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AN OVERVIEW AND A REFLECTION OF THE PROCESS AND PRODUCT OF PH.D. PROGRAMS

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Abstract

This paper aims to analyze the Ph.D. thesis process and outcomes through the perspectives of three key actors—supervisee, supervisor, and academic institution—by drawing upon the personal experiences of the authors. Reflections are based on the authors past experience as supervisees and firsthand involvement in supervision, program management, and committee participation, with the key findings highlighting the intricate dynamics of these roles in shaping Ph.D. education. The aspects discussed in this work are motivation, previous experience, the individual study plan, guidance, and contributions. The motivations for pursuing a Ph.D. were diverse, encompassing personal and professional goals, passion for research, career advancement, and societal contributions. Previous experience from all actors is recognized as a critical factor influencing the success of the Ph.D. journey, where considerations regarding academic background, research interests, and cultural factors may influence the time and the outcome. The individual study plan is recognized by the authors as a vital tool for modeling a Ph.D. student's research and professional development trajectory. Guidance throughout the Ph.D. process is discussed in terms of frequent and consistent supervision, providing regular support and feedback, which gradually shifts towards fostering research independence. This approach emphasizes the importance of mentorship and effective communication among peers at every stage. Finally, contributions are discussed as a final phase of the Ph.D. journey, where students are expected to demonstrate their expertise and impact through publications, awards, patents, and other forms of recognition. Supervisors and institutions also play a crucial role in supporting and showcasing such contributions. This reflection paper shows the relations between these factors and the collective responsibility shared by the actors in producing a successful Ph.D. thesis and an independent researcher. We argue our reflections are a valuable resource for those involved in Ph.D. programs, offering insights into the various dimensions of the Ph.D. journey and highlighting the importance of collaboration and support among these critical actors.

Keywords: Ph.D., Ph.D. thesis, Ph.D. thesis process, PhD. product.

Sammanfattning Svenska

Denna artikel syftar till att analysera processen och resultaten av en doktorsavhandling utifrån perspektiven hos tre nyckelaktörer—doktorand, handledare och akademisk institution—genom att dra nytta av författarnas personliga erfarenheter. Reflektionerna baseras på författarnas tidigare erfarenheter som doktorander och deras direkta engagemang i handledning, programledning och kommittéarbete, där de viktigaste resultaten lyfter fram de komplexa dynamikerna mellan dessa roller och deras inverkan på doktorandutbildningen. De aspekter som diskuteras i detta arbete är motivation, tidigare erfarenhet, individuell studieplan, handledning och bidrag. Motivationerna för att påbörja en doktorandutbildning var mångfaldiga och omfattade personliga och professionella mål, en passion för forskning, karriärutveckling och samhällsbidrag. Tidigare erfarenhet från alla aktörer ses som en kritisk faktor för att påverka framgången i doktorandresan, där hänsyn till akademisk bakgrund, forskningsintressen och kulturella faktorer kan påverka både tid och resultat. Den individuella studieplanen erkänns av författarna som ett viktigt verktyg för att forma en doktorands forsknings- och yrkesutveckling. Handledning under doktorandprocessen diskuteras i termer av frekvent och konsekvent handledning, regelbundet stöd och feedback, som gradvis skiftar mot att främja forskningssjälvständighet. Detta tillvägagångssätt betonar vikten av mentorskap och effektiv kommunikation mellan kollegor i varje steg. Slutligen diskuteras bidrag som ett sista skede i doktorandresan, där studenter förväntas visa sin expertis och påverkan genom publikationer, priser, patent och andra former av erkännanden. Handledare och institutioner spelar också en avgörande roll i att stödja och lyfta fram sådana bidrag. Denna reflekterande artikel visar relationerna mellan dessa faktorer och det kollektiva ansvar som delas av aktörerna för att producera en framgångsrik doktorsavhandling och en självständig forskare. Vi hävdar att våra reflektioner är en värdefull resurs för de som är involverade i doktorandprogram, genom att erbjuda insikter i de olika dimensionerna av doktorandresan och belysa vikten av samarbete och stöd mellan dessa viktiga aktörer.

