

BRIDGING THE GAP BETWEEN PROFESSIONAL PRACTICE AND ACADEMIC RESEARCH – THE INDUSTRIAL PhD

Julia SCHLEGEL¹ and Martina KEITSCH²

¹Snøhetta Oslo AS

²Department of Product Design, Norwegian University of Science and Technology

ABSTRACT

Design and architecture require a good deal of practice based learning and performing. By the same time theoretical knowledge and research training in these fields become increasingly important, especially on an advanced level. In academia, PhD candidates often grapple with this double challenge, not just during their studies but also applying results in the daily professional practice. In order to facilitate cross-pollination of theory and practice, the Industrial PhD. scheme has been introduced in Norway in 2008. Within this scheme companies can apply for support for a three-year period for an employee seeking to pursue an ordinary doctoral degree. This paper discusses the Industrial PhD approach in Norway based on documentations of last years' results and an in-depth case study from an Industrial PhD in a leading Norwegian Architecture Bureau. The paper is meant as input to the ongoing dispute on the relation between design research and practice in different European design and architecture schools and as contribution to appraise and develop doctoral schemes in design and architecture.

Keywords: Industrial PhD, theory practice gap, educating professionals.

1 INTRODUCTION

International analyses document that firms prefer PhD candidates that not only have high level research skills, but also possess industry-relevant competencies [1] developed e.g. through collaboration between the PhD candidate and the firm during their PhD period. Other empirical studies have found similar patterns. Firms generally see the value and relevance of PhD qualifications, but prefer to hire candidates with lower qualification. In their empirical study of firm recruitment strategies, Garcia-Quevedo et al. [2] find that already having PhDs among their staff, or having established collaborations with universities, are more important factors for explaining the propensity of firms to hire PhDs, than the R&D intensity of firms.

Based on such findings and input from Industry and academia, the Norwegian government launched in 2008 a new training scheme, the so-called Industrial PhD to enhance cooperation and mobility between research and industry [3]. The scheme is funded by the Ministry of Trade, Industry and Fisheries, and the Ministry of Education and Research. The Industrial PhD was also a reply to lack of relevant training of academic PhDs for employment in industry partly due to a mismatch between the content of research training programs and the perceived needs of the employers and the labour market [4].

The Industrial PhD scheme in Norway does not represent a new type of doctoral degree, but is designed to support long-term, industry-oriented research that has the same level of scientific merit as the general doctoral degree education [5]. Companies may apply for support for a three-year period for an employee seeking to pursue an ordinary doctoral degree. The doctoral candidate must be employed by the company and the doctoral research project must be of clear relevance to the company's activities [6]. Research projects are developed and conducted in cooperation between the company, the candidate and the educational institution. The candidate researches the topic, the company provides financing and praxis expertise, and the educational institution has the formal responsibility for the educational component and performs quality assurance of the scientific content. The following advantages are presented in the NRC brochure [5].

<i>Companies can</i>	<i>Candidates can</i>	<i>Educational institutions can</i>
<ul style="list-style-type: none"> gain customised research expertise; improve competitiveness; enhance their attractiveness as an employer retain competent employees. 	<ul style="list-style-type: none"> pursue a doctoral degree, but keep working in the business sector; advance their career; broaden their academic horizons. 	<ul style="list-style-type: none"> forge better relationships and closer cooperation with the business sector; have access to externally-funded research resources; carry out scientifically challenging projects.

Table 1. Advantages of doing an Industry PhD

Based on these assumptions, the following sections discuss the Industrial PhD scheme with reference to results and an in-depth case study. The results and conclusion will indicate pro and contra aspects regarding the Industrial PhD and give some suggestions for further development.

2 INDUSTRIAL PHD IN NORWAY: RESULTS FROM 2009-2015

Until 2015 263 projects have received support and about 75 projects have been completed. 65% of the doctoral projects have project period of 3 years (100%) and approximately 35% have project period of 4 years (75%) - slight increase in 4-year projects. Figure 1 shows the areas of expertise [7].

