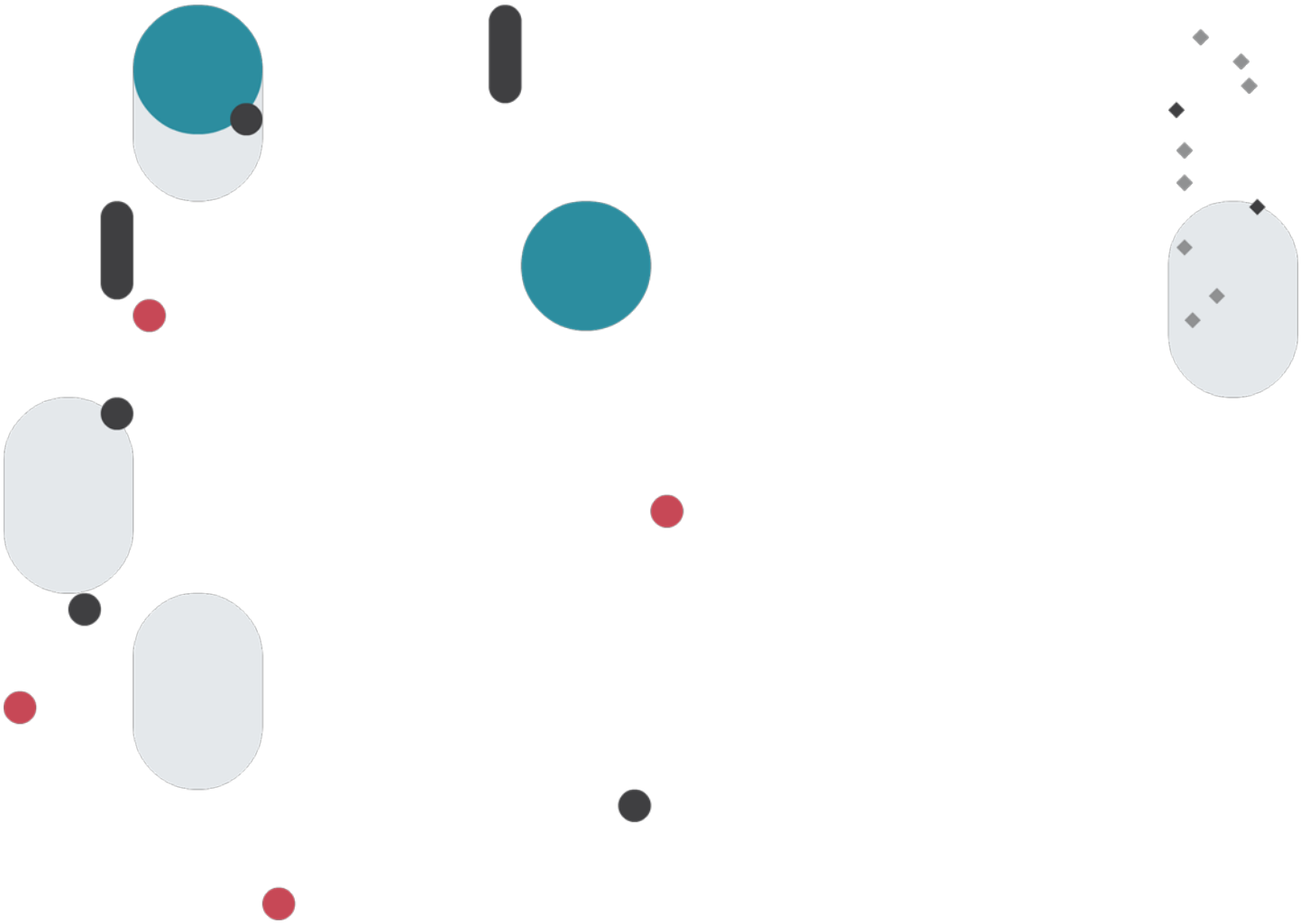

PhD education in a knowledge society

An evaluation of PhD education in Norway

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Report 25/2012

NIFU

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Preface

The Evaluation of PhD education in Norway was commissioned by the Research Council of Norway on behalf of the Ministry of Education and Research. The aim of the evaluation was to provide a description of the status of PhD education in Norway, following the implementation of the PhD degree in 2003. Moreover, the evaluation was to give an assessment of the performance of the PhD education system in terms of its quality, efficiency and relevance, and provide recommendations to the government and the higher education institutions about how to improve PhD education in Norway. The evaluation is of the overall system of PhD education, and does not seek to evaluate individual higher education institutions or PhD programmes.

The Nordic Institute of Studies in Innovation, Research and Education (NIFU) has carried out the evaluation and is responsible for the overall conclusions and recommendations.

The evaluation has been led by Dr Taran Thune, senior researcher at NIFU. Dr Svein Kyvik, Mr Terje Bruen Olsen, Dr Agnete Vabø and Dr Cathrine Tømte - all senior researchers at NIFU, and Professor Sverker Sörlin at Kungliga Tekniska Høgskolan in Stockholm and adjunct researcher at NIFU have contributed to the evaluation and the report.

The evaluation team at NIFU has been supported by an advisory board consisting of three international experts and two national experts, who have contributed with international and sector specific competencies and advice, which have greatly benefitted the evaluation. The evaluation team would like to thank the following members of the advisory group for their expert advice and stimulating discussions:

- Professor Barbara Kehm, the University of Kassel, Germany
- Dr John Smith, the European University Association, Belgium
- Mrs Brit Farstad, the Institute for Energy Technology, Norway
- Professor Berit Rokne, the University of Bergen, Norway
- Professor Gunnar Öquist, the University of Umeå, Sweden

In finalising the evaluation report, several people have read the report and have provided input and advice. The evaluation team would particularly like to thank Haakon Kobbenes, Ministry of Education and Research, Berit Hyllseth at the University of Oslo, Rachel Sweetman at NIFU, and Birgitta Szanday Bøhn at the Research Council of Norway.

Many thanks are also due to the higher education institutions that provided a substantial amount of information about PhD education, and to the many administrative coordinators, university and faculty leaders, PhD candidates, supervisors and PhD graduates who have given us rich details about PhD education in Norwegian higher education institutions.

Oslo, 21st of June 2012

Sveinung Skule
Director

Jannecke Wiers-Jenssen
Research Director

Table of contents

Executive summary

A new doctoral degree in a new context

This evaluation of PhD education in Norway was carried out ten years after the last major review of Norwegian doctoral education. The evaluation in 2002 came to the broad conclusion that Norwegian doctoral education was of a high quality, but that major problems persisted with respect to the efficiency of the system, particularly in producing graduates in a timely fashion.

Since the last evaluation of doctoral education in Norway in 2002, a number of profound changes have occurred in Norwegian doctoral education: the introduction of the common PhD in replacement of the discipline specific doctoral degrees, a doubling in the number of PhD candidates, a growth in the number and diversity of providers on PhD education and many efforts to professionalise and standardise the provision of doctoral education.

A high quality PhD education system

Based on the data collected, experiences from other countries and input from international experts on PhD education, the overall assessment is that Norway has a high quality PhD education system. Compared to many other countries in the current economic climate, the PhD education system in Norway is well-funded, well-organised and offers very good working and learning conditions for PhD candidates, as well as good career prospects for PhD graduates.

The Norwegian system has grown rapidly, and has more than doubled the numbers of PhD candidates over the course of eight years. To cope with the rapid growth in PhD candidates, the higher education institutions have taken many steps to streamline the PhD education by adapting common guidelines and principles for PhD training; they have also promoted good practices in organisation and management of PhD training. As a result of the many different developments over the last decade, PhD education in Norway has taken a definitive step towards becoming a standardised PhD education system with a strong focus on monitoring quality and efficiency.

Although PhD education is now more streamlined, a high degree of variety and adaptation to disciplinary characteristics and professional goals is necessary in PhD training. Compared to other countries, Norway stands out in allowing PhD education to take place in university colleges. There is also considerable diversity in research training sites outside higher education institutions. The increasing number of higher education institutions offering PhD training and increasing numbers of PhD candidates working outside the higher education sector during their PhD (now about 33 per cent of all PhD candidates) will, in all likelihood, lead to increasing diversity in outputs, both in terms of scientific quality and in the career trajectories of PhD graduates.

In terms of output, the strong increase in the number of PhD candidates has not lead to a significant drop in completion rates or in the quality of Norwegian doctoral dissertations. Completion rates for each cohort have increased significantly over the last twenty years, although there are indications that this trend is levelling off.

There are indications that the volume of research work required for a PhD dissertation has decreased since 2002. On the other hand, international committee members who assess the scientific quality of Norwegian PhD dissertations generally find their quality is of a high international standard. There seems, however, to be variations across fields of science and higher education institutions in terms of the quality of output. The quality of PhD dissertations from new universities and PhD dissertations within agricultural sciences and social sciences are rated less favourably than average.

Persistent challenges, emerging issues and recommendations

Although the PhD education system has many qualities, it also faces persistent challenges and emerging issues that need to be addressed. Similar to the findings of the evaluation a decade ago, completion rates and time-to-degree are not satisfactory in several fields of science and still fall short

of government targets. There have, however, been positive developments in time to completion in certain fields of science, notably the humanities, whereas technology and agricultural sciences show opposite tendencies. Current data on completion rates has a significant weakness in the fact that it does not contain information about the sizeable group of PhD candidates who are not scholarship holders, an issue which needs to be remedied.

Another persistent issue is the relatively high age of PhD graduates, which has not declined significantly over time; perhaps this must be seen as part of a bigger problem today than it was recognised as being a decade ago, due to the overall changes in the research training system, where further training in the post doc phase is generally seen as necessary for an academic career.

In terms of the quality of research and training processes, offering enough high quality PhD courses remains a big challenge in many higher education institutions. The issue of critical diversity and critical mass in PhD education must be addressed, and collaboration between the many, relatively small, PhD programmes and higher education institutions in the provision of PhD courses is strongly encouraged, through research schools and research training networks. The current research schools have an unclear status in the Norwegian PhD education system, and even though they promote quality in PhD education, few PhD candidates are involved in them. A systematic evaluation of the national research schools is therefore recommended.

Supervision remains a crucial issue. Even though there have been positive developments over the last decade, the quality and access to supervision for PhD candidates is not satisfactory for a considerable minority of PhD candidates. Efforts to increase the professional development and training of supervisors are recommended.

In terms of emerging issues, the issue of "critical time" for the research training part of the PhD is raised. Many supervisors, particularly those in the medical and natural sciences, express concerns about the risk that too many and too diverse a set of demands are being placed on the PhD period, in a way that has negative long-term consequences for the development of science. To promote a better integration between different learning objectives, increasing flexibility in how learning goals can be achieved and the use of individual study plans is recommended. Better integration between the master and PhD levels and further training in the post-doc period are international trends which might help to address such challenges in Norwegian PhD training.

Internationalisation in PhD education needs to be reconsidered, as the world of science and academic labour markets are increasingly global. In Norway, about 33 per cent of PhD graduates are not Norwegian citizens, and in the areas of natural sciences and technology 73 per cent of PhD programme units report having a majority of international PhD applicants. While this reflects increased opportunities for internationalisation in PhD education, it is a worrying sign that more than 70 per cent of these units claim that their applicants do not have good enough qualifications to be admitted to a PhD programme.

Such increasing international recruitment at the PhD level is positive, but poses short and long term challenges for the higher education institutions, which need to be addressed. Recruitment procedures and quality control of PhD applicants is important, as is the integration of international PhD candidates and finding efficient ways to promote international experiences for all Norwegian PhD candidates.

One area where almost all higher education institutions have a considerable way to go concerns explicating the relevance of the competencies acquired during the PhD period, for different labour markets and occupations. The general picture of the labour market for people with a doctoral degree is positive: there is virtually no unemployment and the large majority of PhD graduates find relevant work. However, the data indicates that increasing numbers of PhD holders will work outside the research and higher education sectors, in a range of clinical, advisory and managerial jobs, jobs which require sophisticated scientific knowledge and analytical skills. Due to this, there is a need for the higher education institutions to strengthen their focus on the increasingly diverse career trajectories of their PhD holders, and consider how PhD qualifications are used in different occupations and sectors.

As far as we can see, most higher education institutions do not have strong policies or tools to enhance relevance. Few higher education institutions monitor the careers of their doctorate holders,

involve prospective employers in PhD training, offer career guidance or have a systematic focus on generic skills at present. We recommend that the higher education institutions take steps to acquire more knowledge about the careers of their doctoral degree holders and that the institutions and relevant national agencies take initiatives to develop better practices in promoting generic skills training.

1 Introduction

1.1 A new doctoral degree in a new context

This evaluation of PhD education in Norway was commissioned by the Research Council of Norway in April 2011 – approximately ten years after the last major review of Norwegian doctoral education (Research Council of Norway 2002). The evaluation in 2002 came to the broad conclusion that Norwegian doctoral education was of high quality, but that major problems persisted with respect to the efficiency of the system, particularly in producing graduates in a timely fashion.

Since the last evaluation of doctoral education in Norway a number of profound changes have occurred. In 2003, as part of the Bologna process, Norway implemented the PhD degree structure. Since 2007 the majority of new doctoral degrees have been PhDs, and by 2010 only 35 of the 1184 doctoral degrees awarded where not PhDs (the old Doctor Philos. degree has been retained). Along with the PhD degree, a more standardised approach to doctoral education has emerged, with doctoral degrees typically being issued based on three years of full-time studies, where approximately 2.5 years are devoted to carrying out a research project resulting in a PhD thesis.

The last decade has seen a massive worldwide expansion in the production of PhDs (Cyranoski et al 2011). From having been the gateway to membership of the traditional academic disciplines at universities, PhD programmes are now offered at many different higher education institutions and in a wide variety of specialisations, many of which are interdisciplinary, professionally-oriented or applied. The PhD has thereby become a qualification for a more diverse set of career pathways, including various clinical specialisations in the health sector, public administration and the private sector.

The Norwegian PhD education system has undergone a major expansion, with the number of doctoral candidates approximately doubling since 2003, with the strongest increases in medical and health sciences, and the natural sciences and social sciences. This expansion has been the result of political priority being placed on increasing the recruitment of PhD candidates in these fields of science. The goal initially set out in 2002 was for about 1100 new doctoral degrees to be awarded annually by the year 2010; this goal was achieved by 2008. The need for educating the next generation of academic teachers and staff in the higher education institutions was a main goal with the expansion of the system, but increasing the overall level of competencies in society more generally, and particularly in the health sector and the private enterprise sector, was also a long-term goal of the expansion of the system.

Accompanying the growth in overall PhD candidate numbers in Norway, there has been a strong increase in the number of international PhD candidates who study for a PhD in Norwegian higher education institutions.

In Norway slightly less than 70 per cent of PhD candidates have a PhD scholarship position that covers salary, project costs and overhead per candidate, usually for three or four years (these are funded by the higher education institutions, the Norwegian research council or other external funds). There is also a considerable number of PhD candidates that do not have a PhD scholarship but are funded by their employers (such as higher education institutions, research institutes or hospitals) or through other external sources. PhD candidates are not regarded as "students" in Norway[1], but have the status of temporary academic staff, with accompanying employee benefits.

Although the vast majority of PhD candidates are enrolled in the eight Norwegian universities (with the University of Oslo, Bergen and the Norwegian University of Science and Technology as the dominant institutions), a small but increasing number of university colleges offer their own PhD degrees. The

[1] The key terms used in the report and a list of acronyms are found in Appendix 5.

programmes offered by these institutions are relatively narrow in scope and, until now, have had relatively few PhDs candidates enrolled.

Partly to cope with increasing PhD candidate numbers, the higher education institutions have implemented several organisational innovations in PhD education with respect to structure, content and management of doctoral education. In general, doctoral education has become more structured and organised than previously.

1.2 The evaluation mandate and operationalisation

With these changes in mind, the current evaluation of PhD education in Norway was designed to provide an answer to the following question:

How does the current system of doctoral education in Norway perform in terms of

- **Quality** – with regard to whether Norwegian doctoral training maintains high international standards
- **Efficiency** – with regard to whether Norwegian doctoral training is adequately organised and the extent to which resources are used efficiently
- **Relevance** – with regard to whether society receives appropriate and necessary competencies

To shed light on the overall system's performance in terms of quality, efficiency and relevance, a large number of specific issues need to be considered. Table 1.1 presents the operationalisation of the three evaluation criteria, in terms of the particular issues the evaluation has focused on.

Table 1.1 Interpretation of the three evaluation criteria

Performance	Dimensions	Operationalisation
Quality	Quality of input	Quality of applicants and new entrants, quality of recruitment procedures
	Quality of the research/training process	Quality of programmes, course work, supervision, research environment, internationalisation efforts, infrastructure/equipment, level of administrative support
	Quality of output	Quality of doctoral theses, published papers, quality of generic skills
Efficiency	Efficiency of production	Completion rates, time to degree, age of doctoral degree holders
	Organisational efficiency	Efficient organisation of PhD education, resource use, monitoring and incentive schemes to promote efficiency
Relevance	Relevance of competences acquired for successful PhD training	Relevance of coursework and training for completion of a PhD
	Relevance of qualifications for post-PhD work	Career ambitions and career trajectories of PhD holders. Use of competences in different labour markets and occupations (R&D and non R&D jobs). Assessment of relevance from employers.

As this evaluation is an evaluation of the complete PhD education system in Norway, it is built on certain premises. The focus of the evaluation is the Norwegian system of PhD education, and not the

complete researcher training system. This entails that data collection, analyses and assessments will focus on the higher education institutions that offer PhD programmes.

Secondly, the evaluation does not evaluate the quality, relevance and efficiency of individual PhD programmes or higher education institutions and does not do justice to the rich diversity in PhD education found in different academic environments.

Another shortcoming of the evaluation is that it has not carried out a new survey of the whole PhD candidate population, due to resource constraints. To gain insight into the PhD candidates' perspectives and assessments of PhD education, the evaluation utilises several existing surveys of PhD candidates as well as qualitative interviews.

1.3 Evaluation design and sources of data

The evaluation uses a mixed methods approach to collect, analyse and interpret data, with a strong focus on utilising the significant amounts of available empirical data that already exists on Norwegian doctoral education, along with new, targeted, empirical investigations to answer questions on which we have limited knowledge. Synthesising existing sources of data and triangulating across data sources and perspectives has been emphasised.

The evaluation was designed in five modules that provide knowledge about the system's performance in terms of quality, efficiency and relevance of Norwegian doctoral education.

1.3.1 Module 1: Register data, review of documentary evidence and existing studies of Norwegian doctoral education

The evaluation is based on analysis of updated available statistical data on Norwegian doctoral education, based on data from four registers: the doctoral degree register, the research personnel register, NORBAL[2] and the Database on Higher Education (DBH). Register data has been used to shed light on all evaluation criteria, and is used throughout the report. We have compiled and updated statistical data on:

- Key characteristics of the PhD candidate population (age, gender, nationality)
- Number of PhD candidates and degrees conferred by subject fields and institutions
- Ratio between different categories of academic staff
- Sources of funding for PhD degrees
- Completion rates and age at completion
- Labour market status, sectoral affiliation and occupations of PhD holders

In addition, a substantial review of existing documentation and research on doctoral education, both in Norway and abroad, has been carried out and has been used extensively throughout the report (see the list of references for an overview of the reports and publications). Of particular importance are the many different surveys of PhD candidates and graduates that different higher education institutions and organisations have undertaken in the last five years, which provide a very important source of information about PhD candidates' perspectives on PhD education.

1.3.2 Module 2: Institutional survey

Module 2 involved a survey of all providers of PhD programmes in Norway. In the fall of 2011, there were 23 Norwegian higher education institutions with PhD programmes: 8 universities (39 faculties), 9 specialised university institutions and 6 university colleges. In the eight Norwegian universities faculties responded to the survey; in the colleges and specialised institutions the central administrative level in each institution responded. One university (Norwegian University of Life Sciences) organises

[2] Statistics on awarded doctoral degrees and doctoral candidates in the Nordic and Baltic countries. Available at: http://www.nifu.no/English/Pages/STATISTICS/NORBAL/NORBAL.aspx?ItemId=1855&ListId=8252dfaf-6056-4ccc-b6e1-7806d4dc4878

all their PhD training in one PhD programme, and therefore only provided one response to the survey. Two university colleges who originally received the survey declined from giving feedback, since their programmes were approved just before the evaluation, and they had not gained enough experience to provide feedback on PhD education. In total 52 units (out of 54 contacted) responded to the survey.

The institutional survey was administered electronically and contained 65 questions (including several multi-item questions) covering six topics (cf. Appendix 2):

- Recruitment and admission of PhD candidates
- Organisation, structure and content of PhD education
- Supervision and monitoring of PhD candidates
- Organisation of PhD candidate research
- PhD dissertations and evaluation practices
- Self-evaluation of current status and practices to promote quality, efficiency and relevance of PhD education, good practice examples

The survey was sent electronically to one contact person in each faculty (universities) or each higher education institution (colleges and specialised institutions), based on information provided by the central leadership in each institution[3]. The contact person was usually a senior administrative person in charge of PhD education in each faculty/institution. In the letters accompanying the survey we explained that several of the questions would require respondents to consult with others to answer, such as leadership, academic staff and PhD candidates.