Introduction

Pursuing a Ph.D. degree is regarded as the utmost academic achievement for a student, serving as evidence of their proficiency in their respective fields and representing the culmination of a successful personal and academic journey. According to Michalski et al. (2016), the Ph.D. degree is “intended for students interested in generating new knowledge through scientific research (i.e., setting up experiments, collecting data, applying statistical and analytical techniques) and/or gaining teaching experience.” The impact of a Ph.D. extends well beyond the university campus, contributing to the landscape of knowledge and advancement. According to the Organization for Economic Cooperation and Development (OECD) (2017), on average, only 1% of the world’s 25 to 64-year-olds who have been to university have a Ph.D. In the United States and as well as in Sweden, it accounts for 2% of the total population.

The Swedish higher education institutions (UKA”) reported in 2021 that there were 17,400 doctoral students, with 41% of them being international students. Among the Swedish doctoral candidates, 54% were women, and 46% were men. Since 2011, a growing female presence among doctoral students has

been consistently observed. Additionally, 2,670 doctoral degrees were awarded in the same year, marking a notable increase of 100 degrees compared to the previous year. However, the former report claims that female students exhibit a lower completion rate within five years than their male counterparts. For instance, among those who started their studies in 2016, 42% of women and 49% of men successfully obtained their doctoral degrees within five years. This disparity may be attributed, in part, to the fact that women tend to take more parental leave compared to men as indicated by UKÄ (2022). In the United States of America, a significant concern is the dropout rate of 50% among doctoral students (Krauss et al., 2010). This high rate poses competitive and financial challenges for universities since a substantial portion of their research output relies on Ph.D. students (Cattaneo et al., 2018).

Sweden's approach to doctoral education distinguishes it from other regions in the world. While in many countries, Ph.D. students are just seen as students, in Sweden, they are simultaneously members of the student community and university employees. This means that the Higher Education Act (i.e., a piece of legislation that governs higher education institutions and their activities in the country) and the Higher Education Ordinance (i.e., a document that specifies many of the practical aspects of higher education) are applied to doctoral education, dictating both the legislation and practical aspects of higher education programs. At the same time, doctoral students are employed by the institution, so laws and regulations concerning employment are also applicable. Therefore, understanding the roles of several actors and their responsibilities through a Ph.D. program is essential for producing a solid Ph.D. thesis.

In this work, we reflect on several key aspects of the Ph.D. process, including motivation, experience, the individual study plan, guidance, and the formulation of research problems and contributions, as well as the final outcomes: a robust Ph.D. thesis and the development of an independent researcher. These reflections are framed through the perspectives of three distinct actors: the supervisee, the supervisor, and the academic institution. We identified these roles because they represent the primary drivers of a Ph.D. program and highlight the structured interactions that shape the academic environment.

While this study is based solely on the authors' personal experiences, these insights are likely valuable to the academic community. Our reflections are grounded in many years of active engagement in academia in various roles. As former supervisees, current supervisors, and active participants in university committees, such as those focused on hiring, academic program management, and thesis review, we have had the privilege of engaging with all sides of the Ph.D. process. Organizing our experiences around these three actors allows us to view the process through different lenses, enriching our understanding of the expectations and challenges each actor faces. Accordingly, although we acknowledge that this work is limited by its reliance on personal experience, we argue that our reflections, shaped by years of professional practice, offer meaningful contributions to the discourse on doctoral education. This is particularly relevant given the high dropout rates and the growing need for a more holistic understanding of the Ph.D. journey.

The Aspects of the Ph.D. Process

In this work, we analyze several aspects of the supervision process through the lens of three distinct actors: the (i) supervisee, the (ii) supervisor, and the (iii) academic institution. Afterward, we discuss essential topics encompassing a Ph.D. program and how each actor should contribute to the product, i.e., a solid Ph.D. thesis.