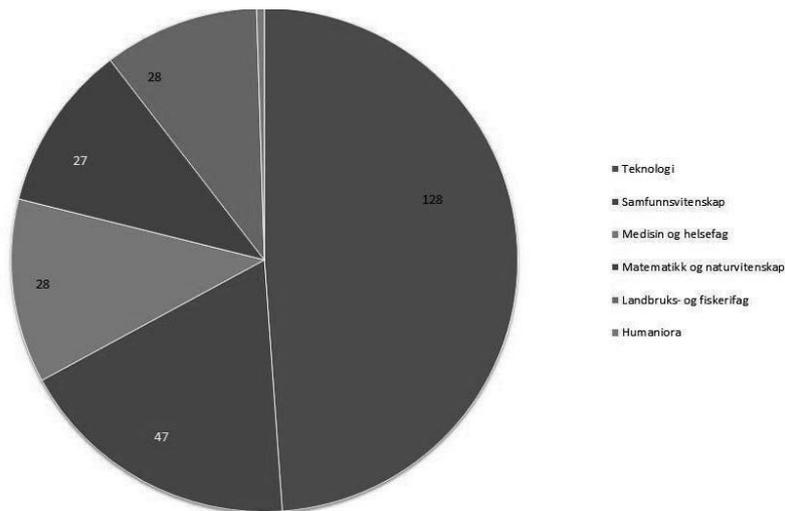


Figure 1. NRC areas of expertise

Based on analyses of existing Industrial PhD applications and interviews with stakeholders (candidates, institutions and companies), NIFU concluded in 2013 [8] that the Industrial PhD scheme has high additionality. Nearly 50 percent of companies believed that the doctoral project would not have been realized without the current financing of NRC, while 33 percent believe the project would have been implemented with a lower level of ambition and without realization of a doctorate. Companies also thought that Industrial PhD projects have been important for skills supply in business, and they also helped regarding competitiveness and innovativeness. They think far less that the projects have been important with respect to enhance the enterprise with respect to R & D opportunities. Candidates consider that their participation has contributed positively to meet various business needs, such as adding new competencies, and develop a better knowledge base and improve competitiveness and that they have largely strengthened its methodological and analytical skills. Supervisors at degree-conferring institutions also believe that they have had a good academic through projects. The table below shows candidates' responses to additional value of an Industrial PhD [9].

Tabell V.16 Hvilken tilleggsverdi får Nærings-ph.d.-kandidater sammenlignet med andre stipendiater? Veiledere ved gradsgivende institusjoners synspunkter (%)

	I stor grad	Til en viss grad	I liten grad	Ikke i det hele tatt	For tidlig å si/vet ikke	N
Tilgang til en aktuell problemstilling	55.1	28.2	14.1	1.3	1.3	78
Bedre lønnsbetingelser	19.7	38.2	14.5	18.4	9.2	76
Praktisk erfaring	46.2	37.2	14.1	2.6	0.0	78
Forske på noe som oppfattes som nyttig	43.0	45.6	10.1	1.3	0.0	79
Tilgang til data	36.7	31.7	26.6	5.1	0.0	79
Tilgang til forskningsressurser	16.7	48.7	24.4	10.3	0.0	78
Bredere erfaring	27.9	53.2	16.5	2.5	0.0	79
Bredere nettverk	26.6	48.1	19.0	5.1	1.3	79
Skjermet tid til å gjennomføre prosjektet	10.1	32.9	32.9	21.5	2.5	79

Table 2. Additional value for Industry PhD candidates compared to regular PhD candidates

3 THE INDUSTRIAL PHD: AN IN-DEPTH ANALYSIS

Some of the aspects above are confirmed on a personal level as well, however, the individual experience of a candidate adds value to the results by elucidating the de-facto situation and circumstances. The description here is from an Industrial PhD conducted between 2010 and 2015 in a larger Norwegian architect bureau.

3.1 Having two patrons (or even three)

The motivation to conduct an Industrial PhD was in our case based on the candidate's experience in her professional environment. Finding ones place as a researcher between academia and practice was experienced as challenging. Traditionally academia and practice are rather divided and many doctoral programs are created for a traditional PhD and its needs. They can hence often provide little support for industrial PhD candidates and the different needs and challenges that arise from this type of PhD. The candidate found herself between two systems, which have little to no experience in cooperation and exchange. This relates e.g. to supervision, where the candidate is sometimes in a situation with two, or rather three 'patrons'. Besides difference in contents and expectations, a practical result is that the candidate has to report the use of hours to the company and the company (1) would usually, and naturally, expect to benefit from the employee. The degree conferring institution (2) prescribes the academic demand and set deadlines for e.g. aspects of the doctor school (if that exists). The research council, financing the PhD, sets the overall length used for the PhD work (3).