The survey tool was tested in two universities before it was administered to all units, but there was still a need for clarifications on some of the questions. Questions sent electronically by the respondents were collected and "questions and answer" emails were sent to all respondents. Many institutions also sent in accompanying letters or additional information such as internal reports by email along with their survey response, giving further details on each PhD programme.

1.3.3 Module 3: Interviews with stakeholders

A large number of interviews have been carried out as part of the evaluation, to solicit information and assessments from many different types of stakeholders. In total 114 persons have been interviewed, and the large majority of the interviews have been carried out face to face. For a full overview of informants, please consult Appendix 1.

Interviews were carried out in three waves:

1. Interviews with eleven key stakeholder organisations at national level: in September and October 2011. Information from the national stakeholder interviews has mainly been used as preparation for further data collection, but has also been a relevant input shaping the assessments and conclusions.
2. Interviews with leadership representatives in the eight universities: December 2011.
3. Field visits and interviews with coordinators, PhD candidates, supervisors and graduates at eight selected PhD programmes: February – March 2012

The selection of higher education institutions and programmes for the field visits and interviews was based on input from the institutional survey. Moreover, it was considered important to include higher education institutions that were relatively new providers of PhD programmes, as well as higher education institutions that had been providing doctoral education for a long time. It was also an aim to ensure that all three types of institutions (university, specialised university institution and college) that offer PhD programmes were included. Another important aspect was to include PhD programmes from a range of disciplines: a sample was selected that included four PhD programmes within the STEM

[3] Since PhD education is organised differently in different types of higher education institutions, we refer to the units that have completed the survey as “PhD programme units” throughout the report.

subjects (Science, Technology, Engineering and Mathematics), and four PhD programmes from various fields within the social sciences and humanities.

The selected higher education institutions and the PhD programmes were:

- Stavanger University: PhD Programme in Petroleum Engineering
- Vestfold University College: PhD Programme in Applied Micro- and Nano systems
- University of Oslo: PhD Programme in Medicine
- Norwegian University of Science and Technology (NTNU): PhD Programme in Electronics and Telecommunication
- University of Agder: PhD Programme in International Management
- The Oslo School of Architecture and Design: PhD Programme
- University of Tromsø: PhD Programme in Theoretical Linguistics
- Norwegian School of Economics (NHH): PhD Programme

In all PhD programmes, interviews were conducted with programme coordinators, PhD candidates, supervisors and graduates. In most cases PhD candidates and supervisors were interviewed in groups, though in some cases, mostly due to logistical matters, individual interviews were conducted by phone. Those who had graduated from PhD programmes were interviewed by phone.

1.3.4 Module 4: Survey of international committee members in thesis evaluation committees

In Norway, each PhD thesis is evaluated by a three member committee, where at least one member should come from a foreign university. The rationale of including a foreign evaluator is to uphold academic standards by calibrating the quality of the PhD thesis to international standards within the different disciplines, or at least to those in the foreign member's home country. For a small scientific community like Norway, this procedure is regarded as a particularly important quality assurance mechanism.

This structure also provided us with a method for assessing the quality of Norwegian PhD dissertations; by asking the foreign members of committees for their opinion about the quality of those they evaluated. To do this, all doctoral degree granting institutions were asked to provide names and, if they had them, the email addresses of all foreign members of evaluation committees who finished their evaluation work in 2010. In total, 1159 of these committee members responded to the survey (a response rate of 79 per cent).

1.3.5 Module 5: Nordic and international perspectives

In order to put the Norwegian PhD education in an international context a brief overview of recent and current trends in Nordic and international PhD training has been conducted. The overview was primarily based on recent evaluations in the Nordic countries and on position papers and statements by international organisations involved in PhD education, such as European University Association, the League of European Research Universities (LERU), ORPHEUS (the Organisation of PhD Education in Biomedicine and Health Sciences in the European System), the Coimbra group and the European Commission. The evaluation has also reviewed reports on PhD education from the National Quality Assurance Agency in the UK, Vitae, the US Council of Graduate Schools, and different evaluations and reports on PhD education in different countries (Australia, Denmark, UK, US and Sweden), as well as internationally published research literature on PhD education.

The evaluation has also used statistical data on different aspects of PhD education in the Nordic countries (NORBAL database), but OECD data and European statistical data sources have been reviewed.

In addition to review of documents and use of international statistical data, the evaluation has benefitted from having an expert group on PhD education that has functioned as an advisory group. The group has consisted on the following members:

- Professor Barbara Kehm, the University of Kassel, Germany

- Dr John Smith, the European University Association, Belgium
- Ms Brit Farstad, the Institute for Energy Technology, Norway
- Professor Berit Rokne, the University of Bergen, Norway
- Professor Gunnar Öquist, the University of Umeå, Sweden

The expert group met in Oslo on two occasions (each meeting lasting two days), and the role of the expert group has been to discuss the evaluation, data and results and conclusions. Discussing Norwegian experiences in light of Nordic and European trends has been a key focus in the expert group. The group has had an advisory function, the assessments and recommendations are the sole responsibility of the evaluation team.

2 Doctoral education in Norway – key features of the system

2.1 The institutional landscape

Several governmental agencies, higher education institutions and other organisations have particular roles in the provision of PhD education in Norway. The Ministry of Education and Research has overall responsibility for PhD training and also funds PhD scholarship positions directly and indirectly (through research programmes). The Ministry of Health that owns the university hospitals has a significant role in funding PhD candidates in health and medical sciences. The Research Council of Norway also funds a large number of PhD scholarship positions and has an advisory function towards the Ministry of Education and Research on doctoral education. The Norwegian Quality Assurance Agency for Higher Education (NOKUT) is responsible for quality assurance and quality development in all Norwegian higher education institutions. At the PhD level NOKUT has a more direct role in accrediting PhD programmes from university colleges (NOKUT 2010).

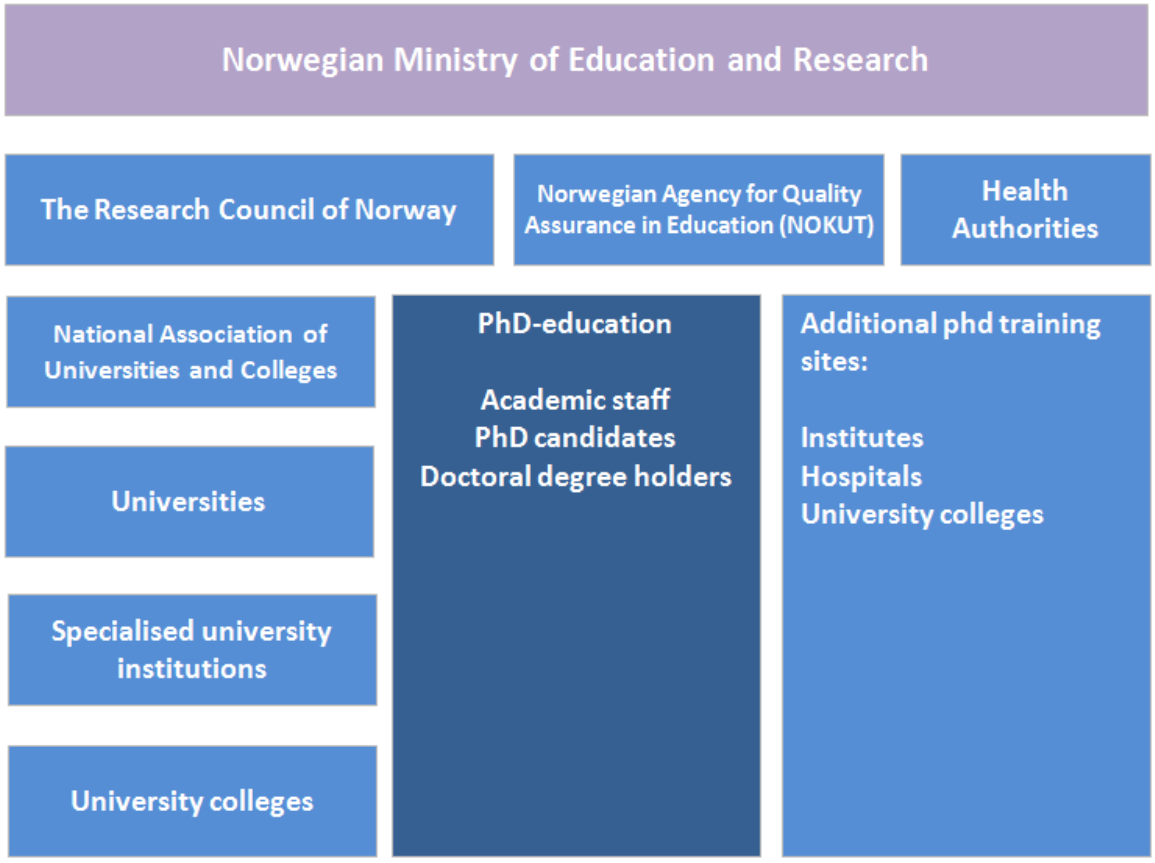

Figure 2.1 Institutional landscape of PhD education in Norway

As of October 2011, 23 higher education institutions in Norway were authorised to offer PhD programmes: 8 universities, 9 specialised university level institutions (6 state institutions and 3 private), and 6 university colleges. PhD training also takes place in other organisations that do not have their own PhD programs, but where a considerable part of PhD candidates work – in Figure 2.1

defined as "additional training sites". In public hospitals and research institutes[4], researchers, doctors, and other health professionals are involved in doctoral training. Also teaching staff in university colleges without PhD programmes are enrolled in PhD programmes in the universities.

2.2 PhD education – institutions and programmes

In Norway, the PhD degree and its regulations are based on the three level degree structure that follows from the Bologna reforms of 2002, and the European qualification framework. Within these regulatory frameworks, the eight universities and the specialised university institutions can decide the detailed regulations for their PhD degrees for themselves, although they generally follow the recommended guidelines for PhD regulations adopted by the Norwegian Association of Higher Education Institutions (UHR). NOKUT issues the right to grant PhD degrees for the university colleges.

The PhD degree is only attainable by following a structured programme, consisting of a taught part (courses) of at least a half year fulltime studies and a research part. In the autumn 2011, 112 PhD programmes were offered at Norwegian higher education institutions and 92 disciplinary specialisation tracks.

The higher education institutions usually have one set of regulations for their PhD degree, which specifies the minimum requirements necessary to obtain the degree, along with a description of the rights and obligations of the PhD candidates and the institution. Ultimately, the board of the higher education institution is responsible for PhD regulation.

The different PhD programmes can have additional, programme-specific requirements laid down in a "PhD programme plan" decided at the faculty level (these are the responsibility of the Dean and the PhD programme board) and also in "study plans" at the institute level when the programme is made up of several specialisation tracks. The actual activities that a candidate must complete to fulfil the criteria for PhD degree is found in the Programme plan or the Study plan, and these can be quite different, even within one programme and certainly between programmes in each institution.

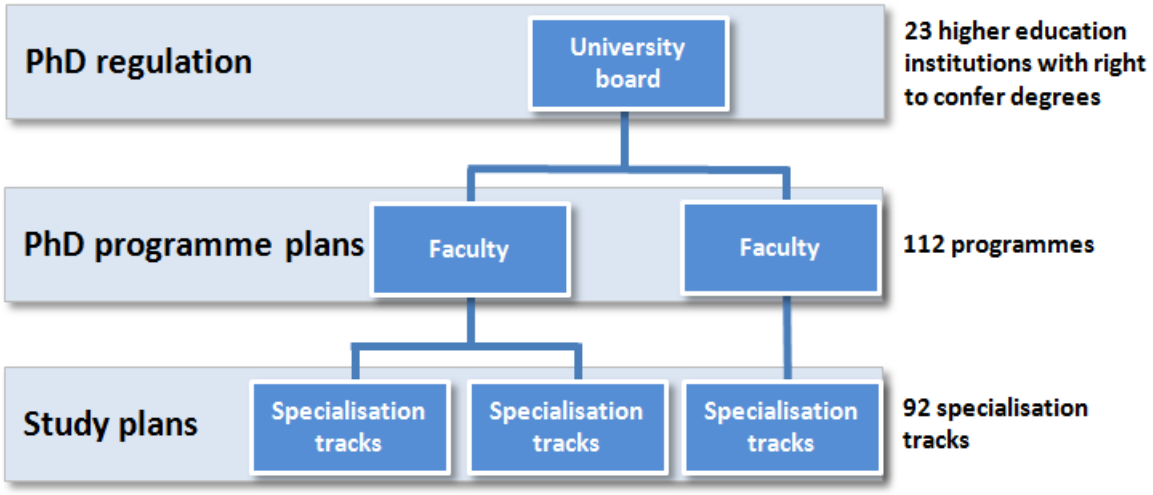

Figure 2.2 Structure of PhD education in Norway

Most of the universities only have one PhD programme per faculty, but each programme can have several discipline-based specialisation tracks with specific study plans. The universities of Oslo and Tromsø in particular have used this approach to offer a large number of specialisation tracks. The Norwegian University for Science and Technology (NTNU) in Trondheim has organised PhD education differently to the other universities with a wide range of specialised PhD programmes rather

[4] Forskningsinstituttens fellesarena (2011): Doktorgradsutdanningen og instituttsektoren.

than faculty based programmes. The two new universities, of Stavanger and Agder have a similar approach as the NTNU, although the latter case is now moving towards a faculty-based programme structure.

Most of the specialised university institutions and university colleges only offer one PhD programme, but some of the specialised university institutions have specialisation tracks within each programme. In total, 112 PhD programmes are reported by the higher education institutions, with a further 92 specialisation tracks; this means that PhD education is offered in more than 200 different academic specialisations in Norway.

The programmes vary tremendously in size, reflecting differences in programme type (broad, faculty-based or narrow, discipline-based programmes) and the age of the programme. Appendix 4 provides further details about the PhD programmes currently offered by Norwegian higher education institutions, the number of PhD candidates enrolled by autumn 2011 and graduates from each programme in the period 2006-2010.

Most higher education institutions and faculties (42 out of 52 units) have a programme board for each PhD programme, headed by the dean/pro-dean/PhD coordinator and representatives from the academic staff, leaders of different specialisations, PhD candidates, and in some cases department heads. The PhD programme board has a key role, as it represents the key linking mechanism between the PhD programme and the PhD candidates' activities, and usually has hands- on roles in monitoring the progress of all PhD candidates.

The administration of each PhD programme is usually run by one administrative coordinator or a small group of administrative staff, who provide administrative support to the programme leadership, supervisors and PhD candidates concerning recruitment, administration of PhD courses and coordinating thesis evaluation procedures, and similar administrative tasks. The number of person-years involved in administering a programme is reported to be between 0.3 and eight person years.

2.3 Size and characteristics of the system and the body of PhD candidates

2.3.1 Numbers of PhD candidates

In 2011 there were about 9000 doctoral candidates in Norway; twice as many as in 2003. This strong growth has, however, not been equally distributed across fields of science. The increase in the number of PhD candidates has been particularly strong in medical and health sciences and the social sciences, while a more modest growth has taken place in the humanities.

Table 2.1 Doctoral candidates 2002-2011 by field of science. Numbers.

Field of science	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Humanities	615	657	619	726	714	751	815	826	932	950
Social science	858	934	1 033	1 330	1 480	1 652	1 802	1 877	1 946	1 963
Natural science	1 148	1 213	1 370	1 572	1 725	1 785	2 007	2 203	2 327	2 300
Technology	781	896	980	1 093	1 118	1 234	1 340	1 417	1 484	1 444
Medical and health science	722	776	1 031	1 313	1 441	1 669	1 919	2 054	2 206	2 384
Total	4 124	4 476	5 033	6 034	6 478	7 091	7 883	8 377	8 895	9 041

Source: Database for Statistics on Higher Education (DBH). - Autumn registration. - Field grouping is undertaken at NIFU. Agricultural and veterinary sciences are included in Natural science.

PhD candidates play an important role in universities' research production during their studies; PhD scholarship holders undertake 60 per cent more person-years of research work than do staff in permanent positions in the four old universities in Norway[5].

In terms of different subject areas relative shares of the total number of doctoral candidates, there has been a strong increase in the share of doctoral candidates studying in the area of medicine and health sciences (from 18 per cent to 26 per cent of the total number of doctoral candidates in nine eight

[5] Data on the universities of Oslo, Bergen, and Tromsø, and NTNU.

years), with a decrease in the relative shares of doctoral candidates in the humanities, natural sciences and technology (Table 2.2).

Table 2.2 Doctoral candidates 2002-2011 by field of science. Percentages.

Field of science	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Humanities	15	15	12	12	11	11	10	10	10	11
Social science	21	21	21	22	23	23	23	22	22	22
Natural science	28	27	27	26	27	25	25	26	26	25
Technology	19	20	19	18	17	17	17	17	17	16
Medical and health science	18	17	20	22	22	24	24	25	25	26
Total	100	100	100	100	100	100	100	100	100	100
(N)	(4 124)	(4 476)	(5 033)	(6 034)	(6 478)	(7 091)	(7 883)	(8 377)	(8 895)	(9 041)

Source: Database for Statistics on Higher Education (DBH). - Annual registration. - Field grouping is undertaken at NIFU. Agricultural and veterinary sciences are included in Natural science.

2.3.2 Funding for doctoral education

Doctoral studies are funded in various ways: the most important are PhD scholarships financed by the higher education institutions and the Research Council of Norway. PhD scholarship holders are appointed to temporary posts in universities and other research institutions for three years, or four years if they include a 25 per cent teaching obligation alongside their studies. Salaries for PhD candidates are commensurate with public sector salaries for those with a master's degree.

From an international perspective, the Norwegian funding system should therefore provide a good basis for attracting gifted students into research where a position in the public sector is an alternative option. However, in subjects such as technology, geosciences, economics, and law, job-alternatives are generally in the private sector and offer notably higher remuneration. In the private sector, the wage premium for having a PhD is generally lower than in the public sector, with only a 2-4 per cent increase in wage compared to having a master degree (Tekna 2012).

Table 2.3 Doctoral candidates 2002-2011 by main source of funding. Numbers.

Source of funding	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Higher education institutions	904	1 466	1 779	2 100	2 275	2 502	2 793	3 047	3 390	3 550
The Research Council of Norway	972	1 273	1 330	1 468	1 519	1 566	1 817	1 852	1 905	1 770
Other	2 248	1 737	1 924	2 466	2 684	3 023	3 273	3 478	3 600	3 721
Total	4 124	4 476	5 033	6 034	6 478	7 091	7 883	8 377	8 895	9 041

Source: Database for Statistics on Higher Education (DBH). - Autumn registration.

The increase in the number PhD candidates since 2002 has, first and foremost, been financed by the Ministry of Education and Research through new scholarships allocated to the higher education institutions in their annual budgets, which now fund 40 per cent of PhD scholarships. The category "Other sources of funding" is still the largest category, and includes funding from the health trusts, medical funds, private funds and employers. The relative share of the research council and other sources of funding have decreased (Table 2.4).

Table 2.4 Doctoral candidates 2002-2011 by main source of funding. Percentages.

Source of funding	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Higher education institutions	22	33	35	35	35	35	35	36	38	39
The Research Council of Norway	24	28	26	24	23	22	23	22	21	20
Other	55	39	38	41	41	43	42	42	40	41
Total	100	100	100	100	100	100	100	100	100	100
(N)	(4 124)	(4 476)	(5 033)	(6 034)	(6 478)	(7 091)	(7 883)	(8 377)	(8 895)	(9 041)

Source: Database for Statistics on Higher Education (DBH). - Autumn registration.

In terms of sources of funding in different fields of science, Table 2.5 shows that PhDs in humanities and social sciences is often funded by the higher education institutions, and that the relative share of funding from the higher education institutions is lowest in the health and medical sciences. Other

sources of funding is common in all fields of science, but particularly so in health and medical sciences. The Research Council of Norway funds PhDs in natural sciences, technology and also a relative large share of candidates in agriculture and veterinary sciences.

Table 2.5 Doctoral candidates 2011 by field of science and source of funding.

Field of science	Source of funding			Total	(N)
	Higher education institutions	The Research Council of Norway	Other		
Humanities	60	11	29	100	(950)
Social science	50	14	36	100	(1 963)
Natural science	34	28	38	100	(2 293)
Technology	44	33	23	100	(1 330)
Medical and health science	24	12	64	100	(2 384)
Agriculture and Veterinary science	37	32	31	100	(121)
Total	39	20	41	100	(9 041)

Source: Database for Statistics on Higher Education (DBH). - Annual registration. - Field grouping is undertaken at NIFU.

In 2010, approximately 67 per cent of PhD candidates held a PhD scholarship position, and while most of these candidates were employed by higher education institutions, some were in the institute sector and health trusts. However, compared to the situation in 2003, the relative share of PhD scholarship holders to total numbers of PhD candidates has decreased by 13 per cent since 2003[6]. In 2010, approximately 3000 persons (about 33 per cent of all PhD candidates) where registered as PhD candidates but not scholarship holders. Most of them work in research institutes, university colleges, in hospitals and some in private enterprises. Their PhD studies are likely to be funded by their employers or by other sources received by their employer, and their PhD studies are carried out in addition to performing other work (although they are not formally in Norway classified as part time students). In medical sciences, there is a separate category of PhD candidates referred to as "clinical fellows", who have a six year PhD period with 50 per cent work obligations, and similar arrangements might be found in other health professions as well.