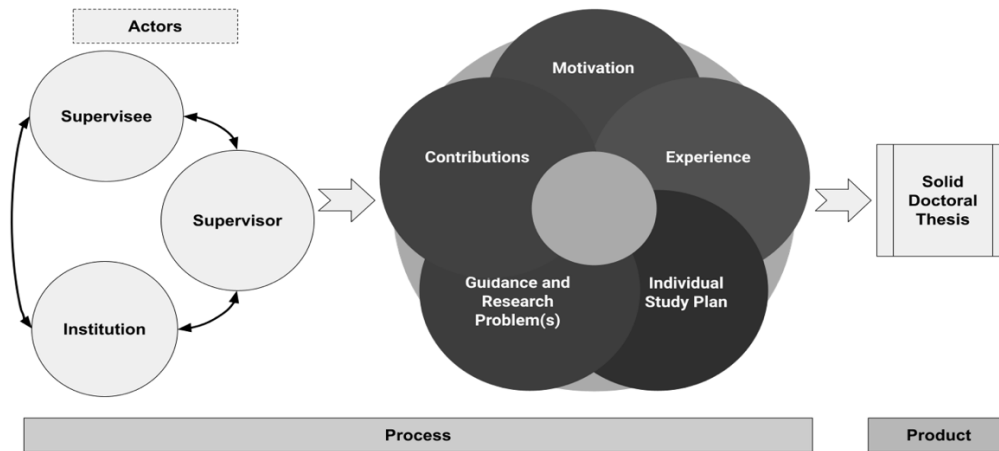


Figure 1: The several aspects of the process for building a solid Ph.D. thesis.

Figure 1 provides an overview of our analytical framework. Five key aspects of the Ph.D. process are discussed in this work, selected based on their importance in Brodin et al. (2020), as they represent what we believe to be the most critical topics highlighted in the book. First, we discuss the main motivations for all three actors to engage in a Ph.D. thesis (Section 2.1). After, we discuss how past experience may influence the success of a Ph.D. thesis (Section 2.2). A discussion regarding the Individual Study Plan (ISP) is then presented in Section 2.3. In Section 2.4, we highlight the importance of guidance through the Ph.D. journey, while in Section 2.5, we reflect on the contribution of each of the main contributors. Finally, Section 4 concludes the paper.

Motivation

The motivations behind obtaining a Ph.D. are paramount to developing a solid Ph.D. thesis. Personal and professional reasons motivate a Ph.D. student to pursue such a degree. The passion for research is a primary driver for a student to start a Ph.D. program and their willingness to contribute to society (Christine et al., 2005). According to Spaulding et al. (2012), personal motivations are typically associated with achievement, personal goals, enjoying a challenge, and desiring the title. Professional motivations range from the supervisees willingness to become scholars or are related to supervisors for being promoted. Research suggests that personally and professionally motivated candidates are more likely to persist (Christine et al., 2005) and obtain such a degree. The professional motivations cited in Spaulding et al. (2012), typically include factors associated with career advancement, such as increasing personal marketability and credibility and being eligible or recognized for a promotion or raise.

From the supervisor's perspective, there are several reasons to be involved in a Ph.D. thesis. Mentoring and educating the next generation of scholars in the supervisor's field is an excellent opportunity for the supervisor to pass on their knowledge and expertise. We believe it is also attractive from the supervisory side to collaborate with younger researchers, which can feed them with new ideas and more energy toward common goals in their discipline. Advancing knowledge with new contributions given collaboratively with their students to their field is also interesting from the supervisor's perspective since they are seen as more mature researchers capable of graduating the next generation of scholars. Finally, supervising Ph.D. students implicates in many programs that professors qualify for career advancement.