One of the main issues is thus often the time organization between the regular work of the employee and the research activities. It can also be difficult to differentiate between the regular work and the research activity depending on the research topic. It can further happen that the PhD project, especially if it does not interact directly with everyday business at the company, becomes over time perceived as a private project of the employee rather than part of his or her contract. Since a lot of aspects of conducting a PhD require work in solitude, the candidate could easily opt for conducting this type of work rather out of the office, which would often mean in his or her spare time. While long working hours or overtime are a well known aspects of any PhD, the double pressure of being in a working environment can further increase the constraint on the candidate's time. On the other side, the structure of a working environment might also help the candidate to manage the time and progress of a PhD better and the relation to practice facilitates reducing deviation from the topic. Being working in practice it can maybe also help to have a more realistic view on the acquirable perfectionism in the end result.

3.2 Methodological and ethical challenges

Fulfilling different demands at the same time can be difficult. While practice might need things a bit earlier and rather omit some depths for applicability, the academic patron might sometimes rather suggest omitting applicability for depths or academic rigor. Academic rigor can sometimes also be counterproductive to applicability. Or at least make it far more difficult for example to give information into the process that could be valuable for practice, but disturb the research progress. Methodologically, research on and in practice can pose difficulties to the researcher in terms of research rigor and stringency. As an example: if the research methodology describes a certain procedure that e.g. needs the researcher to remain a fly on the wall in an observation, yet the

researched situation would demand the researcher to intervene in terms of his or her position in the company, research rigor clashes with the professional responsibility. If the candidate intervenes for the potential benefit of the company, the researcher also altered the observed situation, an aspect that needs to be reflected upon in the methodology and documentation of the research. Further, the alteration might reduce the value of information gathered from the observation since one will not find out what would have happened without the intervention. In other words: remaining distant to the researched situation for the benefit of rigor can be especially challenging to the industrial researcher.

A common point of critique regarding the collection of data in qualitative research is the biasing of the received data through the researcher [10]. In the case of an Industrial PhD this issue is not only relevant for the researcher as a person but also for the researcher as a representative of a company. The first and most obvious aspect of potential bias would be any influence of the researcher through the company's interests. Further, the company, represented through the researcher, could be a potential client or competitor to other participants in the research project, which could initially influence the gathered data, particularly in interviews.

Beyond the bias of business considerations, the mutual professional and educational backgrounds of participants and researcher also create a risk of them potentially identifying too closely with each other. Not only could the researcher identify too closely with the participants [11], but the participants could also perceive the researcher as a "likeminded colleague." Phrases like "you know" (as in: "you know how it is," "as you know," "you know what I mean," etc.), or references to the assumed common knowledge of the interviewee and the interviewed (as in: "the typical," "the usual," etc., without any further description of the referred-to situation or object) could indicate the interviewees' perceived consensus [12] between the researcher and interviewees. If those indicators are not taken into consideration by the researcher by, e.g. further inquiry in regards of the implied information, misinterpretation could easily occur.

Throughout the research project, the candidate in our case was confronted and concerned with issues of bias and ethical responsibility also toward the sensitivity of the subject. The researched topics being architectural competitions and the associated internal processes of architectural offices were aspects of practice that are usually kept strictly confidential. Gaining access to the information required a responsible treatment of the data while approaching it with as little bias as possible. While the candidate was grateful to be given the opportunity to study the subject matter in great detail, it was important to retain a critical attitude toward the cases in order to create a relevant review of the cases.

Additionally, throughout the years, closer connections or even friendships were developed with some of the participants in the studies. The instant codification of the individuals participating in the studies helped not only to anonymize the data but also to keep a greater distance from the data. While personal closeness to the researched individuals was crucial for the trust and engagement of the participants and resulted in a richness of data that could otherwise be impossible to gain, it also demanded particular responsibility in taking care of the data and presenting of results.

Being, as an employee of a company, naturally close to the researched subject, particular care has to be taken in research rigor and transparency of methods in Industrial PhDs and the aspect of bias needs to be addressed and discussed to a potentially greater extent than in a traditional PhD.