Thus, a large share of Norwegian PhD candidates spend their research training period mainly outside the universities, though formally enrolled as PhD candidates. In addition to the formal supervisory relationship within the context of a university department, these candidates are supervised by persons outside the universities to a considerable degree.

2.3.3 Doctoral degrees awarded

There has been a considerable increase in the number of doctoral degrees awarded; from 647 in 2000 to 1329 in 2011. Table 2.6 reflects the effects of the 2003 doctoral reform, showing that the PhD is now the most common degree awarded. In 2011, only 48 people were awarded the traditional dr.philos., which has been retained as an alternative degree for those who are not enrolled in a doctoral programme.

Table 2.6 Doctoral disputations 2002-2011 by type of degree.

Degree type	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total 2000-11
Ph.D.			1	8	72	202	370	647	955	1 105	1 149	1 281	5 790
Other	647	677	738	715	710	653	535	383	290	43	35	48	5 474
Total	647	677	739	723	782	855	905	1 030	1 245	1 148	1 184	1 329	11 264

Source: The Doctoral Degree Register, NIFU

Over the last decade, the fields of medicine and health sciences, and the natural sciences, have each accounted for about a quarter of all doctoral degrees awarded. However, in this period, the increase in doctoral degrees awarded in medicine and health sciences has been much stronger than in any other field. In 2011, this field accounted for a third of the total number of doctoral degrees awarded (Table 2.7).

[6] There might be problems with data quality for PhD candidate numbers in 2003. There are reasons to expect that non-scholarship holders were not systematically registered in all higher education institutions until 2005.

Table 2.7 Doctoral disputations 2000-2011 by field of science. Percentages.

Field of science	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2000-11
Humanities	10	12	12	10	11	10	12	11	11	9	8	8	10
Social science	18	16	18	22	18	17	20	22	22	22	21	20	20
Natural science	28	27	25	26	24	26	23	26	24	24	24	26	25
Technology	19	17	18	14	16	15	13	12	11	11	11	13	14
Medical and health science	21	22	21	22	24	26	24	24	27	29	33	30	26
Agriculture and Veterinary science	4	6	7	5	7	7	7	5	5	4	4	4	5
Total	100	100	100	100	100	100	100	100	100	100	100	100	100
(N)	(647)	(677)	(739)	(723)	(782)	(855)	(905)	(1030)	(1245)	(1148)	(1184)	(1329)	(11264)

Source: The Doctoral Degree Register, NIFU

In the humanities, the number of doctoral degrees awarded has declined in recent years, and this field now accounts for just 8 per cent of doctoral degrees awarded. A similar, although less marked pattern, is found in technology and agriculture and veterinary sciences, whereas the relative share of PhD degrees in natural sciences and social sciences has been relatively stable over time (Table 2.7). As seen in Table 2.8, in most fields of science there was a peak in the number of degrees produced in 2008 - the last year when it was possible to graduate with the old faculty based doctoral degrees.

Table 2.8 Doctoral disputations 2000-2011 by field of science. Numbers.

Field of science	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total 2000-11
Humanities	67	78	86	73	89	82	111	118	131	108	98	103	1 144
Social science	117	111	132	160	143	147	184	225	277	251	247	260	2 254
Natural science	178	184	183	191	187	225	212	269	293	277	282	340	2 821
Technology	124	113	135	102	123	124	122	123	141	128	127	175	1 537
Medical and health science	135	151	154	158	189	220	216	246	337	336	386	396	2 924
Agriculture and Veterinary science	26	40	49	39	51	57	60	49	66	48	44	55	584
Total	647	677	739	723	782	855	905	1 030	1 245	1 148	1 184	1 329	11 264

Source: The Doctoral Degree Register, NIFU

Table 2.9 shows that more than 90 per cent of the PhDs are conferred by universities. So far, very few PhDs have been awarded by the state university colleges.

Table 2.9 PhD disputations 2002-2011 by awarding institution.

Institution	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total 2000-11
University of Oslo		1	22	79	114	205	338	370	401	401	1 931
University of Bergen			16	48	88	137	179	214	231	247	1 160
Norwegian Univ. of Science and Technology (NTNU)		6	24	48	98	181	251	252	253	324	1 437
University of Tromsø				5	8	51	55	112	91	112	434
Norwegian Univ. of Life Sciences (UMB)			2	13	26	32	58	48	58	71	308
University of Stavanger					7	16	12	29	30	28	122
University of Agder					2	2	3	9	7	10	33
University of Nordland (UiN)				1	3	3	6	5	9	8	35
Norwegian School of Veterinary Science (NVH)			1	3	8	5	15	19	16	19	86
Norwegian School of Economics and Business Administration (NHH)			1		3	5	9	8	16	15	57
Norwegian University of Sport Sciences							1	8	11	14	34
Norwegian Academy of Music	1	1	2		2	1	4	6	1	2	20
Oslo School of Architecture and Design			3	4	5	3	6	5	6	4	36
MF Norwegian School of Theology			1	1		1	5	6	6	7	27
Norwegian School of Management BI						1	5	8	8	12	34
Molde University College					3	2	5	4	4		18
Oslo University College							1	1		2	4
Gjøvik University College										2	2
School of Mission and Theology					3	2	2	1	1	3	12
Total	1	8	72	202	370	647	955	1 105	1 149	1 281	5 790

Source: The Doctoral Degree Register, NIFU

NB. Several institutions have changed their name and status. Here we apply the name per the end of 2011.

2.3.4 Gender and nationality of the body of PhD candidates

In 2011, 50 per cent of doctoral candidates in Norwegian higher education institutions were female. Women currently account for about 60 per cent of doctoral candidates in the social sciences, 61 per cent in medicine and health sciences, 52 per cent in the humanities, 45 per cent in the natural sciences, and 26 per cent in technology. Since 2002, the percentage of female doctoral candidates has increased from 42 per cent to 50 per cent, but this increase has been strongest in the medical and health sciences and the social sciences, although an increase of 6 percentage points has also taken place in technology.

In terms of doctoral degrees awarded in 2011, women accounted for 46 per cent of those completing that year; an increase from 35 per cent in 2000. There are, however, large differences across fields of science, with this figure varying from 58 per cent in medicine and health sciences to 25 per cent in technology. However, only 14 per cent of PhD technology graduates where female in 2000, so developments here have been positive.

Table 2.10 Female doctoral candidates 2002-2011 by field of science. Percentages.

Field of science	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Humanities	50	52	51	52	53	53	53	53	53	52
Social science	51	49	52	53	53	55	57	58	59	60
Natural science	41	42	41	42	42	45	45	45	43	45
Technology	20	22	23	22	23	25	26	26	26	26
Medical and health science	51	56	57	58	60	60	60	62	61	61
Total	42	43	44	45	46	48	49	50	49	50

Source: Database for Statistics on Higher Education (DBH). - Autumn registration. - Field grouping is undertaken at NIFU. Agricultural and veterinary sciences are included in Natural science.

Table 2.11 Doctoral disputations 2000-2011 by field of science. Percentage women.

Field of science	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total 2000-11
Humanities	43	44	45	40	37	49	45	53	51	50	47	40	46
Social science	38	37	48	42	49	49	41	52	50	45	51	52	47
Natural science	34	32	38	36	34	30	30	33	37	38	34	38	35
Technology	14	15	16	20	24	18	13	20	21	30	21	25	20
Medical and health science	49	38	50	48	42	48	52	59	55	53	58	58	52
Agriculture and Veterinary science	38	43	49	51	63	61	48	43	48	56	61	55	52
Total	35	33	40	39	39	40	38	45	45	45	46	46	42

Source: The Doctoral Degree Register, NIFU

Over the last decade, there has been a strong increase in the number of doctoral candidates coming from outside of Norway. This is reflected in the growing share of doctoral degrees awarded to non-Norwegians; up from 13 per cent in 2000 to 33 per cent in 2011 (Table 2.12).

Table 2.12 Doctoral disputations 2000-2011 by citizenship.

Citizenship	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total 2000-11
Norwegian	566	548	628	577	636	675	688	789	937	851	858	890	8 643
Non-Norwegian	81	129	111	146	146	180	217	241	308	297	326	439	2 621
Total	647	677	739	723	782	855	905	1 030	1 245	1 148	1 184	1 329	11 264
Percentage non-Norwegian	13	19	15	20	19	21	24	23	25	26	28	33	23

Source: The Doctoral Degree Register, NIFU

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3 PhD education in a knowledge society - international trends and perspectives

PhD education, which was until the 1990s hardly articulated as an area of research policy, let alone of industrial and innovation policy, is now a highly defined and much discussed area of policy and site of ambitious reforms in many countries and in the European Union. PhD education in the first decades of the 21st century has been characterised, at least in a European context, by stronger emphasis on the broader social and economic value of doctoral education, taken to be of importance in efforts to develop a knowledge society, and a knowledge economy. Further investments in PhD training has been framed as a necessary condition for realising overall R&D investment goal of three per cent of GDP (European commission 2010), and several countries and the European Union have had ambitious goals of increasing the number of doctoral degree holders. In 2003 the doctoral level – or third cycle – was incorporated into the Bologna process, leading to a common structure and degree for doctoral education in Europe. With the implementation of the European Research Area (ERA) increased cooperation and mobility across countries ensuring a common approach to quality in doctoral education was to be promoted (European commission 2010).

With the joint changes in economic, research and education policies emphasising investments in education and competencies for innovation and competitiveness in the European context, new demands and new policy discourses have framed doctoral education in a new way (Kehm 2004; 2007). According to Bitusikova (2011), the new policies spurred many developments and initiatives from different sets of stakeholders, "acting in the belief that a sustainable supply of highly qualified researchers with doctoral degrees, capable of working in different sectors of the global economy, is the key to meeting Europe's ambitious policy goals".

But even though policy and reforms have contributed to shaping PhD education in Europe, the degree awarding higher education institutions have played a significant role in the reforms of doctoral education, not least through the work of organisations[7] such as the European University Association (EUA), the League of European Research Universities (LERU) and the Coimbra group and other associations of universities and higher education institutions, who have worked with the EU, with national governments and with their member organisations to promote changes, amongst other things by promoting common principles and approaches to doctoral education.

In 2005, the EUA organised the first Bologna seminar on doctoral education, bringing together several hundreds of academic staff, leaders and policy-makers involved in doctoral education across Europe. The common agreements made between the delegates at the seminar are known as the "Salzburg principles". The ten structuring principles of 2005's Salzburg report (European University Association 2005) were an attempt to set a standard across the diversity of individual and national systems of PhD education. The Salzburg principles attempt to balance traditional core values and recent demands for PhD education to be useful for the knowledge society. The first principle is about original research as the foundation of PhD training, and emphasises a number of points that set out the importance of independent study based on academic integrity in institutions, that can provide high quality and relevant doctoral education. The principles also pay attention to innovation and usefulness and preparation for professional careers. That said, the Salzburg declaration, and the follow up study conducted by the European University Association (2010), must be regarded as a policy initiative which largely reflects the research and academic orthodoxy, safeguarding the primary role of the PhD as the first step in a research career. It thus serves both as a document attempting to align higher

[7] See European University Association (2005, 2010), League of European Research Universities (2007, 2010), the Coimbra group (2007), ORPHEUS (2012), for documents on principles and standards in PhD education.

education institutions with new demands, and as an instrument to create friction around changes, and defend academic hegemony in the values and process of PhD training.

Salzburg principles

1) Original research consist the core of PhD training
2) Doctoral education, training and career development for researchers are an explicit responsibility for the higher education institutions
3) Diversity in research training is seen as a strength
4) Doctoral candidates should be recognised as yearly stage researchers, with appropriate rights and benefits
5) Supervision and assessment is key to doctoral education and supervision should be based on a contractual arrangements between all involved partners
6) PhD education should achieve critical mass through adopting innovative practices and by multi-institutional collaboration
7) Doctoral education should operate with an appropriate time duration (3-4 years)
8) Promoting innovative structures to cope with demands for inter-disciplinary and transferable skills
9) Doctoral education should promote mobility across disciplines and countries
10) PhD education needs appropriate and sustainable funding

Clues to success in PhD education: Critical mass and diversity, transparent recruitment and admission procedures, team based supervision and professional development for supervisors, training in transferable skills, specific quality assurance systems for doctoral education based on peer review, diverse approaches to internationalisation, strong institutional priorities and collaboration across institutions and sectors.
Source: European University Association 2005; 2010

A slightly different set of priorities prevails in the European Union. The European Commission has come up with its *Principles for Innovative Doctoral Training* which state that doctoral studies must be based on the 'Triple I': *international*, *interdisciplinary*, and *intersectoral* (European Commission 2010). It suggests that member states should link their structural funding to innovative doctoral training in order to properly train tomorrow's knowledge workers. Less emphasis is put on academic values.

A result of a 2011 study focusing on the EU neighbouring states in the East and South and on some member states, found there was a general consensus that the training of knowledge workers for industry and the broad economy faces a shortfall – the "1 million deficit" that will occur in the next decade – and that this should be the guiding light for research training. There also seems to be some pessimism as to whether this target will be achievable without importing knowledge workers trained elsewhere, or via training more third country students within Europe (Technopolis 2011). Regardless of whether this pessimism is warranted, it is a signal to all countries that there is an international, European, market for PhDs that will likely provide demand far beyond domestic demand.

Despite a substantial increase in the numbers taking a PhD, following a quarter century of expansion in numbers of PhD candidates, PhD candidates as a share of higher education is still minuscule. Countries with *high* PhD enrolment typically have some 3-4 per cent of their total student population in PhD education, although a few countries such as Israel, Tunisia and Sweden have higher shares.

3.1 Changing framework conditions for PhD education

The context in which research and higher education occurs is dynamic. How should European universities understand their own position in this very complex and partly super-national, partly de-nationalised, partly global, partly European, and yet partly national, scientific system? How should smaller universities in small countries view their situation? How can PhD education be understood in this rapidly changing landscape? Here we will briefly mention a few salient tendencies.

During the last couple of decades, competition within the scientific sector of society has increased. Competition is perceived to occur on all levels of the system: individual, research group, department, university. The competition is for funding first and foremost, but related to funding is the need for personnel, and students, with certain skills. Through the recruitment of "good" staff and enough students (or students who can pay tuition fees, where this is applicable), a university can hope to attract funding and secure a position in the top layer of the higher education hierarchy. On the research group and department level, the focus is different. A race is on here as well, in a constant search for additional resources. This is visible everywhere, although perhaps less so in Norway than in many other countries, because the system sees a generous share (typically 50 per cent) of faculty salaries guaranteed by the institution for research, including PhD supervision.

The increasingly tough competition for funding tends to separate universities into groups of winners and losers. Those who are part of the upward spiral – involving a good reputation, more students, higher tuition fees, better researchers and teachers, stronger scientific performance, and even better reputation – are able to use their superior position to cement their advantage, and strong centres tend to get even stronger. Alliances and mergers between universities occur in order to strengthen the scientific core and attract research money. Weak universities or universities which are too small to create a critical mass for research good enough to attract stable funding, are at risk of experiencing a steady-state, or a downward spiral that is very difficult to get out of.

These developments reveal possibilities as well as threats. If we look at scientific production in quantitative terms – through the number of journal articles – there is evidence of an on-going equalization of global publication over at least a couple of decades. Scientifically less productive nations have taken shares from more established ones. Already several "new" scientific nations have established themselves as strong science producers. In countries like China, India, Mexico, Indonesia, Turkey, Thailand and Brazil, the self-confidence regarding economic and technological abilities is already significant and growing, and this sense is spreading to scientific production. A major on-going trend, expected to last for several decades, is the founding of new universities as countries like China, India, and others modernise and develop. PhD education on a world scale is bound to expand enormously and the employment market in these emerging economies for PhDs trained in Europe will also be considerable in the private sector and in universities. The foreseeable future will also clearly offer a niche for ambitious PhD training institutions in Europe to educate the future professors of universities in Asia and other parts of the world.

The consequences of these trends for PhD education will likely be quite challenging. Trends towards concentration and differentiation in higher education suggest that a concentration of PhD training will take place too; it has been argued that PhD candidates should only be trained in research environments with a critical mass of research activity and with good resources in terms of supervision, equipment, research funding (European University Association 2010). International experience suggests that the size of the academic unit is important in research training, to ensure good guidance and a positive professional and social environment, although the specific needs and scale are likely to vary between different subjects, with different knowledge types and research practice (Louis et. al 2007, Delamont et. al 1997).

Nonetheless, in some countries there are trends that point in the opposite direction, with ever more dispersed PhD training. This pattern deserves further consideration, not least in Norway where opportunities for smaller institutions to train PhDs have opened up in recent years.

Another trend concerns the converging policies of research and higher education on the one hand, and innovation on the other. These areas are increasingly related to each other and often entangled in reality. Innovation might be of greater importance to our universities in the future, in terms of their profile and capacity to attract funds; for some institutions, this may be a matter of survival. For this reason it is important to develop an internationalisation approach which bridges the gap between academic knowledge production and knowledge mediation and innovation.

This brief sketch of R&D trends on the global level already suggests a shift is taking place towards a more scattered and diverse university landscape. There are more academic institutions which act on the scientific arena. In a more diverse academic landscape, with more actors and greater variation in scope and orientation, there is room for *profiling* and there is a demand for *quality*. This process is on-going and is unfolding in a way that contrasts with the Salzburg principles' support for commonality rather than diversity.

3.2 Trends in PhD education – particularly the Nordic countries

The characteristics of PhD education are changing all over the world. The PhD remains the highest degree but it has become less exclusive. In the past few decades there has been a rapid growth in the volume of PhD training. The typical pattern in European countries has seen the annual number of new doctoral degrees double or treble since the 1980s. Between 1998 and 2006 the annual median growth rate in a range of European countries was 6 per cent, with a high of 25 per cent in Portugal and other countries, including Hungary, closer to 0. The growth rates are consistently higher for women than for men (OECD Education database, 2009). This is in line with general patterns in higher education, where dramatic growth in enrolment numbers have been evident over a number of decades; the figures are, if anything, even more pronounced in PhD education. The OECD notes that "Since 2000, doctoral awards have increased at the same pace and even slightly more rapidly than other degree awards (OECD 2009). The steady growth of doctoral graduates can therefore be expected to continue." (Auriol, OECD 2010)

As we see from the Figure 3.1, the largest share (and over a third of the total) of PhDs awarded in the Nordic countries were accounted for by Sweden. Sweden has consistently been the most significant awarder of doctorates in the Nordic region, with Finland in second place.

However, in 2009 Finland overtook Sweden in terms of the number of doctoral candidates (see Figure 3.2) while Norway and Denmark remain closely matched in a race for third place. The peak for Swedish PhD candidate numbers was 2003, when there were around 20 000 doctoral candidates, but by 2009 this had dropped to around 17 000. Finland had a growing number up to 2007, after which numbers have remained fairly stable at just under 18 000. While they still have significantly lower numbers of doctoral candidates, Norway and Denmark have seen a steady growth since 2002, both registering around 8 400 doctoral candidates in 2009. The decrease in the numbers of doctoral candidates in Sweden also corresponds with a dip in 2009 in the number off PhDs awarded.

The overall numbers of PhDs produced of course depend, to a great degree, on the size of a country. The number of doctoral degrees per million inhabitants shows smaller gaps in terms of performance between the Nordic countries, although Sweden remains on top (Figure 3.3). However we can see that a more rapid increase in this measure of PhD production has been taking place in Finland and Norway. Nonetheless, a very clear gap remains between Norway and Denmark on the one hand, and Sweden and Finland on the other, in terms of their PhD level output; this gap cannot solely be explained by different sizes of the overall population or student population, but must be understood in terms of the different status and financial conditions for doctoral candidates in each country, and via the differing national policies taken up for the expansion of doctoral education.

In the Nordic countries there has also been considerable growth in numbers of new PhDs, with a 100 to 200 per cent increase per decade over the last quarter century. All Nordic countries demonstrate the same general pattern, with high and sustained rates of growth in medicine and technology, and slower growth in the sciences and, in particular, the humanities and the social sciences; however, these differences between fields are not extreme.