Academic institutions generally provide Ph.D. programs to improve the institution's reputation for educational excellence, which may lead to higher rankings and increased institutional visibility. Another aspect that academic institutions benefit from Ph.D. programs is that research conducted in such programs can lead to innovations and technology transfer, fostering collaboration with industries and

contributing to regional economic development. Institutions can also contribute to solving societal issues through their doctoral programs. When collaborating with industry and government, complex societal problems from health, environment, and the social fields can be better addressed. Finally, many research grants require the presence of Ph.D. programs, and such funds can support research infrastructure and faculty salaries. In summary, it is essential to notice that all three parties have the common motivation of advancing knowledge and science through research contributions. If supervisees, supervisors and academic institutions all work together, society has a lot to gain.

Previous Experience

Previous experiences of all actors involved in a Ph.D. program must also be considered in several aspects. For example, the processes and quality of the supervisee's experience (e.g., undergraduate and Masters level) are essential to determine how much effort needs to be taken into consideration from the supervisor and institution's side, mainly to ensure that the supervisee understands the program they enrolled and what they need to do to finish it. Language and cultural barriers are significant problems that both supervisors and institutions should consider when hiring international students, and providing proper services to address such barriers is essential for a Ph.D. program to become successful. We believe that the supervisee's past research interests and experiences should align with the focus of their Ph.D. program. This alignment helps ensure genuine passion for the research area, increasing the likelihood of success. Besides that, solid foundational knowledge in the field will help supervisees progress more smoothly through their Ph.D. coursework and research. Different subject-matter contexts and cultural backgrounds can significantly influence how a doctorate is produced, shaping the research process and its outcomes. However, an in-depth exploration of these factors is beyond the scope of this paper. We recognize that these are essential research topics that deserve a more focused attention and their importance in shaping doctoral outcomes should not be underestimated.

From the supervisor's side, they must learn from past experience when supervising Ph.D. students and adapt as much as possible to accommodate the supervisee's needs. Building solid and professional relationships—characterized by open communication, mutual respect, trust, and clear expectations—is, in our view, what characterizes a successful supervisor. These qualities foster an environment where both the supervisee and supervisor can thrive, supported by the supervisor's ability to learn and grow from past experiences. Over time and by facing novel situations through the supervisor's journey, a supervisor needs to reflect and learn from their own decisions to find the right balance and approach to guide Ph.D. students. Since academic environments can be complex, supervisors with experience can guide their students through various challenges, such as publishing research papers, navigating ethics approvals, and understanding the nuances of academic bureaucracy. Therefore, having open conversations and providing proper guidance through the system is also something the supervisor can contribute towards helping the supervisee become an independent researcher.

The academic institution should also learn from its previous experience. In this context, our reflections are based on our experiences at the departmental level, where Ph.D. programs are directly managed. While our reflection focusses on departments, we believe that by learning from past experiences and continuously improving the Ph.D. program, departments play a crucial role in enhancing the reputation of the broader academic institution. Therefore, by maintaining and enhancing what is going well in a Ph.D. program, an academic institution can consolidate its reputation as a strong institution in a given field. In addition, understanding what is not working well and collecting collective feedback on how the program can be improved is essential for a program to improve. Academic institutions can also showcase examples of successful Ph.D. alumni and show how their achievements and life stories reflect on the program's quality and how it helped them become better scholars. Finally, the past experiences of academic institutions promoting diversity and inclusion can impact the success of Ph.D. programs. We

believe that academic institutions that can foster diverse and inclusive environments may attract a broader range of talent that can lead to innovative research and enriched learning experiences.

The Individual Study Plan

Two documents are of utmost importance for a Ph.D. program in Sweden: the General Study Syllabus (GSS) and the Individual Study Plan (ISP) defined in the Higher Education Ordinance. The GSS outlines the general framework and requirements for a Ph.D. program within a particular subject, including the program's objectives, structure, and the qualifications required for admission. It serves as a standardized guideline that all Ph.D. students in the subject must follow. For a higher education institution to provide a doctoral education within a subject, it is necessary to study a GSS for the subject in question (Brodin et al., 2020), and syllabi for the same subject of different institutions may vary in structure and content. Importantly, the GSS provides the foundational framework for the Ph.D. student's ISP.