3.3 Relating back to practice

What stakeholders, and especially the candidate, would often aspire – and partly even expect – are research results that could ideally be directly implemented into practice. While this might in some cases be possible, it can be a very complex process depending on the research topic. As the figure in chapter 2 shows, the largest percentage of Industrial PhDs are conducted in the fields of technologies, agricultural studies, mathematics and medicine while just a small percentage is found in the fields of social studies and humanities. This might to some extent be related to the applicability of research in those different fields. In terms of the benefit for the researchers and academia, Perkmann and Walsh suggest [13] (p.1056-1057) that "academics are able to capitalize on these opportunities for the benefit of scientific production particularly if: (i) their discipline is associated with the sciences of the artificial; (ii) they are highly research-driven; and (iii) they have a portfolio of different types of relationships with industry".

An Industrial PhD in technology could be focused on the development of e.g. a new type of apparatus that the industry would develop anyway. As such the research activity would be naturally part of the industry's everyday business and as such be rather easily applicable to practice. In the fields of social

sciences and humanities, however, the research results could be more difficult to apply in everyday practice. In our case the PhD was, while being based in architecture, in approach rather located in the humanities. Reflecting on the changing nature of architectural practice and how the growing number of stakeholders manage and pursue their collaboration, the research focused on structures and on how problems are approached rather than on quick solutions. While the understanding of those structures is valuable and necessary to reflect upon and react to changes, the implementation into practice requires additional work as well as openness in practice. The expectations of all stakeholders should hence be clearly discussed and clarified prior to the PhD and any necessary processes in practice and management be planned for.

4 FINDINGS

Both quantitative and qualitative findings in this paper show that conducting an Industrial PhD can help to reduce the gap between the researched and the researcher and provide data and insight for all stakeholders that might have been concealed otherwise. While in some fields industrial PhDs might be more difficult to implement into practice, as described above, they could also reveal aspects of companies or entire fields that would otherwise not be reflected upon. Fostering a close collaboration between academia and practice enables the researcher to act in a space that establishes physical and mental distance from everyday practice and allows a more holistic view on the subject of research.

The Industrial PhD further facilitates a position where the researcher can critically review existing research, academic curricula and contemporary research strategies and evaluate them with the deep understanding of a practitioner as well as a researcher. The following recommendations may be valuable for companies as well as academia in the future. While the deeper and more holistic understanding of processes and situations can help to improve processes and structures in practice it can further help to relate practice to academia by fostering exchange and cooperation. Encouraging R&D activities in practice with or without the collaboration with academia will not only broaden the repertoire of a company but also help preserving, maintaining and expanding the body of knowledge inherent in the company and improve its credibility. The reflections on the current status of practice and the findings and recommendations should further feed back into academia to potentially alter or expand research activities as well as critically review the current academic curriculum in the field and its relation to challenges graduates will face in practice. Currently, the organization of an industrial PhD project would benefit from applying a similar rigor to the organization of the exchange and collaboration between the partners as one would to the PhD project itself. That would involve, among others, the following steps:

- Ensuring that both, the degree conferring institution as well as the candidate's employer, fully understand the meaning and extent of a candidate pursuing an Industrial PhD.
- Ensure that appropriate measures can be taken to reduce bias in the research project.
- Establishing a plan to anchor, share and review research findings within the company throughout the research project
- Being realistic about expectations in terms of the applicability of findings and planning on resources necessary to implement research findings successfully into the organization
- Establishing a routine for exchange between academia and practice.

Kihlander et al. further note that the Industrial PhD candidate's role as an interpreter should be taken seriously in the exchange between academia and practice, to ensure that both parties can benefit from the process [14].

5 CONCLUSION

In their book 'The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies' Gibbons et al [15] state (p.181): "The nature of the research process is being transformed, and ... three trends are generally accepted to be significant – (a) the 'steering' of research priorities, (b) the commercialization of research, and (c) the accountability of science. These and other trends, or changes in practice, have given rise to new discourses of science and research." The findings of this article suggest that the Industrial PhD confirms these trends, and if the trends are understood as needs of society to connect industry and academia presents a successful and promising addition to the traditional PhD program. However, additional in-depth research on the Industrial PhD program's integration into professional practice as well its implementation in academia is necessary in order to analyze and reflect upon strength and weaknesses of the program. Further it is relevant to reflect

further upon the applicability of the Industrial PhD program in varying disciplines. In terms of the program's integration into academia an increased openness on the side of academia towards new forms of research would be beneficial for a better collaboration between academia and practice. The conduction of the Industrial PhD scheme will benefit from a closer collaboration between involved stakeholders, and e.g. concerning how results could be integrated into the collaborating universities curriculum. Fostering an extensive exchange could benefit both academia and practice beyond the actual accomplishment of the Industrial PhD project.

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