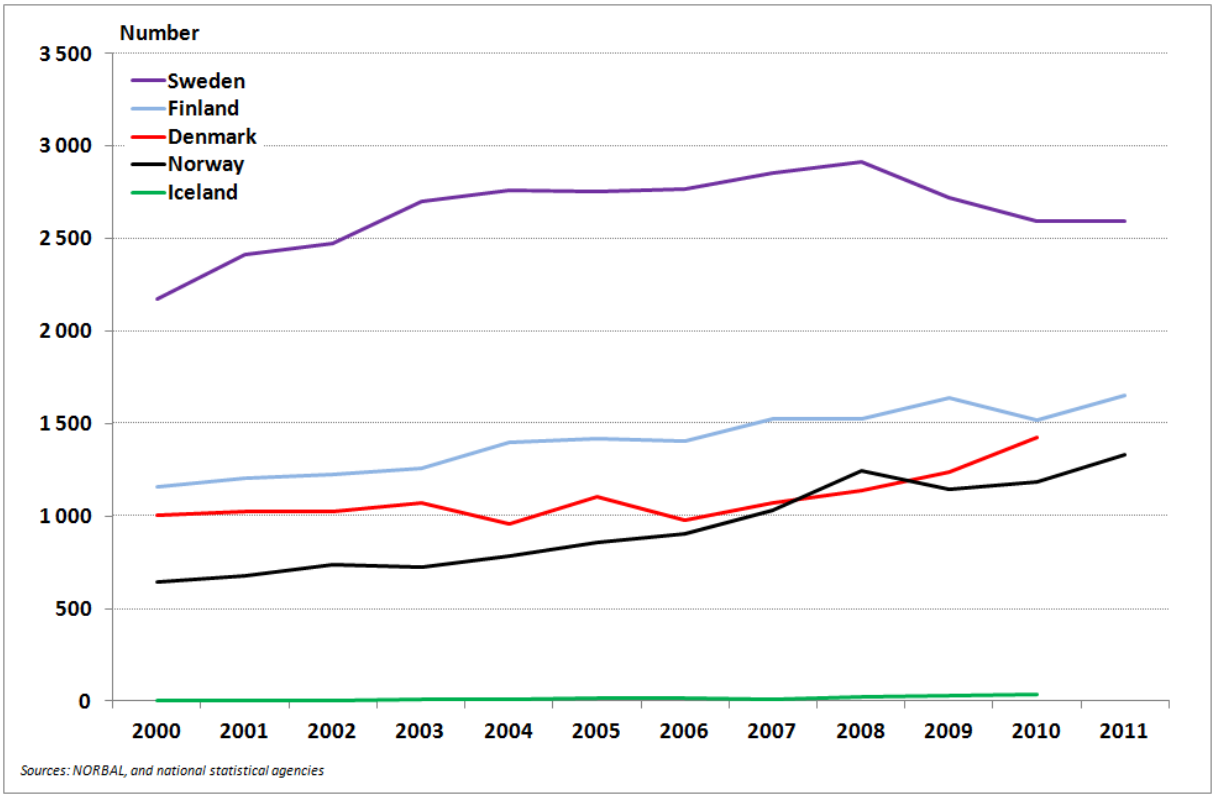

Figure 3.1 Number of awarded doctoral degrees in the Nordic countries 2000-2011.

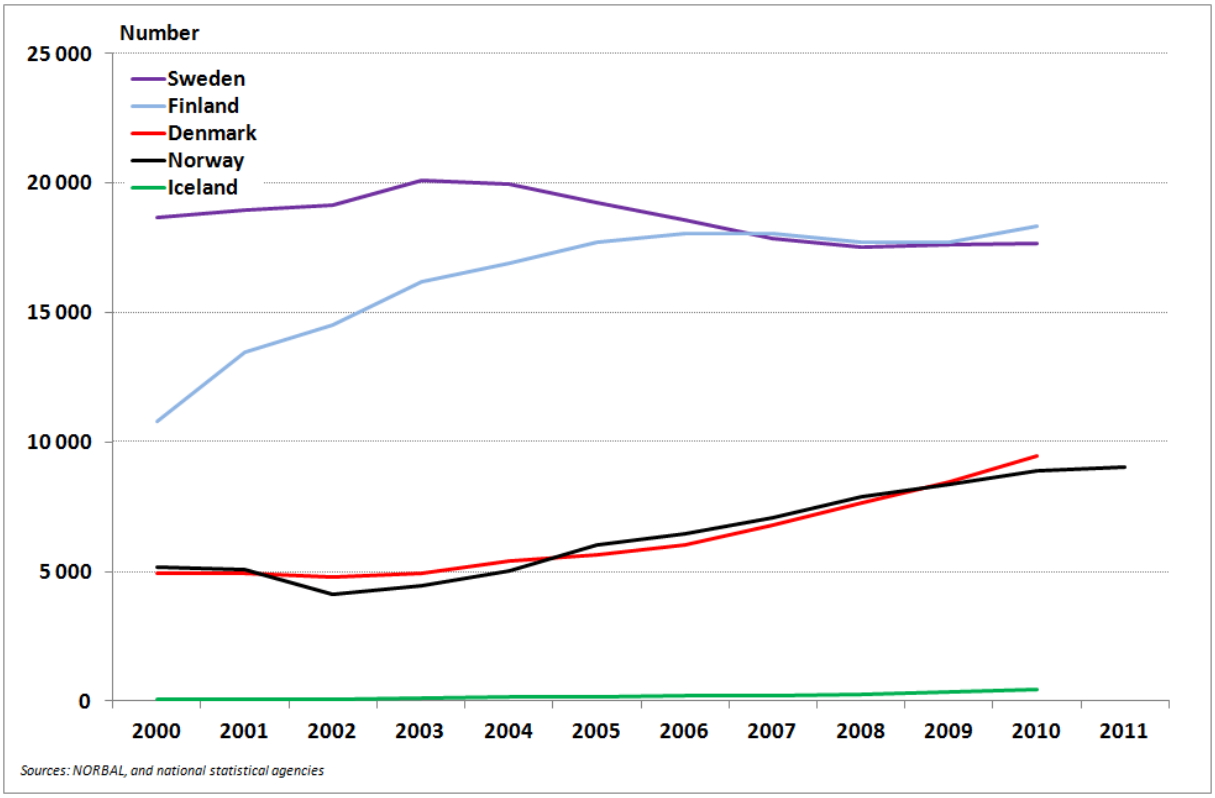

Figure 3.2 Number of doctoral candidates in the Nordic countries 2000-2011.

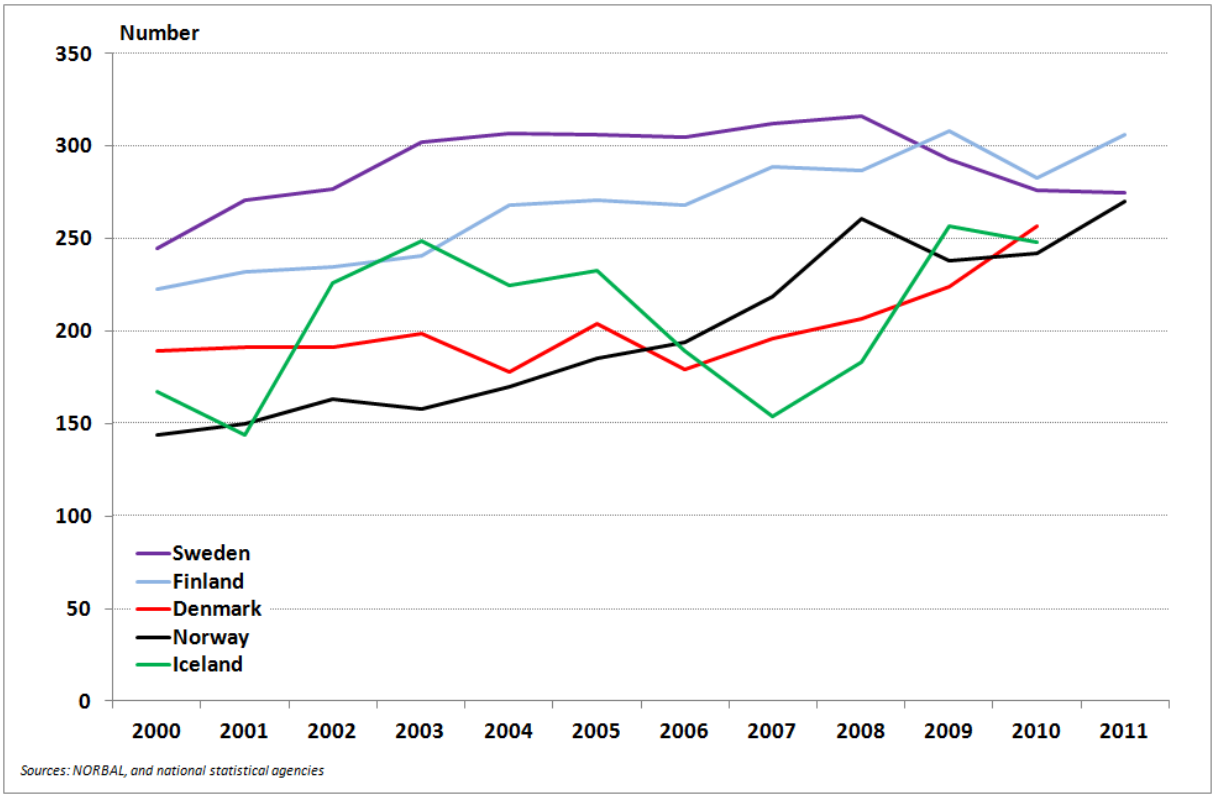

Figure 3.3 Number of awarded doctoral degrees per capita in the Nordic countries 2000-2011.

The change of degree system seems often to be accompanied by an initial acceleration in degree rates. The Danish experience in the 1990s might be a world record for this trend, with a more than 500 per cent increase in PhD degrees between 1987 (167) and 1997 (871)[8]. On the other hand, Danish PhDs later showed stagnation from the late 1990s on, and only increased marginally in the following decade until new funding from 2007 again allowed for expansion. In Sweden new regulations for PhDs introduced in 1998 – involving compulsory salaried funding and very strict exit rules after 4 years – led, in combination with the establishment of foundation - and state funded PhD schools, to a rapid increase in the number of PhDs, followed by a rebound downwards from 2008 (which was the peak year in terms of degrees awarded).

Overall, and certainly in the Nordic countries, the central authorities (the national government or in federal states often the regional authorities) provide the primary organising force and funding for PhD training. The growth of PhD training in recent times has also been principally instigated and made possible by the state, which is not to say that other forms of funding do not exist: foundations, research councils and private sponsorship often play significant roles.

The salaried PhD candidate, with access to the full rights of the welfare state, exists almost exclusively in the Nordic countries and a few other Northern and Central European Countries, although various forms of stipends and fellowships often offer support for PhD students in most countries.

3.3 Dimensions of PhD education and careers of PhD graduates

One can describe the major changes in PhD education over the last few decades as having taken place in two major steps, one following the other. Starting out from a typically individualistic and particularistic norm, where individual professors held a good deal of the direct influence and control over recruitment and training and where internal disciplinary values and standards held a hegemonic

[8] Although, of course, it should be remembered that the classical *Doktorgrad* required a much longer gestation. *Source: Fra Forskerakademiet til FUR 1986-2003* (Forskningsstyrelsen, Danmark, November 2003), p. 51.

position, there was a first move towards establishing the modern PhD in the 1980s and 1990s, with some earlier attempts such as Sweden's largely failed attempt to start a modern, 3-4 year PhD in the 1960s and 1970s (SOU 1966:67 *Forskarutbildning och forskarkarriär*).Typical issues and challenges addressed in this first step were: how to retain broad academic/faculty competencies despite specialisation; how to increase enrolment; and, how to bring completion times down. By and large this step has now been taken by most countries, with the best evidence of this the steep growth of enrolment and degrees and development of completion times, with a significant reduction in many countries.

The second step mainly started after 2000. That step could be summed up as "adapting PhD education to the knowledge society" and is a process that is on-going and in some countries has barely started. Issues here are the training of PhD students in so called "soft skills" or professional competencies, and a focus on employability, the contributions of PhD training to innovation and growth, and more generally to the usefulness of the PhD outside the higher education sector. This means a heavier workload within the same short time frame, and to complicate matters a consensus persists that these changes in training must not be at the cost of old, intra-disciplinary scientific skills. This results in an almost inevitable focus on the postdoctoral level which is increasingly considered as an extension of training for those PhD students considered suited to a future research career in universities or research institutes focused on basic research. This trend clearly follows the American model in terms of the role for postdoctoral training, and its links with PhD level training.

This second step in the transformation of the PhD appears to be levelling out previous local and national differences. One feature of this is increasing mobility, sometimes in the form of compulsory or at least recommended periods of study or research stays in foreign institutions, or, more commonly, visits to international conferences where the student is expected to present work and take part in discussion.

Increased enrolment has inevitably meant that more institutions offer PhD training and degrees, often in spite of resistance from the older and more established research universities. As could be expected, this has resulted in PhD education becoming a more important part of the strategic planning of individual universities. Offering PhDs is a sign of maturity, and hosting large, successful PhD programmes is a sign that the university belongs among the higher echelons of such institutions. This prestige dimension of PhD training has created incentives to expand it, which in turn leads to a pressure for policies and regulative systems to open up the possibilities for institutions to establish new programmes. Institutions also seem more willing to prioritise funds for PhD training, knowing that a large portion of all research work in the university is performed by PhD candidates (in countries like Sweden and Norway this is of order of 50 per cent or more). There is also evidence to suggest that this research work by PhD candidates is not measurably of lesser quality than that undertaken by more senior scholars (Vetenskapsrådet 2006).

For a number of reasons, the strategic control of PhD education has migrated from the lowest level of the organisation, the individual professor and division/unit/lab, to a more strategic level where it is the concern of Deans and vice chancellors, or even university boards. In many countries it is also now considered a national policy issue to enhance and increase PhD training, and governments have sometimes introduced production targets and handed out designated accountable funds to universities. This is also considered a European policy priority, under the Lisbon strategy of 2001; sufficient numbers of PhDs are argued to be a prerequisite in order to meet the future demand for researchers which in turn are assumed to be needed for European R&D efforts to keep up in the increasingly global and competitive knowledge economy.

The PhD is no longer seen as primarily, let alone exclusively, a representation of academic heritage and a breeding ground for the next generation of university teachers and scholars. PhDs are now trained in an effort to sustain growing demands for advanced research competencies in society at large. PhDs are increasingly employed in private R&D laboratories, specialised research institutes and government laboratories, as they have been throughout the 20th century. However, they are also increasingly employed in firms and public agencies as leaders and directors of advanced activities of

any kind. A good international overview of the economic and social demography of PhDs is lacking, but studies in individual countries consistently show this pattern of an ever growing social spread of PhDs across the economy, and available OECD data illustrates the same pattern (Auriol 2007; 2010).

Overall employment rates among PhDs are very high and unemployment thus low, at least in most countries at most times. In fact, PhD holders are the most employed category in the population, a pattern which is not necessarily based on the quality of the training but may reflect the extremely favourable selection of individuals that are enrolled in, and successfully complete, this very demanding level of education. However, there are some exceptions to this pattern that may be worth mentioning. Cyclical patterns of limited unemployment can be seen in the areas of science and engineering where PhD graduates will typically be building careers in areas of industry where job opportunities are sometimes scarce. A number of countries (Austria, Denmark, Belgium) have also experienced more consistent unemployment among humanities graduates. Several countries also have substantial mismatch with the labour markets, which is a more common challenge in PhD employment across Europe, as evident in countries such as Austria, Spain, Romania and the Netherlands. Humanities and the natural sciences are affected more by such mismatches than other areas. The typical mismatch is that PhDs are employed in positions which require less advanced skills than those which the PhD is trained for.

At the same time, the doctoral degree and what it means in an academic career, varies between disciplines, countries and over time. At some times and in some fields of science, a doctoral degree has been the key marker of a peak in one's academic career; a stark contrast to views that it is a marker of having received initial researcher training (Bleiklie & Høstaker 2004). In other words, different career paths linked to PhDs have been characterised by different logics regarding "social aging" in careers. Social ageing refers to the culturally and socially determined stages in a research career at which one is considered eligible, or mature enough, for a tenured position.

The last decade has seen the PhD gain a broader, more comprehensive status as a standard element in researcher training; it has essentially become the firsts step in a research career in many settings. In the wake of the expansion of PhD degrees, we can also see that these qualifications are being devalued in terms of the career advantage they create, and in some disciplines and fields a PhD is no longer enough to compete for a tenured position: doctoral training must be supplemented with one or more post-doc periods, or other forms of temporary engagement, in order to qualify for a tenured academic position. These trends have contributed to a debate on the national level about the role of the PhD in academic careers, the increasing use of temporary positions, and the supposed loss of attractiveness in academic careers due to challenging working conditions and limited rewards. There are also some concerns raised that those who qualify for tenure in academia may need a set of competencies that doctoral training may not provide, for example teaching and supervision experience. As the criteria for social aging in research and academic careers change, it seems that individuals need to do more to reach tenure – a step that in itself has implications for the attractiveness of academic careers. As the PhD takes on a broader range of uses and relevance in terms of a wider range of careers, its status in academic career progression seems to be becoming less clear and less exclusive.

Given these overall trends and tendencies in current international PhD training, what can be said of the Norwegian response? As seen in chapter two, similar to many other countries, Norway has experienced a significant growth in the number of PhD candidates. The next three chapters of the report will provide information to shed light on how Norwegian universities have adjusted to larger PhD candidate numbers, the implementation of a common doctoral degree, as well as increasing demands for quality, efficiency and relevance in PhD education.

4 The quality of PhD education

4.1 Introduction

This section investigates how the current system of PhD education in Norway performs in terms of quality, specifically with regard to whether Norwegian doctoral training maintains high standards in an international comparison. The terms of reference for this evaluation do not include further description about how quality or international standards are to be understood. The concept international standard in provision of PhD education is interpreted as adherence to emerging common principles and good practices advocated by international organisations such as the European University Association (The Salzburg principles and clues for success). International standard for quality of doctoral dissertations has been assessed by asking for the assessment of international committee members who sat in dissertation committees in 2010 for Norwegian higher education institutions (chapter 4.4). Three dimensions of quality in PhD education have been discerned to guide this evaluation, based on international developments and efforts to develop good practices and guiding principles for quality improvements in PhD education, and on published research and evaluation reports on PhD education.

Table 4.1 The performance criterion quality

Performance criterion	Dimensions	Operationalisation
Quality	Quality of input	Quality of applicants and new entrants, quality of recruitment procedures
	Quality of the research/training process	Quality of programmes, course work, supervision, research environment, internationalisation efforts, infrastructure/equipment, level of administrative support
	Quality of output	Quality of doctoral theses, published papers, quality of generic skills

The quality improvement and standardisation work promoted by European and national bodies[9] focuses on all of these dimensions, but the main emphasis is on the quality of provision of PhD education in terms of structure and content of PhD education, and the support available for PhD candidates.

High quality PhD education is also defined in terms of the output of the system, in producing high quality research and highly educated researchers with academic competencies and broader skill sets that mean they are prepared for employment in different sectors of society. The quality of input is a less common topic in documents discussing quality and quality development in PhD education, but this emerged as a very important issue in the institutional survey and interviews.

- **Quality of inputs** concerns first and foremost the quality of recruitment procedure quality of applicants and the quality of new PhD candidates, in terms of competencies and education at the time of entry. Other input factors, such as availability of academic supervisors or level of resources and infrastructure available to each PhD candidate, should also be regarded as key inputs for successful PhD education. In this evaluation, we focus only on the recruitment and competence of applicants and new entrants to the programmes (in Norwegian referred to as "inntakskvalitet"). Data on this issue was collected through the institutional survey and

[9] European commission, European University Association, League of European Research Universities (LERU), Coimbra group and ORPHEUS have all promoted development of quality principles and good practices. In Norway, bodies such as UHR and NOKUT are important agencies promoting quality development in doctoral education.

interviews with leadership, programme coordinators and academic supervisors of PhD candidates. This is described in section 4.2.

- **Quality of training and research processes** concerns all aspects related to how PhD education is provided in terms of its structure, content, activities and support for PhD candidates. Data on these issues were collected through many different sources: statistical data registers, documents, surveys and interviews with institutions, supervisors, PhD candidates and PhD holders, described in section 4.3.
- **Quality of output** concerns scientific output as well as the competencies PhD candidates develop regarding both academic/disciplinary competencies and generic skills. In terms of the first issue, the quality of scientific output produced by Norwegian PhD candidates should be assessed. To do this we present new survey data on international examiners' assessments of the quality of Norwegian PhD dissertations in section 4.4. The issue of the promotion of generic skills will be addressed in chapter 6.

4.2 The quality of inputs – recruitment procedures and applicant quality

According to the information provided by the institutional survey, 1685 new PhD candidates were admitted into PhD programmes in 2010, in the 21 surveyed higher education institutions[10]. The large majority were admitted into PhD programmes in the eight universities, with the University of Oslo and NTNU the two dominant providers, with 577 and 416 new candidates each in 2010.

About half of the new PhD candidates admitted in 2010 had a master's degree from the same higher education institution as they were enrolled as a PhD candidate, and 30 per cent had a master's degree from a university outside Norway. Only 17 per cent of new PhD candidates in 2010 were reported as having a master's degree from another Norwegian higher education institution.

There is a high degree of variance between faculties and institutions with respect to the educational background of their new PhD candidates. The University of Life Sciences (UMB) and the Norwegian University of Science and Technology (NTNU), specialising in agricultural sciences and technology and engineering, both have a particularly high proportion of new PhD candidates with a master degree from a foreign university.

Table 4.2 Educational background of candidates starting PhD studies in 2010, by subject area. Percentages.