The ISP is a personalized, flexible document that maps out the Ph.D. student's specific research goals, coursework, and timeline for completing the program. It can be adapted throughout the student's journey to reflect their progress and evolving needs. According to Brodin et al. (2020), the obligations of both supervisor and supervisee should be specified in the ISP and followed by both parties, and the academic institutions can decide on the specifics of how their ISP is formulated (e.g., what to include, how often it needs a review, how to change it, etc.). These obligations often include tasks such as meeting deadlines for research milestones, completing coursework, attending seminars, and regularly reporting progress. Supervisors, on the other hand, are typically responsible for providing regular feedback, ensuring that the student receives adequate guidance, and facilitating the student's research activities.

Ph.D. students are entitled to supervision primarily if the obligations outlined in the ISP are fulfilled. The supervisees also have the right to request a new supervisor if necessary. However, Ph.D. students do not unconditionally have the right to choose their supervisors, to change, or to retain their projects since this must be in line with both the GSS and ISP and deemed feasible for completing the study program within the specified time (Brodin et al., 2020). The Ph.D. student's right to supervision may be lost mainly if they neglect their obligations concerning the ISP. Therefore, from the supervisee's perspective, the ISP should be used to mainly establish, in agreement with the supervisors, the thesis' achievable objectives and goals and serve as a blueprint for their Ph.D. thesis. If a student wishes to change their supervisor, they must typically submit a formal request to the department or doctoral committee, outlining the reasons for the change. The department then assesses the feasibility of appointing a new supervisor, taking into account factors such as the new supervisor's expertise in the student's research area, their availability, and the overall progress of the student's project. While the student's preferences are considered, the department ultimately makes the final decision to ensure the research remains aligned with the GSS and can be completed within the designated timeframe.

The ISP may also be used from the student's perspective to guide their career goals beyond academia and ensure they engage in activities (e.g., community outreach, industry internships, etc) that may enhance their employability. Thus, the ISP may help them sustain their motivation and keep up with their mission objective (Figure 2).

The Higher Education Ordinance states that at least two supervisors must be appointed to a Ph.D. student, and one must be the principal supervisor. Supervisors are also responsible for, together with the Ph.D. student, creating a well-defined and realistic ISP. The supervisors must help the supervisee define research objectives, develop a timeline, and identify relevant coursework and training opportunities. It is also essential to set clear expectations regarding the student's research and how they will evaluate their progress and performance. Therefore, setting specific research goals and milestones to be achieved

is essential. Supervisors should ensure that the Ph.D. student can access necessary resources, including research facilities, funding, and equipment, and the ISP can include provisions for resource allocation and funding support.

From the academic institution's perspective, they must establish the ISP policies and guidelines so that the supervisor and supervisee can follow and understand their responsibilities when co-designing the document. Academic institutions can use such documents to evaluate the quality and effectiveness of the ISP process across its departments and programs, aiming at verifying that the ISP guidelines are followed and that students receive adequate support and guidance toward a solid Ph.D. thesis. Providing resources and support for the supervisors is also essential to ensure the program's quality evolves over time and actively promoting (e.g., workshops, seminars, mentoring programs, etc.) best practices of the ISP document development.

Guidance

Throughout the thesis journey, guiding students involves equipping them with pedagogical and psychological tools to nurture their self-confidence, self-reflection, and independence as they progress toward attaining the predetermined thesis objectives outlined in their ISPs.

