	0.071	0.031	0.043	*
Job control	0.003	0.033	0.001	n.s.	0.119	0.036	0.054	***	0.045	0.039	0.021	n.s.	-0.017	0.033	-0.008	n.s.
Science cluster																
Exact sciences (ref)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biomedical sciences	0.126	0.048	0.059	**	0.088	0.052	0.039	n.s.	0.102	0.056	0.045	n.s.	-0.001	0.047	-0.001	n.s.
Applied sciences	0.015	0.051	0.006	n.s.	-0.016	0.054	-0.006	n.s.	0.040	0.059	0.016	n.s.	-0.016	0.050	-0.007	n.s.
Humanities	0.055	0.066	0.016	n.s.	0.305	0.071	0.083	***	0.444	0.077	0.120	***	0.261	0.065	0.075	***
Social sciences	0.024	0.051	0.010	n.s.	0.172	0.054	0.071	**	0.310	0.059	0.128	***	0.182	0.050	0.080	***
Type of appointment																
Assistantship (ref)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scholarship	-0.008	0.045	-0.004	n.s.	0.005	0.047	0.002	n.s.	0.026	0.052	0.012	n.s.	0.012	0.044	0.006	n.s.
Research project	-0.073	0.045	-0.035	n.s.	-0.070	0.048	-0.032	n.s.	-0.065	0.052	-0.030	n.s.	-0.058	0.044	-0.028	n.s.
No university funding	-0.125	0.074	-0.031	n.s.	-0.145	0.078	-0.033	n.s.	-0.112	0.085	-0.026	n.s.	-0.022	0.072	-0.005	n.s.
Other funding	-0.086	0.080	-0.018	n.s.	-0.003	0.085	-0.001	n.s.	0.063	0.092	0.013	n.s.	-0.062	0.078	-0.013	n.s.
Unknown funding	-0.214	0.099	-0.035	*	-0.226	0.106	-0.035	*	-0.082	0.115	-0.013	n.s.	0.014	0.097	0.002	n.s.
PhD phase																
Initiating (ref)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Executing	-0.056	0.041	-0.028	n.s.	-0.222	0.044	-0.106	***	-0.078	0.047	-0.037	n.s.	0.010	0.040	0.005	n.s.
Finishing	-0.005	0.050	-0.002	n.s.	-0.174	0.053	-0.071	**	0.101	0.057	0.041	n.s.	-0.006	0.049	-0.003	n.s.
Inspirational leadership style	0.426	0.013	0.566	***	0.424	0.014	0.529	***	0.346	0.015	0.430	***	0.447	0.013	0.590	***
Much interest in an academic career	0.024	0.034	0.013	n.s.	0.070	0.036	0.034	n.s.	0.146	0.039	0.070	***	0.062	0.033	0.031	n.s.
Perception of high chance of an academic career	0.106	0.034	0.052	**	0.132	0.037	0.062	***	0.156	0.040	0.073	***	0.047	0.034	0.023	n.s.
Positive perception of career outside academia	0.066	0.020	0.055	***	0.070	0.021	0.055	***	0.068	0.023	0.053	**	0.052	0.019	0.044	**

Note. B=unstandardized regression coefficient, β=standardized regression coefficient, Ref.=reference category. Significances: n.s.=not significant, *=p<.05, **=p<.01, ***=p<.001

Table 2: Predictors of PhD candidates' experienced work relation, Flanders 2018: B, Standard error, β, and significance (continued)

	Support in competency development (*N* = 2536)				Support in network development (*N* = 2535)				Support in career development (*N* = 2534)				Communication: expectations and feedback (*N* = 2535)			
	B	Standard error	β	Sign (S)	B	Standard error	β	Sign (S)	B	Standard error	β	Sign (S)	B	Standard error	β	Sign (S)
Organizational context																
University																
KU Leuven (ref)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ghent University	-0.034	0.037	-0.016	n.s.	-0.079	0.039	-0.035	n.s	-0.031	0.043	-0.013	n.s.	0.039	0.036	0.018	n.s.
University of Antwerp	-0.044	0.050	-0.015	n.s.	0.013	0.053	0.004	n.s	-0.033	0.058	-0.010	n.s.	-0.002	0.049	-0.001	n.s.
Vrije Universiteit Brussel	0.004	0.074	0.001	n.s.	0.013	0.078	0.003	n.s.	-0.132	0.085	-0.027	n.s.	0.005	0.072	0.001	n.s.
Hasselt University	0.073	0.045	0.028	n.s.	-0.022	0.048	-0.008	n.s.	0.051	0.052	0.018	n.s.	0.078	0.044	0.030	n.s.
Closed decision-making in het team	-0.112	0.018	-0.108	***	-0.106	0.019	-0.096	***	-0.119	0.020	-0.108	***	-0.078	0.017	-0.075	***
Family-work conflict	0.014	0.020	0.012	n.s.	0.006	0.021	0.005	n.s.	0.060	0.023	0.049	**	-0.038	0.019	-0.033	n.s.
Work-family conflict	-0.031	0.020	-0.033	n.s.	-0.022	0.021	-0.022	n.s.	-0.045	0.023	-0.044	*	-0.078	0.019	-0.082	***
Sociodemographic characteristics																
Female	-0.006	0.032	-0.003	n.s.	-0.057	0.034	-0.027	n.s.	-0.045	0.037	-0.022	n.s.	-0.022	0.031	-0.011	n.s.
Age	-0.011	0.004	-0.054	**	-0.008	0.004	-0.040	*	-0.011	0.004	-0.055	**	-0.005	0.004	-0.026	n.s.
Partner	0.015	0.034	0.007	n.s.	0.010	0.036	0.005	n.s.	-0.023	0.039	-0.010	n.s.	0.014	0.033	0.006	n.s.
Children	-0.011	0.050	0.004	n.s.	0.004	0.053	0.001	n.s.	0.148	0.058	0.050	*	0.124	0.049	0.044	*
Model fit	$R^2 = 42.0\%$				$R^2 = 42.0\%$				$R^2 = 31.9\%$				$R^2 = 44.9\%$			

Note. B=unstandardized regression coefficient, β=standardized regression coefficient, Ref.=reference category. Significances: n.s.=not significant, *=p<.05, **=p<.01, ***=p<.001

Appendix 1: PhD candidates experienced working relationship with their supervisor: distribution of the PhD candidates across the scores per item, Flanders 2018