	Education from			Total	(N)
Institution	Current HE institution	Another Norwegian HE institution	Overseas institution		
University of Oslo	54	17	29	100	(577)
University of Bergen	61	15	24	100	(248)
NTNU	47	10	43	100	(416)
University of Tromsø	52	17	31	100	(121)
UMB	30	13	58	100	(80)
University of Stavanger	26	44	30	100	(43)
University of Agder	59	22	20	100	(41)
University of Nordland	29	46	25	100	(28)
Public colleges and specialized university institutions	53	21	26	100	(92)
Private institutions	39	42	18	100	(33)
Total	51	17	32	100	(1 679)

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

In the social sciences and humanities more than 60 per cent of PhD candidates were educated at the same university in which they are enrolled for a PhD, whereas almost 60 per cent of PhD candidates in STEM subjects are recruited from universities outside Norway.

[10] About 200 more than the number of new PhD contracts reported to the database on higher education in 2010.

The relationship between the number of PhD scholarship positions announced and admission of new PhD candidates indicates that less than half of 2010's new PhD candidates were recruited through openly announced PhD scholarship positions (727 positions were announced in 2010 according to our survey). This means that more than half of the new candidates were recruited without applying for an openly announced position, either by contributing to raising the necessary funding means themselves or via internal or other, less formal, recruitment processes.

4.2.1 Opinions about recruitment situation and the quality of applicants

The higher education institutions were asked to give their opinion on several statements concerning the current recruitment situation for new PhD candidates. A large proportion of the PhD programme units agree that many applicants do not have a relevant educational background (43 per cent) and do not have good enough qualifications (44 per cent). The large majority (73 per cent) agree that they receive a large number of applicants.

The source of applicants is also a concern for many; 40 per cent of the PhD programme units agree that they receive too few applicants with education from Norwegian universities, and 25 per cent of units claim that they have a majority of international PhD candidates in their programmes. The majority, 64 per cent, of units claim that they announce positions through international recruitment channels. Only 29 per cent think that the PhD population is unbalanced in terms of gender and 28 per cent claim to practice "preferential treatment of underrepresented gender" when hiring PhD scholarship holders.

There are only minor differences between types of higher education institutions' (old universities[11] versus new universities and other higher education institutions) assessments of these issues. However, as might be expected, there is a marked difference between fields of science when it comes to their assessment of the current recruitment situation for PhD candidates.

All units report that that it can be difficult to get enough applicants for announced positions. A large proportion of units within natural sciences and technology (60 per cent) report that many applicants do not have a relevant educational background and 73 per cent of them report that applicants do not have good enough qualifications to be admitted to the PhD programme.

Table 4.3 Percentage of PhD programme units that agree, to a great extent or some extent, with statements about the appropriateness and qualifications of candidates, by subject area.

Statement	Humanities and Social sciences	Medical and health sciences	Natural sciences and Engi-neering	Total
We have too few applicants for PhD positions	37	43	27	35
Many applicants lack the appropriate educational background	37	29	60	42
Many applicants lack good enough qualifications	30	43	73	44

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

Note. The field of science groupings are based on discretionary classification of faculties' and university colleges by NIFU. Agricultural and veterinary sciences are included under medical and health sciences.

STEM subject units also report having too few recruits from Norwegian universities, and 73 per cent of natural and technical science units report having a majority of international PhD candidates.

[11] The universities of Oslo, Bergen, and Tromsø, and NTNU..

Table 4.4 Percentage of PhD programme units that agree, to a great extent or some extent, with statements about applicants' national or international orientation, by subject area.

Statement	Humanities and Social sciences	Medical and health sciences	Natural sciences and Engi-neering	Total
There are too few applicants educated at Norwegian institutions	23	14	87	40
We always advertise PhD positions internationally	57	43	87	63
A majority of our PhD applicants are from overseas	7	0	73	25

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

Note. The field of science groupings are based on discretionary classification of faculties' and university colleges by NIFU. Agricultural and veterinary sciences are included under medical and health sciences.

The high proportion of units reporting that applicants to PhD positions lack relevant educational backgrounds or high enough qualifications does not mean that applicants admitted to the PhD programmes are of a low standard, since the units generally claim to receive a lot of applicants for these positions. We therefore cannot assume that higher education institutions are unsatisfied with the quality of the PhD scholarship holders accepted, as this may only reflect problems with certain applicants.

4.2.2 Recruitment procedures in natural science and technology units

In field visits and interviews carried out in particular higher education institutions several units, particularly those within natural science and technology, but also some within economics and business administration, describe substantial resources being used on recruitment procedures for new PhD candidates.

The major concern for those responsible for running programmes is the high level of international applicants for PhD positions and the administrative and academic routines required for international recruitment. Most higher education institutions report having an international office which checks the PhD applicants' formal background and CVs, but supervisors report some problems with limited competence in these international offices. For example, a lack of knowledge about grading practices in foreign universities can be an obstacle in assessing applicant's accomplishments as part of the recruitment process.

Supervisors also highlight the importance of interviewing PhD applicants to be sure they are choosing the right person. As the number of international applicants has grown, so has the workload and complexity related to this recruitment process; it is common for foreign applicants to be brought to Norway for interviews.

The institutions are taking different steps to address the increasing workload and complexity of international recruitment to PhD positions. Due to problems with too many unqualified applicants responding to open calls, some units report that they have stopped or are considering stopping, announcing new PhD positions through open channels or that they prefer to use academic networks to recruit PhD candidates.

Several institutions report initiatives to increase the recruitment of PhD candidates from their own master programmes, first and foremost by motivating able master candidates but also by creating incentives for the best students to continue and go for a PhD. For example, NTNU has established a master degree with a strong focus on researcher training (integrated PhD degree), and a similar programme is also found in medical faculties in all the four old universities (the so-called "research track"). The Norwegian School of Economics (NHH) are discussing a similar initiative to promote better integration between masters and PhD levels.

Such initiatives give the institutions an opportunity to motivate their own master's students, and the new PhD candidates will benefit from a socialisation process deriving from their background as master students from the same institution and scientific specialisation.

At the same time, the units are concerned about recruiting candidates to PhD positions in a way that promotes open competition amongst the best qualified. In this way, research tracks and similar initiatives at the master's level are primarily seen as a way of motivating potential candidates to

continue to the PhD level. At the same time it is important not to establish a practice of preferential treatment for the units' own master students without competition. Open and transparent recruitment procedures are seen as a fundamental principle on the European and national level, but those principles have significant resource implications for higher education units that seem to be unresolved at present.

The current situation facing Norwegian PhD recruitment should be addressed at the national level, both in terms of increased collaboration between STEM subject units in different higher education institutions, and through collaboration with national agencies such as NOKUT to make more efficient use of resources in the quality assurance of applicants to PhD positions.

4.3 The quality of training and research process

Many different elements contribute to the quality of PhD programmes. In this section, the main components and activities that make up PhD programmes will be addressed: PhD courses, supervision, research activities, support and access to resources and infrastructure for research. This chapter also addresses the role of research schools in Norwegian PhD education.

4.3.1 PhD courses and other mandatory activities

Regulations for the "course part"

Although the faculties and higher education institutions are responsible for designing regulations for their PhD programmes, within the broad regulations set down by national law and policy frameworks, they have generally adapted the PhD regulations to a common national standard.

One issue that varies between institutions and between programmes (and probably between specialisations tracks) is the balance between the "course part" and the "research part" of PhD programmes. There is a high degree of variance between higher education institutions and between programmes in terms of 1) how many credit points of course work each PhD candidate is required to take and 2) how many of those credit points must come from mandatory courses or on a choice from a range of activities.

The scale of the course part in the PhD programmes surveyed varies between 20 and 60 credit points, according to the information provided. Two main patterns emerge from this information: the old universities generally have course requirements of 30 credit points; and, there is much more variation between the new universities, specialised university institutions and university colleges, where several programmes have up to 60 credit points.

PhD programmes with a "course part" of more than 30 credit points are usually found in professional areas, particularly within economics and management subjects, but also in law and architecture, and PhD programmes in these subjects also have fewer elective courses and more mandatory activities than other programmes.

There is a high degree of variation in how many credit points are based on mandatory courses and the extent to which PhD candidates can select courses and design their individual study programme. All PhD programme units state that PhD candidates can select PhD courses in other institutions.

Particularly at the NTNU and UMB, most programmes seem to have few mandatory courses. According to the NTNU, the programmes have defined mandatory topics that each candidate needs to be trained in, but the actual courses offered by the faculties are not mandatory.

It also seems that some programmes allow the PhD candidates to take master’s level courses, for at least half of the total number of credit points, where as other programmes only accept courses defined as PhD level courses.

The content of PhD courses and other mandatory activities

We also asked each unit to report what kinds of courses are usually mandatory. Particularly for the broader, faculty based programmes these responses might hide significant differences between the specialisation tracks. Philosophy of science courses are mandatory in 49 of the 52 units, followed by courses in research ethics in 79 per cent of the surveyed PhD programme units. Other common

mandatory courses are research methodology (70 per cent of programme units) and theoretical courses (in 52 per cent of the units), while 23 per cent of the units report "other" mandatory courses, including courses in topics such as animal experiments or health, safety and environment.

Units were also asked whether their PhD programmes specified any mandatory activities other than PhD courses. The following activities are frequently mentioned:

- Participation in internal seminars, in several cases organised via three seminars at the introduction, half-way and end stages of the PhD
- Publication and communication activities, usually involving international conference participation
- Courses in academic writing
- Courses in teaching/pedagogy or mandatory lectures for bachelor's and master's students

In many programmes the so-called "mid-way module" is also mandatory, where the PhD candidate writes a preliminary PhD report, presents their PhD research project in a seminar, and usually receives feedback from academic staff other than their supervisor.
Almost all of the new universities and university colleges with PhD programmes have such arrangements, but they are also in place in some PhD programme units within the old universities (particularly within medicine, law and dentistry). Some units also report having "90 per cent seminars" or "end seminars" which have a similar role, and where the PhD candidate needs to have passed the mid-way and/or end seminars before being allowed to submit their thesis.

Some of the units report that PhD candidates receive credit points for participating in these activities, whereas others say participation is mandatory but the candidates do not receive credit points for these activities.

PhD candidate and supervisor satisfaction with PhD courses

There are several sources of data about PhD candidates' satisfaction with their courses, from survey data collected by the higher education institutions themselves and interviews.

In the 2009 survey of PhD scholarship holders, organised by the Norwegian Association of Researchers (Thune & Olsen 2009), 63 per cent of PhD scholarship holders agreed that the number of PhD courses they have been offered has been satisfactory, and 50 per cent agreed that the quality of PhD courses is high and relevant to the research they are carrying out. PhD scholarship holders in STEM subjects are generally more satisfied with the number, quality and relevance of courses. Scholarship holders within the humanities express less satisfaction; 50 per cent of them find that PhD courses offered are not relevant for their research. A similar finding, indicating lower levels of satisfaction with courses among PhD candidates in the humanities, has also been reported in previous surveys (Kyvik & Olsen 2007).

Surveys carried out by the higher education institutions of their own PhD candidates provide further information, and generally describe the same overall pattern. In a NTNU survey (NTNU 2009), more than 50 per cent of candidates claim they are satisfied with the variety, quality and relevance of PhD courses. Candidates in STEM subjects are most satisfied, and candidates in humanities are the least satisfied, with the courses offered. At the University of Tromsø (2011), less than half of candidates claim to be satisfied with the courses, and 70 per cent of respondents claim that there are not enough courses available. The University of Oslo survey (2012) results are generally comparable to these other surveys. The PhD candidates at the University of Oslo were asked to give a general assessment about the courses offered and a general assessment about their satisfaction with the PhD programme: about 50 per cent express a high degree of satisfaction with the PhD programme, with no major differences between faculties. In terms of satisfaction with courses, 30 per cent think PhD courses are high quality, 50 per cent think they are average quality, and 10 per cent find the quality to be poor. PhD candidates in the faculty of education and odontology are most satisfied. Candidates in the humanities and theology are notably less satisfied with PhD courses.

In the eight PhD programmes visited, most respondents across all units report a relatively high degree of satisfaction with the quality of the PhD programmes. However, critical assessments of PhD courses

were found in several programmes and institutions, both in terms of the number of mandatory courses, as well as problems with access, quality and relevance of courses. The PhD candidates in the larger programmes in the old universities generally seem to be more satisfied with courses than PhD candidates in other programmes.

However, there are inconsistencies in the assessment of PhD courses by different groups of actors involved. On the one hand, both PhD candidates and supervisors think that there is too much mandatory course work in PhD degrees, particularly in units where a three year PhD is the norm. In these programmes, PhD candidates report these courses are too time-consuming and, that to some degree they prevent them from going abroad as part of their PhD education and that the courses can delay their own research. The relevance of the courses is also questioned; some PhD candidates report taking less relevant courses because these were better suited to their time schedule.

On the other hand, there are complaints that several institutions have difficulties in providing enough PhD courses, frequently enough. The size of the programme is obviously a factor in the ability of units to offer frequent, high quality PhD courses. Small programmes, with few full-time professors, have great difficulties in providing enough PhD courses. Two of the programmes (Vestfold University College and the Norwegian School of Economics) partake in national research schools (see next section) and the PhD candidates interviewed report a high degree of satisfaction with PhD courses, in terms of the quality, range and frequency of courses offered.

Based on the information available, it seems fair to conclude that small and highly specific PhD programmes, outside the large universities, benefit from collaborating with other institutions offering PhD courses, rather than attempting to develop a whole portfolio of courses themselves. The national research school programme has an important role here, but broader network programmes to provide funding for national research courses might also be further developed, along with a good infrastructure for information about PhD courses available.

4.3.2 Research schools

The institutional survey asked the higher education institutions about whether PhD education was offered through so-called research schools or doctoral schools ("forskerskole" in Norwegian). Research schools were initially proposed in 2002 by the previous evaluation of doctoral education in Norway, and followed up in a white paper on research in 2005 (Ministry of Education 2005) where they were presented as a tool to enhance the quality of PhD education. As a response to this policy, a national programme for funding "national research schools" was implemented in 2008. Initially, only five such national research schools were funded, through eight-year grants. However a range of other initiatives are also in place that are referred to as research schools or graduate schools, including institutional initiatives, national and international networks, which are organised and funded in many different ways.

A problem that persists is that the term research school is not particularly well defined, and is used in several different ways. The higher education institutions, through the Norwegian Association of Higher Education Institutions, are partly responsible for this, as they intentionally decided not to give a precise definition when the research school concept was introduced in Norway, to allow for adaptation to the particular needs and opportunities in different scientific fields (UHR 2003). Based on a review of international and particularly Nordic experiences, three different interpretations of research schools were identified: an independent administrative unit responsible for PhD education; a network of research environments within and across higher education institutions, within a particular scientific area that offers PhD education; and, national research school initiatives funded by a national programme.

The European University Association, who have also strongly promoted the idea of doctoral or graduate schools, define them as "an independent organisational unit" with leadership and specific funding attached to the scheme. The Norwegian Association of Higher Education Institutions (UHR 2003) has also specified a set of criteria for research schools, where they are described as:

- A supportive environment that integrates people and research environments across institutions and departments, working on a clearly specified topic
- Provides education at regular intervals

- Provides close monitoring of progress and support to PhD candidates, and has a strong focus on supervision
- Promotes quality in PhD education
- Is closely connected to international networks and promotes internationalisation and international collaboration
- Should be anchored/closely linked to ordinary PhD programmes and the faculties responsible for them
- Should be "equal to regular PhD studies" but admission and graduation can occur in collaboration with regular PhD programmes
- Should have a particular identity, formal organisation and adequate resources, and should be organised as "flagships" or "networks"
- Should have a minimum number of PhD candidates associated with the school and minimum size of supportive environment

This list of criteria immediately suggests two issues that need to be addressed. First, the description and criteria for research schools are idealistic. Second, and more importantly, the relationships between ordinary PhD programmes and research schools are highly unclear: research schools are described both as an equal, alternative to PhD programmes, and as support tool for them. This unclear status of research schools vis-a-vis PhD programmes is a main concern in the evaluations that has been carried out so far.

Types of research schools

Before going into the issues set out above in more detail, further information about research schools in Norway should be set out. In the institutional survey PhD programme units were asked to list all research schools that they participated in and to indicate what type of research school it was (institutional initiative, national research school or international research school). We also asked the unit to indicate the number of PhD candidates associated with each research school that they participated in.

All listed research schools were later checked by the evaluation team. Based on this it is clear the list is not a complete catalogue of all research schools that are operational today. Some of the listed schools are no longer active and some initiatives and some relevant networks are not listed, although information about them is available on the institutional websites.

Second, the institutions had great difficulties in giving information about the number of PhD candidates associated/participating in each school, and many units have not provided any data despite listing links to a research school. This means that the data reported on participation must be assumed to be limited. However, it also tells us that most of these schools have voluntary participation arrangements, and many will not have a fixed number of participants for such schemes, making it difficult for them to calculate PhD candidate numbers in some cases.

Despite these issues with the data, it is apparent that the research school concept has initiated widespread activities in all the surveyed higher education institutions, based on the initiatives of the Norwegian Association of Higher Education Institutions and the national programme for research schools. Only 33 per cent of the surveyed units claim that their unit is not part of any research school. The rest (67 per cent) report that they participate in one or more research school. The number of units participating in research schools and the number of candidates in each unit that participate is described in Table 4.5.

Table 4.5 Participation in research schools per unit and number of PhD graduates.

Institution	Research school initiated by institution	National research school	International research school	Number of PhD candidates that participates
University of Oslo	4	4	2	105
University of Bergen	5	4	3	376
NTNU	1	5	2	174
University of Tromsø	4	4	1	181
UMB	1	1	1	150
University of Stavanger	1	3	0	8
University of Agder	0	3	1	72
University of Nordland	0	1	0	19
State colleges/SUS	1	5	1	154
Private colleges/SUS	2	2	1	109
Total units with research school	19	32	12	1 348

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

Research schools initiated and funded by the higher education institutions

Institutionally initiated research schools are particularly prevalent at the universities of Tromsø, Bergen and Oslo, all universities with broad, faculty based PhD programmes. The University of Tromsø currently has six research schools, and the University of Bergen reports 14. The University of Oslo had a great number of research schools from 2004 to 2010; 18 received funding from the board of the University of Oslo and 4 that were initiated without funding from the University. According to Hyllseth (2010) only the University of Oslo and Tromsø have had institutional programmes where funding was granted to research schools based on competitive applications.

Some of the institutional research schools are apparently emerged from particular research centres, whereas others more closely resemble inter-faculty PhD programmes. Examples of the first type are research schools associated with Centres of Excellence or larger research projects. There are also examples of inter-faculty research schools and some of these also involve networks between different institutions.

A few institutionally initiated research schools seem to encompass a whole faculty or PhD programme, but this is not a common approach.

National and international research schools

Of the PhD programme units surveyed, 62 per cent participate in national research schools and 23 per cent participate in international research schools. Overall, the PhD programme units report participation in 20 different national research schools.

National research schools are of two types: research schools that receive external funding over a prolonged period, and research schools that the institutions partly fund themselves and receive external support from different sources. Both types are made up of networks of academic environments in different higher education institutions and the research school is usually focused on a narrowly defined field of research. The international research schools are similar, but are made up of international, usually Nordic, participating institutions, within a defined area of science.

Several of the national research schools are funded by the Research Council of Norway (RCN): five under a specific programme for national research schools, but there are also other thematic and strategic initiatives run by the RCN that can and do provide funding for research schools. At least three or four other national research schools receive funding from the RCN. These national schools have a broad participation among the higher education institutions.

In addition to these nine research schools, several national network schools exist that do not have stable funding. Some are regionally-based; most are national and focused on providing PhD courses and on specific, often cross-disciplinary, areas of research. All of them are funded by the member institutions, and probably some external resources accessed through a governmental funding scheme to promote collaboration between higher education institutions funds from the research council to arrange national research courses, or different research council programmes. The units report that they

participate in 11 such national network schools, and in 10 international/Nordic research schools. Some of the Nordic research schools have been also funded by NordForsk, the organisation under the Nordic Council of Ministers that provides funding for Nordic research cooperation as well as advice and input on Nordic research policy.

The value and status of research schools

As seen in the introduction to this section, the implementation of research schools led to great expectations, and research schools were seen as tools that could enhance the quality of doctoral education, but also improve efficiency and integration of PhD candidates; this was seen as particularly relevant for integrating doctoral education across small and dispersed units. However, there has been little evidence to show what research schools really do and how far they support PhD education.

As seen above, research schools are highly diverse in terms of activities and resources. The national research school scheme has not yet been evaluated, but we do have some data on how research schools support PhD education.

In the institutional survey informants were asked to agree or disagree with nine statements concerning the research schools.

Table 4.6 PhD programme units' views on research schools. Percentages.

Statement	To a great extent	To some extent	Neither/ nor	To a limited extent	Not at all	Total	(N)
Research schools give PhD candidates access to an academic network	64	33	3	-	-	100	(36)
Research schools contribute to internationalization	28	61	8	3	-	100	(36)
Research schools give candidates insights into multidisciplinary research	28	56	14	3	-	100	(36)
Research schools offer relevant PhD courses of high quality	67	28	3	-	3	100	(36)
Research schools give candidates access to qualified supervisors	22	42	19	11	6	100	(36)
Research schools give candidates access to research equipment and resources	14	31	29	20	6	100	(35)
Research schools provide a good social environment	28	58	14	-	-	100	(36)
Research schools lead to good completion rates	-	56	41	-	3	100	(34)
Research schools contribute to greater social and workplace relevance	9	40	40	9	3	100	(35)

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

As seen in the Table 4.6, most informants agree that the research schools provide PhD candidates with access to academic networks, a good social environment and courses of high quality, and that the research school promotes internationalisation. All these statements are in line with the expectations set out for research schools. Fewer of the PhD programme units agree that the research school promotes efficiency or relevance, or gives the PhD candidates access to equipment and resources. Slightly more informants from the old universities express positive assessments of the research schools than other higher education institutions.