Psychological tools might include regular feedback sessions, which help students refine their research and build confidence; structured goal-setting exercises to promote self-reflection and track progress; and offering opportunities for independent decision-making in research design, fostering autonomy. Additionally, psychological support, such as encouraging resilience through constructive criticism and providing access to mentoring or peer support groups, can enhance the student's ability to navigate challenges and grow both academically and personally.

Effective guidance, coaching, and support can significantly increase the probability of students successfully completing their studies (Fedynich et al., 2011). We believe that from a supervisor's standpoint, it is imperative to adopt a chronological guiding process that could be organized into distinct phases. In the initial year, the supervisor's involvement is more extensive as they should guide students to ensure they comprehend the study's roadmap and maintain a sense of progress. Therefore, at the beginning of the Ph.D. journey, the supervisor must have an active voice in the initial versions of the ISP, ensuring that the supervisee is aware of his obligations and that they need to show solid progress in the program. Moving into the second year, the focus shifts to reviewing the students' proposed methodologies for accomplishing their goals and related research publications. Here, the supervisor actively shapes the structure of the papers and provides feedback on sections authored by the students. From here, the supervisees may start having a more active voice in shaping the path to their thesis and should discuss in more detail what they believe is necessary to continue their training. The supervisee has more autonomy to guide their research path once they show a proper literature review and in-depth discussions about the research problems they will address and the contributions to be given to a specific field. However, it is important to note that autonomy must be offered on an individual basis, depending on the student's demonstrated competence and understanding. In fields where decisions may have significant implications—such as clinical settings or research that directly affects people's lives—granting premature autonomy could be dangerous. In such cases, a more cautious approach is necessary, where the supervisor retains closer involvement until the supervisee clearly shows the required expertise and responsibility. In the subsequent years, the supervisor gradually transitions to a more hands-off approach, empowering students to leverage their acquired expertise in developing paper structures and content and drafting the structure and content of their dissertations. During this final stage, the supervisor's role shifts to reviewing the drafts produced (e.g., papers and dissertations) and selecting

examiners for the defense process. Here, the supervisee should show and convince the supervisor how they evolved and that they can eventually conduct independent research.

One of the main factors in a successful doctoral journey is providing the supervisee with guidance concerning research and methodology by their supervisor (Fedynich et al., 2011). Indeed, inadequate supervisory support is the primary factor contributing to the highest rate of dropouts, estimated at approximately 40% (Högskoleverket, 2012). The supervisee should feel that they can rely on his supervisor (Fokkens-Bruinsma et al., 2021), both technically and personally. They must receive clear direction and support throughout the thesis journey. This includes help in refining the research questions, offering expertise in the field, and providing constructive criticism and suggestions for improvement. Having regularly scheduled meetings (Table 1) for feedback on thesis progress proved to be a pivotal role throughout the entire thesis journey (Ndayambaje, 2018). Adhering to a structured communication routine is essential for a supervisee to maximize the benefits of their supervisor's expertise and ensure the timely completion of their thesis.

From the academic institution's side, they should offer a supportive layer of guidance to ensure that students know they are not isolated in their academic journey, solely relying on their supervisor. If conflicts or uncertainties arise, the institution should offer academic and, if necessary, psychological support to assist students in potentially stressful situations that can arise during their Ph.D. thesis. This is achieved by conducting regular assessments of the student's progress, typically on an annual or semi-annual basis, carried out by the institution's graduate study department or a Ph.D. committee designated by the institution. These assessments ensure the study plan is followed and anticipate potential deviations. The department can take this role by appointing a Ph.D. committee, which includes a source of high-level advice, such as the director of graduate studies, who arranges milestone meetings to check the progress once a year. Furthermore, the institution may require public appearances of the student throughout the thesis process to verify the progress among a wider audience and give a chance to the student to broaden his or her communication channels. These appearances could be arranged in the first year and end with the presentation of the research proposal and report, whereby the institution appoints an internal examiner in cooperation with the supervisor. During the second year, the second milestone is the thesis proposal, which could be arranged at the end of the year, whereby the institution appoints an external examiner in cooperation with the supervisor. In the final year of the thesis journey, a final seminar concludes the series of evaluation checkpoints involving an external examiner before letting the student defend his or her thesis. The students would need to make at least four presentations and related drafts, refining the research outcomes' quality and developing the student's presenting skills. These various elements substantially influence the outcome of the thesis journey, as shown in Table 1.