In 2009, NIFU carried out a survey among PhD scholarship holders who were members of the Norwegian Association of Researchers (Thune & Olsen 2009). In this survey a few questions on the research schools were included. Only 33 per cent of the PhD candidates participated in a research school, most of them in research schools initiated by the institutions. The candidates that had participated were asked to agree or disagree with statements about the research school that they had participated in. As seen in Table 4.8 the PhD candidates' assessments of the research schools are in line with the assessments expressed in the institutional survey: research schools are thought to give the PhD candidates access to relevant PhD courses and gives access to a relevant academic network.

However, when compared to PhD candidates who do not participate in research schools, those in research schools are not substantially more satisfied with the courses they receive, integration in academic environments or their working situation. However, slightly more PhD candidates who participate in research schools state that they have participated in academic networks in Norway and abroad, and more of them have participated in academic conferences in Norway (Thune & Olsen 2009).

Table 4.7 PhD scholarship holders' views concerning research schools. Percentages.

Statement: The research school…	Agree com-pletely	Agree partly	Neither/ nor	Disagree partly	Disagree comp-letely	Irrele-vant/ don't know	Total	(N)
... gives me access to a academic network	23	41	10	12	9	4	100	(301)
...offers relevant research training (courses) of a high quality	22	39	10	18	8	4	100	(301)
... gives me access to relevant and qualified supervision	27	25	17	13	12	7	100	(301)
... gives me access to infrastructure and resources	15	24	24	15	15	8	100	(299)
...gives me access to a good social environment	21	28	21	13	11	6	100	(300)
...leads to me being able to complete a PhD within the prescribed time	7	12	31	13	22	16	100	(301)
...overall, provides me with substantial benefits	17	31	19	14	11	8	100	(301)

Source: PhD scholarship holders' working conditions and career expectations. Survey of PhD scholarship holders who are members in the Norwegian Association of Researchers (Forskerforbundet). NIFU, 2009.

Table 4.8 Percentage of PhD scholarship holders who agree, to a great extent or some extent, with statements about the course part of the PhD, among those who are and who are not linked to a research school.

	Linked to a researcher school?		
Opinion	Yes	No	All
I have been offered a sufficient number of PhD courses	65	62	63
The quality of PhD courses is high	52	49	50
The PhD courses on offer are relevant to my thesis	49	52	51
The PhD courses provide me with broader academic competence/skills	60	62	62
(N_{min} - N_{max})	(300-300)	(590-593)	(892-895)

Source: PhD scholarship holders' working conditions and career expectations. Survey of PhD scholarship holders who are members in the Norwegian Association of Researchers (Forskerforbundet). NIFU, 2009.

Another source of information about what research schools do, and their status within the PhD training system, are three institutional evaluation reports of research schools. The universities of Oslo, Tromsø and Bergen have evaluated their research school initiatives: Oslo in 2009 (University of Oslo 2009, 2011), Tromsø in 2010 (University of Tromsø 2010) and Bergen in 2011 (University of Bergen 2011). The evaluations were commissioned by the university boards, as a follow up of the institutional initiatives to implement research schools, but the evaluations covered all research schools operating in each institution, including institutional, national and international ones. The data on each research school were collected from the leaders of the research schools themselves and from faculty/institute leaders; the evaluations did not involve data collection amongst PhD candidates or academic staff. In general, the evaluations paint a positive picture of research schools, particularly the evaluation from the University of Bergen (University of Bergen 2011) which describes research schools as a "qualitative improvement" and notes that they have "considerable added value to PhD education".

The evaluations provide quite a lot of documentation about the content, participation and organisation of research schools, underpinning the impression that research schools exist in a multitude of forms, with variations in their ambition, scope and type of activities. In general the research schools focus their activities on providing specialised PhD courses, meeting places and academic networks for PhD candidates and in some cases supervisors. Their offer usually involves intensive courses, run annually or a few times a year, which include participants from different institutions, often inviting international

guest researchers to lecture in the courses. Research schools also offer more informal meeting places such as workshops, seminars and social gatherings.

The PhD candidates are also enrolled in ordinary PhD programmes and have to fulfil the requirements set out by the faculty, which is legally responsible for their PhD education. Research schools offer additional or supplementary courses and activities that PhD candidates can choose from, and only in very few units is research school participation mandatory for PhD candidates in a given programme. The following quote illustrates the typical role that research schools play and their status in the PhD education system:

> "The research schools organise different activities and have few formal rules or procedures for organisation and support to the PhD candidates who participate in the research school. This is an offer to the candidates with few formal requirements compared to the organised PhD education. The research schools consequently have no formal function in the final qualification of PhD candidates" (University of Bergen 2011, translated from Norwegian)

Since research schools are not part of the formal structure of PhD education, their status and links to formal PhD programmes is a key topic also for these evaluations. A recommendation made in the reports is to make formal ties to PhD programmes a selection criterion for new research schools. The purpose is to make sure that the activities offered by the research school are in line with the programme requirements, the priorities of the faculties, and the overall strategies of the universities.

When research schools consist of participants from different higher education institutions, which might have different PhD regulations and programme requirements, it can be quite challenging to create PhD courses and activities that fit each institutions' requirements. Aligning PhD regulations and programme requirements will be needed in these cases.

The evaluations at the institutional level underline the impression that research schools in the Norwegian context cannot be described as independent units responsible for PhD training, although the label "school" might give the impression of an autonomous and permanent status. Instead, they function as supplements to regular PhD programmes, especially by providing courses that might otherwise not be feasible, and by providing a positive learning environment for the PhD candidates who participate in them. However, the majority of PhD candidates in Norwegian higher education institutions do not participate in research schools.

The evaluation by the University of Oslo (2009) points out that there have been positive developments in PhD programmes in general which are in line with the aims and criteria for research schools. For instance in the findings that the faculty and PhD programme staff have worked strategically on including PhD candidates in research groups, have focused on improving supervision, focused on creating arenas and social networks for PhD candidates, and made efforts to follow their progress much more closely (as described below). Consequently, the experiences of PhD candidates in regular programmes, and PhD candidates in research schools, might not be all that different.

The survey from the University of Oslo in 2012 finds small but positive differences for PhD candidates who participate in research schools. The results of a survey by NIFU of a limited sample of PhD research fellows in 2009 also supports this impression, but a more rigorous evaluation of the research schools, comparing PhD candidates who participate in them to other PhD candidates, is necessary.

4.3.3 Supervision of PhD candidates

Institutional perspectives and practices

In the survey of PhD programme units, each unit (faculty or institution) was asked a number of questions about the current regulations, policies and practices for supervision of PhD candidates. In institutional plans and the institutional survey, developing good supervision practices is frequently mentioned as the most important challenge for continued development of PhD education.

In the survey, all units were asked whether they had formal regulations about how many hours of supervision each PhD candidate was entitled to receive and whether the units had practices to monitor the amount of supervision each candidate does receive. Most of the units (71 per cent) claim that they

have written regulations or contracts specifying the number of hours of supervision each candidate is entitled to; the universities of Tromsø, Agder and Stavanger, and most of the university colleges, claim to have written regulations on supervision time. However, only 27 per cent of the PhD programme units report that they have a system to monitor the supervision time that PhD candidates receive.

We also asked whether the higher education institutions required academic staff to undertake training to become supervisors of PhD candidates, and if so, what kind of training they received. Only half of the units (25 out of 52) surveyed claim that supervisors are offered training. The NTNU, University of Agder and University of Tromsø, and the specialised university institutions all say they offer training for supervisors. In the other universities some faculties do and others don't, and none of the university colleges state that they do.

In the units that do offer training to supervisors, training takes different forms. Some focus on supervision as part of the mandatory pedagogical training that all permanent staff are required to take (this was mentioned by the University of Oslo, NTNU, University of Tromsø and University of Agder), others have specific seminars for PhD supervisors or seminars for both supervisors and candidates. Only one unit specifically mentions that training of supervisors occurs in collaboration with a research school.

The PhD programme units were also asked to state how many of the PhD candidates enrolled in their PhD programmes in 2010-2011 had more than one supervisor. In total 4686 candidates were reported to have more than one supervisor, or approximately 50 per cent of all candidates. In several units all candidates are reported to have more than one supervisor.

Interviews and documentary analysis also reveals that, in several faculties, co-supervisors are mandatory for all PhD candidates. The main supervisor is usually from the same institution as the PhD candidate, whereas the affiliation of the co-supervisors might vary. Most co-supervisors appear to be recruited from the main supervisors' research network, according to interviews with supervisors in the eight case study programmes.

Most units report that they receive complaints from PhD candidates about supervision "from time to time". Complaints on supervision are dealt with in several ways, first and foremost by discussions with the involved parties and the faculty leadership or department heads. If problems between a supervisor and candidate cannot be resolved, most units report that they either include a co-supervisor or change supervisor altogether. Only 11 per cent of the surveyed units report that they use supervisor training to deal with complaints.

PhD candidates' satisfaction with supervision

There are a number of surveys of PhD candidates that all include questions on supervision, in terms of the amount of supervision time received, the competence of supervisors and the candidates' satisfaction with supervision.

A survey of the PhD scholarship holders that were members of the Norwegian Association of Researchers (Thune & Olsen 2009) shows that the majority (75 per cent) have two or more academic supervisors. In the humanities almost 50 per cent have only one supervisor. A survey by The Norwegian Society of Graduate Technical and Scientific Professionals in 2011 showed that about 60 per cent of their PhD candidate members had more than one supervisor and 40 per cent had more than two supervisors (Tekna 2011).

In a recent survey of PhD candidates at the University of Oslo, almost 60 per cent report that they have one or more external supervisors in addition to an internal supervisor (University of Oslo 2012). At the University of Tromsø, 85 per cent claim to have more than one supervisor (University of Tromsø 2011).

In terms of the amount of supervision each candidate receives, the data available suggests that the majority of PhD candidates receive supervision on a regular basis. In the 2011 Tekna survey, about 70 per cent of the respondents report that they receive supervision at least once a month. In the 2012 survey of the University of Oslo, 68 per cent of respondents say they receive supervision more than once a month and 30 per cent report that they receive supervision weekly or more often. The 2009 survey of PhD scholarship holders that were members of Norwegian Association of Researchers, finds

that 29 per cent received supervision at least every second week. A problem is that the different surveys have used different levels of frequency for supervision. However, a considerable minority of PhD candidates still receive supervision infrequently.

In the 2009 NIFU survey of PhD scholarship holders that were members of the Norwegian Association of Researchers, the majority of respondents (78 per cent) were satisfied with the supervision they received, and a slightly lower majority (60 per cent) stated they could easily get in contact with their supervisors when needed, and that the competencies of the supervisor/s were adequate for their needs. A high degree of satisfaction with supervision and their competencies is also found in the surveys from the University of Oslo, NTNU and the University of Tromsø. There is however a considerable minority that is not satisfied with the supervision received.

There is a strong correlation between frequency of supervision and the candidates' assessment of the quality of supervision they receive. The 2011 Tekna survey also finds that there is a relationship between the frequency of meetings with a supervisor and the candidates' assessment of the competence of the supervisor/s. Finally, the University of Oslo survey shows that those PhD candidates employed by the universities and those not employed by the universities are equally satisfied, and receive approximately the same amount of supervision (University of Oslo 2012).

The nature of the relationship between the PhD candidate and the supervisors varies strongly between fields of science. In experimental disciplines in which lab-work is important, PhD candidates and their supervisor are likely to be part of research groups, and the supervisor typically has a much more hands on approach to supervision than in the humanities and social sciences. Candidates in experimental subjects generally receive more support, not only from their supervisor but from colleagues and more senior PhD candidates and post-docs, and generally report higher satisfaction with all elements in researcher training, including supervision. Due to this, several of the programmes in engineering, and also others in economics and other social sciences, report that they are focusing on integrating PhD candidates into research groups.

We see no sign that the size of the PhD programme, or the age of the programme, has an impact on PhD candidates' assessment of supervision. In some of the new, smaller PhD programme units, supervisors seem to be very committed, have high expectations and generally spend considerable time supervising their PhD candidates, for instance in the case of Vestfold University College.

Based on the different data sources, it is fair to conclude that team-based supervision is now common in most fields of science, although a large group of PhD candidates, particularly in the humanities and social sciences have only one supervisor. As seen in the institutional survey, most institutions have made team supervision a mandatory requirement in the admission of new PhD candidates. In general the PhD candidates are satisfied with the supervision they receive, and indicate a high degree of satisfaction with the frequency of contact and competencies of their supervisors, but still a considerable minority receive infrequent supervision and are not satisfied. There do appear to be differences between fields of science in the organisation of research and supervision of PhD candidates, but so far we see no strong indications of systematic differences between types of institutions when it comes to the organisation of supervision.

4.3.4 Integration in research environments, support and access to resources

Institutional perspectives and practices

As shown above, frequency and quality of supervision is related to the PhD candidates' broader access to support from their environment, not only from their main supervisor.

Most higher education institutions admitting new PhD candidates state that they will try to recruit candidates that propose research projects which fit in with their priority research areas, and are in line with their research strategy. There are some differences between fields of science, and units within health and medicine in particular appear to have a more open recruitment strategy; this may be due to medical and health sciences having many more PhD candidates and a more heterogeneous PhD candidate population than other fields of science.

Related to this, another quality enhancing tool in doctoral education, and driving idea behind PhD programmes and research schools, is institutional efforts to integrate PhD candidates into research groups and networks, to make sure that the PhD candidates are part of active research communities.

There are, of course, big differences in the organisation of research in different fields of science, and particularly between experimental and non-experimental sciences (such as the humanities, social sciences, law, theoretically based natural sciences) where research is more individualised and less reliant on collaboration between different team members. That research in many fields is not collective has been seen as a problem, not at least for the socialisation and training of new scientists (PhD candidates), who often experience the PhD period as a lonely journey. High drop-out rates and low efficiency in the social sciences and humanities have previously been explained by the individualistic organisation of research in these fields (Tvede et al 1997).

All units in the institutional survey report paying a lot of attention to how to integrate PhD candidates in research groups or research projects. Most units claim that PhD scholarship holders (where the higher education institutions have employer responsibilities) are integrated in research groups, but that external PhD candidates are not necessarily integrated in research groups. Some of the PhD programme units focus mainly on the integration of new candidates into social/academic networks between PhD candidates. Other units claim that they have an explicit strategy to include all PhD candidates in a research group, and that this is a condition for enrolment in the PhD programme.

There does not seem to be one, consistent policy in each institution. Most natural sciences and engineering faculties have a strong policy of integration of candidates in research groups, but a similar approach is also found in other units in social science, education, theology, law and humanities, although it is adapted to the characteristics of the research they perform.

Integration and support - the PhD candidates' experiences

The significance of belonging to a research group during the PhD period needs to be considered from the candidates' perspective, and several of the PhD candidate surveys have included questions about how the candidates carry out their research work, and the level of integration and support they receive from the research environment.

The survey of PhD scholarship holders organised by the Norwegian Association of Researchers found that 75 per cent of respondents worked independently, for the main part, and 25 per cent worked in research groups (Thune & Olsen 2009). The majority of these respondents were from the humanities and social sciences. About half of the scholarship holders report being well-integrated into the academic community, but candidates within the humanities reported a lower degree of integration and less satisfaction with their work and research environment.

In the survey of PhD candidates by the Norwegian Society of Graduate Technical and Scientific Professionals, 72 per cent report they belong to a research group (Tekna 2011). In a survey carried out at NTNU in 2009 about 40 per cent of respondents said that they worked in a research group with several other PhD candidates, and 80 per cent of the candidates at the University of Tromsø report participating in a research group. At the University of Oslo, 75 per cent of PhD candidates state that they participate in a research community or a research group.

Research groups are most common within STEM subjects, but there are also examples of social science faculties that have organised research in groups, for instance the Faculty of Education at the University of Oslo. Within the STEM subjects, candidates who work on experimental research are more likely than others to work in research groups (Tekna 2011).

Both the survey from the Norwegian Society of Graduate Technical and Scientific Professionals and the survey from the Norwegian Association of Researchers find that PhD candidates that belong to a research group are generally more positive in their assessment of their PhD training and the supervision/support that they receive. Candidates who belong to a research group also report having access to more resources and report acquiring a broader set of experiences and competencies during their PhD, than candidates who work independently (Thune & Olsen 2009). Research school candidates are also generally more satisfied with their work situation and receive more collegial support than PhD candidates who work independently (ibid).

Candidates who work on research projects run by their supervisor also demonstrate higher degrees of satisfaction with their training, according to the recent survey from the University of Oslo (University of Oslo 2012). This survey also finds that external PhD candidates and PhD candidates employed by the university have relatively similar experiences and similar degrees of satisfaction with their training.

Research funds, infrastructure and administrative support

Most of the PhD candidate surveys contain a few questions about the PhD candidate's satisfaction with infrastructure and equipment, funds to cover research expenditures and administrative support. Access to research equipment and funds to cover research expenditures is a particularly important issue for PhD candidates in experimental sciences.

In a survey of working conditions of Norwegian academics from 2009, the PhD scholarship holders reported that they were generally satisfied with research equipment and basic infrastructure, such as library services, ICT, office space etc. (Vabø & Ramberg 2009). However, a relatively high proportion of the respondents (34 per cent) were dissatisfied with the funds available to cover research expenditures. In the 2009 survey of PhD fellows in the Norwegian Association of Researchers, 17 per cent claim they have inadequate access to the equipment and resources needed to carry out their work (Thune & Olsen 2009).

As far as we have been able to document, there are no fixed rules for research funds or the amount each candidate should have. According to the survey by Tekna, 18 per cent of their PhD candidates did not receive research funds, but approximately 60 per cent did receive a fixed annual sum (Tekna 2011). The University of Tromsø survey shows that about 65 per cent of the respondents had access to funds to cover the expenses needed by their project, and 50 per cent had their own budget for covering research expenses (University of Tromsø 2011).

4.3.5 Internationalisation and participation in international research communities

Institutional perspectives

All of the higher education institutions have a clear goal of promoting internationalisation at the PhD level. Interviews with leadership in the eight universities, and the review of documents and strategies both reveal that several of the universities have internationalisation strategies and that the PhD action plans provide details about the goals and tools universities can use for promoting internationalisation in PhD education.

Several of the universities have concrete goals and expectations, particularly in exposing all PhD candidates to international research communities and promoting mobility of PhD candidates. Several of the universities also say that they expect PhD candidates to have an extended research stay abroad. The University of Natural Science and Technology has a goal that at least 25 per cent of PhD candidates should have longer research stays abroad. At the University of Stavanger, the leadership has stated that longer research stays abroad (minimum three months) are required for all PhD candidates. Several of the universities also say that they have set aside designated resources to increase mobility among PhD candidates, for instance at the University of Tromsø or University of Stavanger.

Several of the universities, and particularly the Universities of Stavanger, Bergen and the University of Life Sciences, are also making focused efforts to accommodate the increasing numbers of international PhD candidates, particularly in terms of the recruitment and admission of new candidates, and how to support them on arrival in Norway with issues like visa and work permits, housing, language classes and so on.

All universities recognise the important differences between disciplines and programmes when it comes to promoting internationalisation; some fields of science are inevitably international, in terms of academic resources, publishing, participating in international networks (such as natural sciences) whereas other areas require further developments to promote internationalisation and ensuring that PhD candidates are exposed to the international research community (as in the humanities and social sciences).

In the institutional survey, we asked each programme units to report on the extent to which they supported (international mobility among their PhD candidates. The Universities of Tromsø and Stavanger and the University of Life Sciences all strongly agree that they support international mobility. In the other universities responses are less positive: most faculties say that they support international mobility to some extent, or not at all. Very few units at the University of Oslo, Agder and Nordland say that they facilitate international mobility among PhD graduates. The specialised university institutions and university colleges say that they support international mobility to high extent or to some extent.

We also asked each programme unit to report how many PhD candidates had stayed abroad for at least three weeks in 2010. The numbers reported are very low: only about 400 PhD candidates were reported to have had a stay abroad of at least three weeks, or only 4 per cent of the total PhD candidate population that year. Several units reported that no candidates stayed abroad. The low numbers are also likely to reflect that the institutions do not have clear records for such activity, and either lack good reporting systems for international activities, or have not had such a system until recently.

Internationalisation – the PhD candidates' perspective

At least four surveys of PhD candidates have included questions about the number and type of international experiences PhD candidates have had. In the 2009 survey of PhD scholarship holders that were members of The Norwegian Association of Researchers, 47 per cent said they have had visits/stays abroad during their PhD, but the length of the visit was not specified. This was least common among PhD candidates in medical sciences. The 2011 Tekna survey found that the number of PhD candidates who plan to have a prolonged period abroad during their PhD has decreased the last two years.

The 2009 survey from NTNU shows a broad range of international experiences among the PhD candidates, and the survey found that 13 per cent of the candidates report a stay abroad of more than three months. PhD candidates in medical sciences are the least likely to have extended study periods abroad. The data also indicates that the number of PhD candidates having longer stays abroad has decreased over time (NTNU 2009).

The NTNU and the University of Oslo surveys also attempt to gauge the main reasons why PhD candidates do not plan extended stays abroad, as part of their PhD. According to the University of Oslo survey, family obligations and lack of time and funding are the main reasons. The NTNU survey indicates that quite a high percentage of the PhD candidates do not see an extended stay abroad as vital to their academic environment, and approximately 50 per cent state that they have not been encouraged to have an extended stay abroad as part of the PhD.

Participation in international conferences, workshops and in international networks is much more common than longer stays abroad. At NTNU 75 per cent of the surveyed PhD candidates had such experiences. About 50 per cent of PhD fellows organised by the Norwegian Association of Researchers state that they participate in international networks and 74 per cent have participated in international conferences. Participation in international conferences is common across all fields of science (Thune & Olsen 2009)

There are big differences between fields of science when it comes to extended stays abroad, which seem to be particularly important for PhD candidates in the humanities. Shorter stays, participating in networks and conferences is more common, and more easily attainable, for PhD candidates in all fields and work situations. The sharp increase in international recruitment in STEM subjects probably explains the decrease in extended stays abroad in these fields, as does the increasing use of three-year contracts, which leaves little time for longer visits abroad.

4.3.6 Self-evaluation and tools to improve quality at institutional level

In the institutional survey, each unit responsible for a PhD programme was asked to respond to several statements concerning the quality of PhD education in general, the quality of training and research and the quality of output in their programme unit.

The surveyed units express a high level of satisfaction with the PhD education in general and with the course part, supervision and output, in terms of PhD dissertations. Nonetheless, the units claim that there is room for improvement in the quality of PhD courses, and particularly in the quality of supervision. A main concern regarding the quality of PhD courses relates to providing enough courses frequently enough, which is seen as a particular problem for the smaller PhD programmes.

Table 4.9 Percentage of PhD programme units that agree, to a great extent or some extent, with statements regarding the quality of doctoral education, by subject area.

Statement	Humanities and Social sciences	Medical and health sciences	Natural sciences and Engineering	Total
We are satisfied with the quality of doctoral education	90	100	100	94
We are satisfied with the quality of doctoral courses on offer	93	100	100	96
We are satisfied with the quality of supervision offered to doctoral students	83	100	93	88
We are satisfied with the quality of dissertations by those completing a PhD	86	100	92	90
There is a need to raise the quality of doctoral programmes	66	57	47	59
There is a need to raise the quality of PhD courses on offer for doctoral students	53	71	60	58
There is a need to raise the quality of supervision of doctoral students	80	71	73	77
There has been an increase in the number of candidates who do not have their thesis accepted/approved	24	57	15	27

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

Note. The field of science groupings are based on discretionary classification of faculties' and university colleges by NIFU. Agricultural and veterinary sciences are included under medical and health sciences.

Units within the STEM subjects and medical/health sciences express a high degree of satisfaction with the quality of training and research processes, but all units claim that there is room for improvement. Within medical /health fields, a large number of units claim that there is a need for improvement in the quality of their PhD courses. In the social sciences and humanities, supervision seems to be a particular issue that institutions are trying to address.

Comparing the older universities and the new universities and university colleges with PhD programmes, more units in the second group of institutions express satisfaction with the quality of PhD programmes, but fewer of these units are satisfied with the quality of research output. More units in the old universities see a need to improve quality, again particularly the quality of their supervision.

Table 4.10 Percentage of PhD programme units that agree, to a great extent or some extent, with statements regarding the quality of doctoral education, by type of institution.

Statement	Old universi-ties	Other universities and university colleges	Total
We are satisfied with the quality of doctoral education	92	96	94
We are satisfied with the quality of doctoral courses on offer	92	100	96
We are satisfied with the quality of supervision offered to doctoral students	85	92	88
We are satisfied with the quality of dissertations by those completing a PhD	100	78	90
There is a need to raise the quality of doctoral programmes	62	56	59
There is a need to raise the quality of PhD courses on offer for doctoral students	62	54	58
There is a need to raise the quality of supervision of doctoral students	81	73	77
There has been an increase in the number of candidates who do not have their thesis accepted/approved	31	22	27

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

Note. The category old universities includes the universities of Oslo, Bergen, Tromsø and the Norwegian University of Science and Technology (Trondheim).

The institutional survey also asked whether the units had planned or implemented tools to improve the quality of PhD education: 27 per cent of the PhD programme units claim that they have instruments to improve quality in planning, and 58 per cent of the units have implemented tools to improve the quality

of PhD programmes. Many of the initiatives that the programme units have implemented concern supervision, the course portfolio and closer monitoring of the candidates' progress.

The tools described fall in three main categories:

1) **Tools to increase the quality of organisation of PhD education, at institutional and faculty levels.** This includes a wide range of initiatives, including the development of new organisational structures with a particular responsibility for PhD education (PhD programme boards), institution-wide projects to improve PhD education, development of institution-wide strategies and plans for PhD education, more collaboration between units involved in PhD education and efforts to raise awareness and making clear responsibility in all units involved in PhD education, implementing formal routines and guidelines/regulations for PhD education, increasing access to reliable statistical data about the PhD candidates and greater use of internal and external evaluations or expert groups to evaluate and improve PhD education at institutional or programme level.
2) **Tools to increase the quality of recruitment and quality of PhD candidates.** Initiatives are made, particularly in units in STEM subjects, to make recruitment procedures more efficient and create better ways to check and verify the quality and qualifications of applicants, particularly foreign applicants.
3) **Tools to increase the quality of the education and research processes.** A wide range of initiatives are reported to improve the quality of education and research processes, as described above. Efforts are being made at several institutions to develop more comprehensive course portfolios and provide courses in generic skills, particularly in academic writing. Many units are focusing on improving the quality of supervision by creating supervisor forums, supervision training sessions, and promoting the use of supervisor teams. PhD candidates are generally monitored more closely, and there is stronger focus on milestones and reporting along the way in most units. Some units focus on supporting a better learning environment for the PhD candidates, by integrating them into research groups, research schools and by supporting PhD forums and similar initiatives.

4.4 Quality of output

4.4.1 PhD dissertations

The institutional survey asked the PhD programme units to provide information about the PhD dissertations submitted, in terms of the type of thesis and language use. We also asked the units to report what kinds of standards or regulations they have for article-based PhD dissertations.

The units report that almost 1100 PhD dissertations were completed in 2010, which is approximately the same number as reported to the Doctoral Degree Registry (1149 in 2010). Of the theses' submitted in 2010 77 per cent were article-based. There are, however, large differences between fields and disciplines. In the humanities, the majority of doctoral theses are monographs, while article-based dissertations are the norm in medicine/health (99 per cent) and in STEM subjects (85 per cent).

In terms of language, 54 per cent of the PhD programme units report that more than 80 per cent of all dissertations are written in a foreign language, particularly within health/medical sciences, natural sciences, agriculture and economics/management. Units with lower shares of dissertations in foreign languages are found within the humanities, social sciences, law and education.

Regulations for article-based PhD dissertations

Since 77 per cent of all PhD dissertations are article-based, meaning that they consist of a collection of articles and an introductory chapter, the regulations concerning number of papers needed and authorship rules, are important to look into.

According to the information submitted, 29 per cent of the PhD programme units do not have written regulations for article-based dissertations. However, some of these units are faculties within universities that have general guidelines for article-based dissertations, as part of their overall PhD

regulation, for instance at the Norwegian University of Science and Technology and Science (NTNU), the University of Oslo, and the University of Bergen. Several other units that do not have local regulations refer to the institutional guidelines of the university, or the general guidelines for PhD degrees adopted by the Norwegian Association of Higher Education Institutions (UHR).

Surprisingly, nine of the units that do not have written guidelines are faculties within the natural sciences, where article-based dissertations are most common and have long traditions. Natural science or engineering faculties in 7 of the 8 Norwegian universities say that they do not have written guidelines.

The units that do report having local guidelines are mainly found within the social sciences and health/medical sciences, although these guidelines vary substantially between fields and institutions, particularly in terms of how many articles must be included and the status of the articles. All units that have guidelines accept articles written by several authors and have routines to report the contributions of each author. The units within medical sciences have the most precise set of criteria for PhD dissertations and these are similar across institutions. Within health and medical sciences, a PhD dissertation should be made up of at least three papers, published or accepted for publication in an international peer-reviewed journal. Co-authorship of papers is the norm, and the PhD candidate should be the main author of at least two papers, and strict routines for declaration of co-authorship are to be followed.

Written guidelines for dissertations are also quite common in social science units, but the guidelines are less defined and more varied across institutions. A common guideline is that the thesis should be made up of at least three papers, but if papers are co-authored the dissertation should be extended and made up of 4 to 5 papers. According to the information submitted by the PhD programme units, papers should either be published, submitted for review, accepted, presented at international conferences, or be "publishable" in international journals. Several units within the social sciences demand that at least one article is either published or accepted for publication in an international peer-reviewed journal. Co-authorship is dealt with by demanding that the submission of the thesis is followed by co-authorship declarations.

We have not compiled detailed information about changes in formal requirements for article-based theses over time. However, the evaluation undertaken in 2002 reported that, at that time, four papers was the norm in the natural and medical sciences, and four to six papers were standard in the social sciences. The evaluation panel recommended the number of papers be reduced to align with the Anglo-American PhD, and the introduction of the joint PhD degree in 2003 seems to have seen the required minimum number of papers reduced in most fields. There is also some scattered evidence that further adjustments have been undertaken after the introduction of the PhD, both with regard to the number of papers required, the status of these papers in the publication process, requirements for first-authorship, and requirements for the length of the introductory chapter. These changes are also connected to demands for candidates to finish their PhD work on time, as well as the wish to adapt requirements to some kind of international standard, although diffuse, of what constitutes a PhD thesis.

According to studies of PhD publishing patterns co-authored papers is now the norm in biomedicine (Hagen 2010, Larivière 2012, Kemp et al 2011). According to Hagen (2010) in a recent study of PhD dissertations in Norway and Sweden the median number of submitted papers per dissertation was four, and the number of co-authors per paper ranged between 5 and 2 per paper. The highest number of co-authors per paper was found in the medical sciences. In the case of biomedical dissertations, Hagen finds that there is a combined effect of fewer papers submitted per thesis and more co-authors per paper, entailing a gradual decrease in the PhD candidates' share of authorship credit for the dissertation over time.

In conclusion, the regulations for article-based theses and the requirements for the number of papers, sole authorship and co-authorship, all vary considerably across disciplines, and have also changed over time. This is a consequence of different disciplinary research traditions and research cultures, and the adaption to realities of how much research can be done within the PhD period. Two challenges are raised by these findings; firstly, whether different practices across disciplines may lead to disciplinary

differences in the quality of PhD theses; and secondly, whether reduced requirements for the volume of research may have affected the quality of the theses. Neither of these questions is easy to answer, but the next section provides data that may illuminate these issues.

4.4.2 The quality of PhD dissertations

Methods and sample

Very little has actually been written on what constitutes the quality of doctoral theses, neither in policy documents nor the scholarly literature on doctoral training. Many universities have issued general or specific guidelines in which quality and standards of PhD theses are mentioned. Properties like originality, sound methods, significant contribution to knowledge, and publishable results are commonplace criteria. Studies of theses examiners' written reports indicate the widespread use of similar notions, including concepts such as literary presentation, innovative work, and international standards (see e.g. Johnston 1997); these studies also indicate that there is considerable agreement concerning the criteria which constitute a good thesis (Phillips 1992, Mullins & Kiley 2002, Aittola 2008).

In Norway, the Norwegian Association of Higher Education Institutions has issued recommended guidelines for the PhD degree, in which some general requirements for the PhD theses are set out: "A doctoral thesis must be an independent piece of scientific research that meets international standards with regard to ethical requirements, academic level and methodology used in the research field. The thesis must contribute to the development of new knowledge and achieve a level meriting publication in the literature in the field" (UHR 2011).

In Norway, the PhD thesis is evaluated by a committee constituted of three members, of which at least one of whom should come from a foreign university. The rationale for including a foreign evaluator is to uphold academic standards, by calibrating the quality of the PhD thesis to the standard used internationally, or at least that found in the country of the foreign member. For a small scientific community like Norway, this procedure is regarded as an especially important quality assurance mechanism. Another reason for inviting a well-reputed external professor to take part in the evaluation is to gain validation and status from the broader academic community for the PhD and the candidate (Tinkler & Jackson 2000).

This opened up a method for assessing the quality of PhD theses, by asking these foreign members of committees for their opinion about the quality of PhD dissertations they recently assessed[12]. To do this, information about all foreign committee members that served on PhD evaluations in Norway in 2010 was compiled, and a questionnaire was administered to this whole population of foreign PhD evaluators. To achieve this, the PhD granting institutions provided names and affiliations for all foreign members of evaluation committees who sat in 2010. The institutions also provided email-addresses for most of these thesis evaluators. To supplement this, NIFU searched for the remaining email addresses using Google, and compiled a final set of 1615 names and email addresses. An invitation to a short electronic survey was sent out, and 145 emails were returned due to incorrect or unusable email addresses, meaning that 1470 received the survey. Of these invited individuals, 1159 responded to the survey, giving a response rate of 79 per cent.

The foreign members of the PhD committees were asked to answer the following question: How would you describe the quality of the latest Norwegian PhD thesis that you evaluated, when it comes to: (a) Originality, (b) depth and coverage, (c) theoretical level, (d) methodological level, (e) skills in written presentation, (f) contribution to the advancement of the field, and (g) external (applied/societal/cultural/industrial) relevance. Response alternatives were excellent, very good, good, acceptable, poor, and for external relevance "not relevant/uncertain".

[12] The same approach was used in two previous Danish evaluations of PhD education (1999 and 2006) as well as in the 2002 evaluation of Norwegian doctoral education. We have, however, modified the questionnaire used, to allow for greater detail in assessments.

The members were asked to decide which academic field the PhD thesis should be classified as belonging under, and the responses were: humanities (10 per cent); social sciences including law and education (18 per cent); natural sciences including mathematics (22 per cent); medical and health sciences (28 per cent); engineering and technology (16 per cent); agricultural and veterinary sciences (4 per cent); or "other, please specify" (2 per cent). Theses within the latter category were recoded into one of the academic fields above.

The foreign committee members came from 45 different countries[13]. Respondents were grouped as coming from Nordic countries (Sweden, Denmark, Finland, and Iceland), other European countries, and North-America (USA and Canada) in order to examine possible regional variation in response patterns. Of the foreign members, 42 per cent came from other Nordic countries, 41 per cent from other European countries, and 14 per cent from North-America. Only 3 per cent came from other regions of the world.

The majority of the foreign members of the PhD committees appear to be experienced evaluators; over the last decade, about 25 per cent had examined more than 15 PhD theses, and just as many between 10 and 15 theses. Most of them also had evaluated PhD theses for candidates based abroad. In this same time period, 60 per cent had examined more than two theses in other countries. Only one third of the respondents had, however, previously been a member of a Norwegian PhD committee.

Assessment of quality of Norwegian PhD dissertations

Table 4.11 displays the results for all fields combined. The pattern of assessment of the various quality elements is very consistent; less than 20 per cent regarded the various elements of the most recent thesis they evaluated as being "excellent", slightly more than 40 per cent said they were "very good", and 25-30 per cent said they were "good". Only 1-3 per cent characterised the latest thesis they had evaluated as having elements that were "poor", probably involving the one per cent of candidates that failed. Assessments of the "theoretical level" of the theses are slightly less favourable than those of the other elements, while assessments of "depth and coverage" and "skills in written presentation" are slightly better. With regard to "external relevance", the 15 per cent of the respondents who replied that this element was not relevant or that they were uncertain were not included in Table 4.13.

Table 4.11 "How would you describe the quality of the latest Norwegian PhD thesis that you evaluated, when it comes to:"

Quality aspects	Excel-lent	Very good	Good	Accept-able	Poor	Total
Originality	17	43	31	8	1	100
Depth and coverage	19	46	25	9	1	100
Theoretical level	15	39	30	14	3	100
Methodological level	19	43	25	11	2	100
Skills in written presentation	23	44	26	6	1	100
Contribution to the advancement of the field	14	44	30	11	1	100
External (applied/societal/cultural/industrial) relevance	15	41	33	10	1	100

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Foreign committe members survey. - Foreign committe members survey.

In line with findings in the previous survey of foreign members of PhD evaluation committees (Research Council of Norway 2002), North-Americans give Norwegian PhD-theses better ratings than their European peers, who in turn are more positive than members from the other Nordic countries. This finding applies to all quality elements. Table 4.12 shows results for the quality assessment of theses, when it comes to "the contribution to the advancement of the field", by the evaluator's home region. While 26 per cent of the North-Americans characterised the thesis as "excellent", only 15 per cent from other European countries and 9 per cent from other Nordic countries did so.

These regional differences are not easily explainable, and different interpretations may be put forward. One explanation might be that the quality of PhD theses is higher in the Nordic countries than in the

[13] The 15 most frequent being Sweden (303), the UK (164), Denmark (133), the USA (125), Germany (74), Netherlands (46), France (44), Finland (36), Canada (34), Italy (31), Spain (26), Belgium (20), Switzerland (17), Austria (14), and Iceland (12). Of the total number of foreign committee members who responded to this survey, 93 per cent came from these 15 countries, and 69 per cent came from the five countries with most evaluators.

rest of Europe and higher still than in North America. Another explanation might be that there are cultural differences between countries with regard to the interpretation of concepts or meaning expressed by the terms "excellent" and "very good". A third explanation might be that North Americans tend to be given better theses to assess than those that are given to Nordic members of the evaluation committees, because North American academics will be more likely to be invited in cases where the supervisor or faculty consider the thesis to be very good or excellent. Finally, North Americans who are invited to Norway might be personal friends, or close collaborating colleagues with the supervisors involved. It is, however, beyond the scope of this evaluation to resolve this issue. Nevertheless, these regional differences have to be kept in mind when interpreting the results of this survey.

Table 4.12 "How would you describe the quality of the latest Norwegian PhD thesis that you evaluated, when it comes to Contribution to the advancement of the field:"

Country presently employed	Excellent	Very good	Good	Acceptable	Poor	Total	(N)
Other Nordic countries	9	39	37	13	2	100	(479)
Rest of Europe	15	49	25	9	1	100	(472)
USA and Canada	26	42	22	8	2	100	(158)
Total	14	44	30	11	2	100	(1 109)

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Foreign committe members survey. - Foreign committe members survey.

Table 4.13 shows that theses in various fields are rated somewhat differently, in particular when we look at the responses from evaluators from the different regions. Overall, PhD theses in the natural sciences and the humanities get the strongest ratings, while theses in the social sciences and agriculture/veterinary medicine are rated slightly below average. While 65 per cent of the theses in the natural sciences are graded "excellent" or "very good" when it comes to "contribution to the advancement of the field", this applies to 50 per cent of theses in the social sciences. This pattern is generally confirmed even when we control for the regional affiliation of examiners. However, theses in engineering/technology and medicine/health do get very high scores among North American examiners.

Table 4.13 Percentages of the foreign committee members reporting the contribution to advancement of the field to be excellent or very good. By field of science and the respondent's country of employment.

	Country presently employed						Total	
	Other Nordic countries		Rest of Europe		USA and Canada			
Field of science	%	(N)	%	(N)	%	(N)	%	(N)
Humanities	54	(50)	68	(40)	73	(15)	64	(110)
Social science	41	(95)	61	(66)	61	(36)	51	(201)
Natural science	53	(79)	72	(135)	68	(37)	65	(257)
Technology	41	(51)	61	(95)	76	(25)	57	(182)
Medical and health science	49	(184)	60	(99)	71	(34)	55	(326)
Agriculture and Veterinary science	38	(13)	59	(27)	50	(8)	53	(49)
Total	47	(472)	64	(462)	68	(155)	58	(1 125)

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Foreign committe members survey.

Recruitment of international committee members

The previous evaluation of doctoral education (The Research Council of Norway 2002) was criticised because it was assumed that a considerable proportion of foreign committee members had an academic acquaintance with supervisor(s) involved in the these, and that they had been asked to participate in the evaluation on the basis of this acquaintance, and therefore would tend to give a more positive assessment than was appropriate or fair. This is a common criticism in relation to the selection of examiners (Tinkler & Jackson 2000).

In a Norwegian context, it is thought that academic standards are upheld if at least one member of the evaluation committee comes from abroad. However, it is still problematic to assume these members to be independent in an academic environment characterised by international networks and collaborative research (Mullins & Kiley 2002). A significant number of the foreign members naturally work within the same academic tradition as the supervisor(s). Consequently, it is not certain that a random sample of foreign experts would have reached the same conclusions as those who were approached to review

these and participated in the survey. In the present evaluation, we therefore asked whether the foreign members knew the supervisor of the PhD candidate whose thesis they evaluated, and also whether they could indicate other reasons why they were asked to serve on the PhD thesis evaluation committee.