Contribution(s)

The final step towards a successful and solid Ph.D. thesis is showing its contributions to the research field and the broader academic community. This responsibility primarily lies with the supervisee, who, through extensive study and specialization, must prove their deep knowledge of the state-of-the-art literature in their field and sub-area. Evidence of such contributions can be provided through publications in peer-reviewed journals and conferences, presentations at academic events as shown in Table 1. Another way to show evidence of contributions is if the research has led to patents or intellectual property, which is seen as solid evidence of contributions to innovation and knowledge creation. Finally, receiving academic or research awards, scholarships, fellowships, or honors can indicate the recognition of the supervisee's contributions by peers and experts in the specific field of study.

From a supervisor's point of view, they must show that they can train independent researchers with solid contributions. Supervisors can provide evidence of their mentorship by documenting regular meetings

and discussions with their Ph.D. students. Maintaining records of these interactions, including given feedback and advice, can showcase their commitment to student's development. Collaborative publications and research projects with their Ph.D. students can show a supervisor's active involvement in advancing their students' research careers. Co-authoring papers or collaborating on projects is tangible evidence of joint contributions. Also, being able to showcase the success of past Ph.D. students under their supervision is a strong indicator of a supervisor's effectiveness, and in many places, showing such evidence is crucial to obtaining new research funding. Finally, supervisors who assist their Ph.D. students in securing academic or industry positions after graduation demonstrate their commitment to the student's long-term success. Therefore, tracking and documenting successful job placements is evidence of this support.

From an academic institution's perspective, demonstrating their contributions to the success of Ph.D. students is essential for creating and maintaining a solid academic reputation. Consequently, they may be able to attract talented students and faculty and ensure program quality. Academic institutions may showcase their research productivity by highlighting faculty publications, patents, and collaborative research projects with the government and industry.

Key Factors and Their Interrelationships in Ph.D. Studies

The analysis of the Ph.D. key factors of each actor has shown not only their significant impact on shaping the outcome of the doctoral process but also has highlighted the interrelation of these factors, since they intersect and mutually influence each other's impacts. The analysis of key factors of each actor affecting the Ph.D. journey has not only revealed their significant impact on shaping the outcomes of the doctoral process but has also highlighted their close dependency. These factors intersect and mutually influence each other's impacts, highlighting the challenging doctoral experience.

Figure 2 illustrates the mutual relationship between the key factors of various actors discussed in this study. For example, the guidance provided by the supervisor and institution significantly influences the contributions of the supervisee, supervisor, and institutions. Similarly, the academic institution enhances the visibility and outreach of the supervisee's work through its reputation and networks, thereby increasing the supervisee's motivation. The three actors past experience influence positively their contributions and results in a better guidance from the supervisor and the institution as well. Additionally, the support received from the supervisor further enhances the motivation level of the supervisee. Quantitative data is the preferred option when the objective is to measure variables, test hypotheses, and establish general patterns across populations (Bryman, 2016). Utilizing measured data can enhance the follow-up process of assessing the progress and outcomes of the dissertation and the doctoral journey. Converting qualitative aspects depicted in earlier sections, i.e., peer-reviewed journals, meeting frequency with the supervisor, seminars given (Table 1), to measurable data enables the effective assessment of progress and outcomes throughout the doctoral process, thereby ensuring continuous improvement and refinement.

Quantitative data is the preferred option when the objective is to measure variables, test hypotheses, and establish general patterns across populations (Bryman, 2016). Utilizing measured data can enhance the follow-up process of assessing the progress and outcomes of the dissertation and the doctoral journey. Converting qualitative aspects, extracted from earlier sections analysis (e.g., peer-reviewed journals, meeting frequency with the supervisor, seminars given shown in Table 1), into measurable data enables effective progress assessment throughout the doctoral process, ensuring continuous improvement and refinement.

Overall, this analysis highlights the collaborative nature of the doctoral journey, where the interplay between the supervisee, supervisor, and institution plays a central role in achieving academic excellence and scholarly advancement. Through ongoing dialogue and mutual support, we can foster an environment conducive to impactful research and professional development.

	Motivation	Contribution	Guidance	ISP	Past-experience
Peer-reviewed journals		✓			
Public talks		✓			
Meetings frequency			✓		
Seminars			✓		
Milestone meetings			✓		
Number of PhD supervisions					✓
ISP review and update				✓	✓
Timely Feedback		✓			

Table 1: Metrics influencing the thesis outcome.

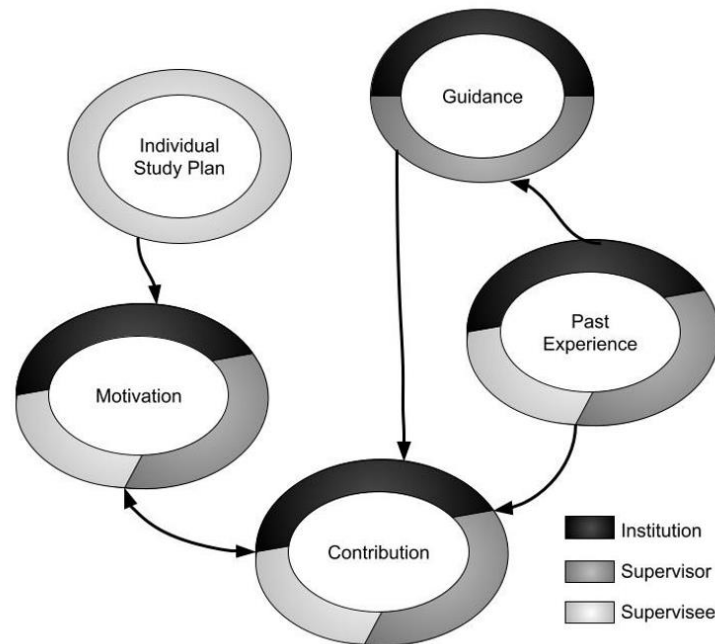


Figure 2: The interrelation dynamic of the key contributing factors of the supervisee, supervisor, and institution

Conclusion

This work explores a reflection on the process and product contributing to a solid doctoral work. In this context, we defined three actors: the supervisor, the supervisee, and the academic institution. Considering this journey's extended and challenging nature, the cooperative synergy among these

participants is crucial in influencing the outcome of a Ph.D. program. Furthermore, we have outlined vital factors to each participant for successful cooperation, encompassing motivation, prior experience, the individual study plan, guidance, and contributions. The interpretation of each factor may differ when viewed from the perspective of each participant. However, their input is essential for the doctoral journey's success. While we recognize that each contributor has his distinct motivations, we believe that the motivation of the supervisee is the primary driving force behind the successful completion of the thesis. The supervisee can also maintain their motivation by using the ISP as a guiding compass, shaping their career aspirations beyond academia. The ISP serves not only as a mean to recall the objectives and goals of the thesis work but also as a source of inspiration for their broader career path. The supervisor's clear guidance is vital in providing essential technical and personal support. It creates a sense of security for the supervisee, reassuring him that he can rely on his supervisor. The academic institution's contribution is greatly valued, with its reputation and extended academic and industrial networks serving as valuable assets for the supervisee's work visibility and outreach. Lastly, the past experiences of each participant are unquestionably significant factors in shaping both the process and the outcome of a solid doctoral work. These experiences can only enhance the overall output of the other factors within the process.

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