Close to 60 per cent answered that they knew the supervisor beforehand (see Table 4.14). About one third said that they were probably recommended by colleagues of the supervisor, and about one quarter said they were familiar with parts of the PhD thesis before they were asked to sit in the committee. Almost three-quarters of respondents had published on the same topic as the PhD thesis they evaluated. There are, however, no significant differences in personal acquaintances with the supervisor between evaluators from the three regions.

Overall, there were very small differences in responses between those who knew the supervisor beforehand and the rest of the evaluators. The former group were generally 3-6 per cent more likely to give ratings of either "excellent" or "very good". The exceptions were issues of "methodological level" (where they were above the others by 11 percentage points), and "contribution to the advancement of the field" (no difference). These results do not change significantly when controls are made for the regional affiliation of the examiners.

Table 4.14 "Please indicate why you think you were asked to serve on the PhD thesis evaluation committee in Norway", by regional affiliation. Percentages.

	Country presently employed			Total
	Other Nordic countries	Rest of Europe	USA and Canada	
I knew the supervisor of the PhD student whose thesis I evaluated	56	63	60	59
I was (probably) recommended by colleagues of the supervisor	38	29	37	34
I was familiar with parts of the PhD thesis before I was asked	21	30	26	26
I have previously served on other evaluation committees at the same university	27	10	9	18
I have published on the same topic as the PhD thesis I evaluated	69	76	75	72
Other reasons	7	4	8	6
(N)	(484)	(479)	(159)	(1 159)

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Foreign committe members survey. - Multi-response question, more than one alternative allowed.

Quality of dissertations in different higher education institutions

We have also investigated whether the quality of PhD theses are rated differently according to institutional affiliation. We have distinguished between five individual institutions; the four old Norwegian research universities (in Oslo, Bergen, Trondheim (NTNU), and Tromsø), and the Norwegian University of Life Sciences (UMB), which attained full university status in 2005. Furthermore, we have grouped the eight specialised university institutions together, due to the small number of theses at each institution. Finally, three former state university colleges which have been upgraded to university status, the University of Stavanger (2004), University of Agder (2007), and University of Nordland (2011), have been put together in a category named "new universities".

The results indicate that there are no systematic differences, at the aggregate level, in the quality of theses awarded by the four old universities (Table 4.15). Theses by PhD candidates at the specialised university institutions also seem to be generally at the same level, with two exceptions. Slightly fewer theses at these institutions got a high score in terms of "contribution to advancement of the field" than those awarded by the old universities, but significantly more theses from these institutions were rated "excellent" or "very good" with regard to external relevance. PhD theses from the Norwegian University of Life Sciences (UMB) appear to be of somewhat lower quality according to the opinion of the foreign members of the evaluation committees, while theses written at the three new universities received the lowest ratings. While about 40 per cent of theses at these institutions were rated "excellent" or "very good" in terms of their "contribution to advancement of the field", this applied to about 60 per cent of the PhD theses awarded by the old universities.

Table 4.15 Rating of PhD theses by institution (excellent or very good). Percentages.

	Univ. of Oslo	Univ. of Bergen	NTNU	Univ. of Tromsø	UMB	Spec. univ.	New univ.
Originality	61	61	63	65	52	63	40
Depth and coverage	67	66	67	67	52	63	47
Theoretical level	56	59	52	58	38	51	35
Methodological level	62	65	65	63	53	61	49
Skills in written presentation	68	71	66	68	61	66	60
Contribution to the advancement of the field	59	61	60	63	49	54	42
External (applied/societal/ cultural/industrial) relevance	54	54	60	57	52	69	49
(N)	(469)	(198)	(232)	(72)	(66)	(68)	(43)

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Foreign committe members survey.

This pattern also holds when controls are made for the regional affiliation of examiners. When we look at the indicator "contribution to the advancement of the field", examiners from other Nordic countries give a much less favourable rating (excellent or very good) to new universities than to the old universities (more than 20 percentage points difference), while in the group of other European examiners, differences are smaller (about 10 percentage points) between old and new universities. Only 4 examiners from North America examined theses at new universities so it is impossible to say much about this group. Specialised university institutions are, however, an exception here. Their overall good rating may partly be due to the larger percentage of examiners from North America. Nordic examiners rated theses from these institutions lower than theses from the old universities; about 20 percentage points fewer theses from the specialised university institutions were graded as excellent or very good with respect to their contribution to advancement of the field.

Thus, when we take the regional affiliation of examiners into consideration, there is some empirical evidence that, at the general level, theses from the old universities are rated higher than theses from new universities and specialised university institutions. This finding also receives some further support from the institutional survey. When we compare the assessment of theses by foreign members of the PhD committees with self-assessments by the institutions themselves, we find a corresponding pattern; while 100 per cent of the units in the old universities are content with the quality of the PhD theses, this only applies to 78 per cent of the units in the other institutions.

4.4.3 Assessment procedures for PhD theses

Traditionally, the assessment of PhD theses and the examination of doctoral candidates worldwide differ a great deal across countries (Powell & Green 2007). This relates, among other things, to the composition of the evaluation committee, whether the examination and defence take place in public or private, and whether the committee can give a pass pending amendments or revisions of the thesis, or whether an immediate pass or fail are the only alternatives.

In the international committee member survey, the respondents were given the opportunity to comment on the assessment procedure for doctoral candidates in Norway. The large majority of respondents did so, and the overall impression that emerges is that assessment procedures are rigorous and fair to the candidate, but are also more time-consuming than in most other countries. In this report, we have summarised comments from evaluators from three countries which practice different procedures to Norway; the USA, UK and Sweden.

Compared to the USA, UK and Sweden, the PhD examination process in Norway is more rigorous and formal. Norway is the only country where a joint examiners evaluation report is required before the defence. This procedure obviously has pros and cons; many thought the practice of requiring a pre-examination report to be sound, while some argued that this process was time-consuming and delayed the date for the public defence.

In contrast to Sweden, where an independent opponent to the evaluation committee scrutinises the research work, in Norway two members of the evaluation committee examine the candidate. As opposed to the common system in the USA and UK, where theses usually get a pass provided minor amendments are made, Norwegian PhD theses are required to be published (or made publicly

available) before they are defended. Many respondents from these two countries argued against this practice, suggesting that the candidate should have the opportunity to make changes to the thesis following the defence, based on the feedback received from the examiners.

In Norway, the PhD thesis is evaluated by a committee consisting of three members, of which at least one should come from a foreign university. The committee is appointed by the university after the candidate has submitted his/her thesis for evaluation. The selection and the number of committee members are similar to Sweden, but different from the UK (where there are usually two) and the USA (usually five). In the USA, the examination committee is identical to the PhD committee which was appointed to supervise the candidate's dissertation work. This difference between the Norwegian and the US system was commented on by several American respondents, of whom the majority thought the Norwegian system was good and fair to the candidate.

Similarly to Sweden, Norway practices a public defence of the thesis; in both these countries, and in the USA, the candidate normally starts by presenting his or her research work, before the examination takes place. The issue of public versus private examination was commented on by many respondents from UK and USA. Opinions were mixed; many were positive to the public character of the defence, but equally many were critical. Many respondents thought that the process of public examination tends to become more of a formality than a real test of the candidates knowledge. But there were also many respondents from the UK and USA who were positive to the public defence of the thesis. These positive responses related to three main reasons: that the examination and defence were open to the public; that this was a good opportunity to test the candidates' abilities to present and defend their research; and, that this ceremonial occasion was a kind of rite of passage marking the transition from research student to qualified researcher.

The public trial lecture is a practice that is specific to Norway in an international context. Even though it has now become possible to hold this lecture at an earlier stage, before the disputation and before a separate committee, the common practice is still that the candidate gives this lecture the same day, or the day before the public defence of the thesis. The PhD evaluation committee will assign the topic of the lecture and assess the presentation. Views on this lecture from the respondents were mixed; many thought it was a good practice, while just as many thought it should be removed, pointing to an overload of work for the PhD candidate, that the assessment procedure was time-consuming, and that there are other and more suitable ways to ensure that the candidates demonstrate their teaching skills.

4.5 Assessments and recommendations

4.5.1 The quality of inputs

Overall, the recruitment situation for new PhD candidates is generally positive, but there are concerns about the situation for PhD candidates in natural science and engineering, both in terms of applicants' qualifications and resource-intensive recruitment procedures. Across all institutions, the majority of new applicants in STEM subjects are recruited from institutions outside Norway, and in certain PhD programmes up to 80 per cent of new PhD candidates are non-Norwegian. Although international recruitment of PhD candidates is generally perceived to be positive, the universities and colleges need to ensure that the right candidates are recruited to open PhD positions and that there is some degree of integration between master's and PhD levels.

The combination of different factors alongside these high levels of international PhD candidates, not the high level of international recruitment in itself, gives rise to some concerns. Improving the quality and efficiency of recruitment procedures, developing better collaboration between higher education institutions in recruitment procedures, and introducing initiatives to motivate and prepare candidates at the master's level to continue on a PhD are also on-going concerns.

These concerns do not apply to the same extent in the social sciences and humanities, or in medical and health sciences. In some of these fields, however, there are concerns that there is too much internal recruitment to PhD programmes, and that these units should strive for more open calls for PhD positions and increased competition.

The well-funded Norwegian PhD training system, with good work and research conditions both for PhD candidates and PhD holders should be attractive to international researchers. In light of this the goal must be to increase the quality and efficiency of recruitment procedures, while also promoting arrangements to stimulate more master's students at Norwegian higher education institutions to continue on to a PhD.

- **Recommendation**: The higher education institutions, in collaboration with appropriate national authorities, such as NOKUT and the Ministry of Education, should look into examples of good practice in international recruitment at the PhD level, to establish ways forward to address these issues.

Many units in areas where it is difficult to recruit master's students onto the PhD level (such as engineering/technology, economics, etc.) are experimenting with initiatives to motivate master's students to continue with researcher training. Such initiatives have merits, because they increase the integration between master's and PhD level. The evaluation therefore recommends that the higher education institutions continue to experiment with ways to integrate their master's and PhD level programmes, while also taking steps to assess the effects of such initiatives. Internationally, within natural science and engineering, but also in economics, many universities are moving towards a "4+4 model", where the last year of the master's degree is a preparation for a continued research degree at PhD level. Looking into international experiences in provision of research degrees is therefore also advised.

At the same time, preferential recruitment of internal master's students carries some downsides or risks; not least that it goes against the principle of open and transparent recruitment procedures.

- **Recommendation**: Higher education institutions – particularly in areas with difficult recruitment situations – should attempt to establish and share information on how better integration between master and PhD levels can be promoted, whilst adhering to the principles of open competition for PhD scholarships and transparent recruitment procedures.

4.5.2 The quality of training and research processes

The higher education institutions with PhD programmes have made significant efforts over the last decade to increase the overall number of PhD candidates, at the same time as promoting increased efficiency and quality in PhD education. As a general observation, PhD education has become an area receiving explicit institutional responsibility from the levels of university boards to faculties, institutes and centres.

The higher education institutions have significant decision making authority over the PhD education they offer, and regulations concerning requirements, content and activities vary significantly across fields of science and institutions. Flexibility is a basic principle in PhD education, as PhD education needs to be aligned with the varying research goals and cultures of disciplines and fields of science.

At the same time, basic standards of quality have been pursued in Norwegian PhD education, particularly when it comes to promoting good practice in the organisation and administration of PhD education. The Norwegian association of higher education institutions and NOKUT have had important roles in promoting such good practice. The many interviews and reports reviewed in this evaluation provide evidence of a change in the mode of, and attitudes towards, PhD education in Norwegian higher education towards becoming an explicit concern for the institutional leadership.

PhD courses and research schools

There is a high degree of concern about the quality and relevance of PhD courses, and efforts are being made to strengthen the quality of course portfolios. This is, however, still *the* area of PhD training where PhD candidates and supervisors are the least satisfied, particularly in the social sciences and humanities. In natural sciences and technology, individual study plans seem to be used to a greater extent, where the PhD programme plan specifies mandatory topics, with few if any broad mandatory courses.

- **Recommendation**: In line with the implementation of the national qualification framework, the use of individual study plans at the PhD level is recommended, when the programme units has an operational PhD programme board that can assess each study plan in light of programme requirements.

Relevant and high quality courses require substantial specialisation at the PhD level. In a small country like Norway, collaboration across institutions is the only feasible way to promote such specialised training across many and small institutions. The national research school scheme has promoted the development of high quality PhD education, often linked to international research centres and world leading experts. However, relatively few PhD candidates are involved in these initiatives and their status and value in the PhD education system remains unclear.

- **Recommendation**: The present national research school programme should be evaluated, focusing on the added value of research schools not only for the candidates belonging to them, but also on their broader impact in promoting good practices in PhD education.
- **Recommendation**: Building on the present, strong tradition of collaboration across institutions in providing PhD courses, a national research training network scheme is recommended as a supplement the research schools.

Supervision and support for PhD candidates

The higher education institutions all recognise that supervision and integration of PhD candidates in active research communities is the key to high quality PhD training. Since research practices are so different in different fields of science, there is no uniform idea of what constitutes high quality supervision or how PhD candidates should be integrated into the research community. However, it seems that most higher education institutions in Norway agree that supervision should be regulated and that PhD candidates should not only depend on one supervisor. Across the different institutions, team based supervision seem to be an emerging practice, and not only in experimental sciences. Likewise, creating positive learning environments for PhD candidates – as part of research groups in experimental sciences or networks of PhD candidates – is a goal pursued by most units with a PhD programme.

In general, most PhD candidates are satisfied with the supervision they receive. Nonetheless, there is reason for concern as a considerable minority claim that they receive less guidance than expected, and that the quality of supervision is unsatisfactory.

PhD candidates who belong to larger research projects or research groups are more positive about the PhD education they receive, report broader learning outcomes and have access to more resources than other PhD candidates. Access to research funding to cover expenses also seems to be unequally distributed.

There are no formal requirements for being a main supervisor in Norway (other than having a PhD degree or competence level with a PhD), in contrast with Sweden's docent requirements. Supervisor training need not be offered through pedagogical classes. Post-docs and early stage researchers should be utilised as co-supervisors, with some form of supervision or mentoring from more experienced researchers. Feedback to supervisors from external experts (for instance as part of the midway module) is also recommended.

- **Recommendation**: Training of supervisors and prospective should be an explicit institutional concern and a mandatory requirement for becoming a main supervisor of a PhD candidate.

Integrating PhD candidates into active research communities is generally recommended, as the collegial support of other PhD candidates, post-docs and other members of staff generally provides a good learning and working environment. Exactly how this should be done depends on the field of science.

- **Recommendation**: To promote inclusion of PhD candidates in active research communities, higher education institutions should allow for some degree of concentration of resources in research groups when planning the distribution of new PhD positions, based on institutional strategies and prioritised research areas.

Internationalisation at the PhD level

The data collected and systematised in this study indicate that internationalisation at the PhD level is a multifaceted issue, but that the trend is towards greater diversity in goals and approaches.

Data collected from the different institutions indicates that the number of PhD candidates who have a longer stay abroad is actually decreasing in certain fields of science. This development has to be seen in light of the increasing recruitment of international PhD candidates and the development of tools that also bring leading international scientists to Norway, such as national and international research schools and centres of excellence. Elite research communities such as centres of excellence have an obvious role in promoting internationalisation in PhD education, partly because excellent research environments are international in nature, but also because they have resources to fund international network participation, field work, invitation of guest researchers, and so on. The role of national and international research schools in promoting internationalisation should be targeted in the upcoming evaluation of research schools.

PhD candidates and supervisors alike see international experiences and active engagements in international research communities as a key goal of PhD training; despite this, extended stays abroad for all PhD candidates are not thought to be attainable (due to time and financial reasons) or advisable (in terms of the value an extended stay brings to the PhD candidates research and training process) in every case.

Participating in activities such as international conferences, networks, PhD courses and summer schools are seen as more attainable and efficient ways of allowing PhD candidates to gain experiences of working in international research communities.

This requires access to resources, and data indicates that PhD candidates who belong to larger research groups or projects typically report more international conference and network participation than other PhD candidates. Ensuring access to resources to finance participation in international research networks and communities should be a goal for all PhD candidates.

- **Recommendation**: Annual research funds to cover research expenses should include a designated and adequate share of funding to cover participation in international networks/conferences for all PhD candidates.

4.5.3 The quality of outputs

Formal requirements for the volume of doctoral dissertations have been reduced since the previous evaluation in 2002, there is no empirical evidence that the quality of the research undertaken has decreased. The survey of foreign members of assessment committees indicates that the majority of PhD theses (about 60 per cent) are of a very high standard, and additional comments made by the respondents to this survey indicate that, in general, Norwegian PhD theses are seen as high-performing on an international level.

The results of the survey indicate that PhD theses in the social and agricultural sciences were rated significantly less favourable than the average, but even in these fields about half of the theses were regarded as being "very good" or "excellent". The data does not offer any obvious explanation for these differences. Potential explanations might be that: the social sciences require more papers for article-based theses, than in other fields (lowering the quality of papers produced), or it may simply be that the quality of candidates, of the research environments, or of supervision varies across these areas.

The survey data also indicates that the quality of theses from the four old universities is generally higher than those from other institutions. With regard to contribution to advancement of the field, about 20 per cent more theses at the old universities than at the new universities and specialised university institutions were graded as excellent or very good by Nordic examiners.

Assessment procedures

In terms of the quality of assessment procedures for PhD theses, the overall impression from comments by international examiners is that assessment procedures are rigorous and fair to the candidate. International experts see value in the formal and rigorous procedures used in Norway, but

concerns are expressed about PhD dissertations being published before the final exam; many think that, in accordance with good scientific practice, it should be possible to make corrections to a manuscript to take account of the peer reviewers' advice before final publication, even in the cases where the thesis has formally passed and there is no need for a major revision. The foreign members of the assessment committees also had mixed opinions about the public trial lecture; many thought it was good, while just as many thought it should be removed, pointing to excessive work for the PhD candidates, that the assessment procedure was time-consuming, and that there are other, more suitable ways to ensure that the candidates demonstrate their teaching skills. The public trial lecture is specific to Norway in an international context, and the previous evaluation report recommended that this lecture be removed from the disputation process.

- **Recommendation**: The higher education institutions, through the Norwegian Association of Higher Education Institutions, should look into the possibilities for changing regulations to allow committee members' advice to be taken into account before publication.
- **Recommendation**: The time is now ripe to remove the trial lecture in its present form. It is specific to Norway; since the introduction of organised course-based research training it no longer has any function in demonstrating a candidates' breadth of skills; and, most importantly, the rapid expansion of the PhD system has made it an expensive arrangement for the institutions themselves and for employers of PhD candidates, who usually receive a paid leave of absence for preparing the trial lecture.

5 The efficiency of PhD education

5.1 Introduction

Different approaches can be used to examine the efficiency of PhD education; a purely quantitative approach, and a more qualitative approach focusing on efficiency of organisation, resource use and tools to promote efficiency. In this evaluation we apply both strategies.

Table 5.1 Operationalisation of efficiency

Performance criterion	Dimensions	Operationalisation
Efficiency	Efficiency of production	Completion rates, time to degree, age of doctoral degree holders
	Organisational efficiency	Efficient organisation of PhD education, resource use, monitoring and incentive schemes to promote efficiency

Usually, three indicators are used to measure efficiency in research training; (a) completion rates, (b) time-to-degree, and (c) the age of doctoral graduates. In addition to these quantitative indicators, the evaluation's terms of reference specifically asked for a qualitative investigation of the efficiency of PhD education, focusing on the extent to which higher education institutions (and indeed the whole PhD training system) organise PhD education efficiently and the extent to which resources are used in an efficient manner at the institutional and system levels.

To shed light on this, the evaluation has collected information through the institutional survey and interviews about how PhD education is organised and what the higher education institutions do to promote efficiency. Data of relevance to organisational efficiency have also been discussed under the heading of "quality", particularly those concerning the organisation of PhD programmes, courses, and supervision which are also relevant for promoting efficiency.

After presenting the qualitative data on how the programme units organise PhD training to promote efficiency, updated time-series analyses of completion rates and time-to-degree data will be presented, followed by a discussion and an assessment of the performance of the Norwegian system on these dimensions.

5.2 Organisational efficiency

5.2.1 Systems for monitoring PhD candidates' progress and initiatives to promote efficiency

The survey of PhD programme units contains several questions about what initiatives and tools higher education institutions have implemented, to ensure that the candidates complete their PhD studies within the allotted time-to-degree[14].

We asked each PhD programme unit to report whether they had implemented procedures to monitor the progress of PhD candidates, what they do when candidates do not make sufficient progress, and whether they had implemented any incentive schemes to increase efficiency in time-to-degree.

All units report that they have formal systems to monitor the progress of PhD candidates; most report using a mix of administrative and academic procedures. These formal demands to report on progress are usually specified in the PhD regulations. Separate progress reports are submitted annually or each semester by the candidate and the supervisor. Department heads, PhD coordinators, or PhD programme boards review these.

[14] Usually 3 years fulltime, 4 years (with 25 per cent other work), or up to 6 years (with 50 per cent other work).

Several of the PhD programme units also report that they have annual meetings between department heads or PhD coordinators and each PhD candidate, to discuss their progress and make plans, but this is usually only offered to PhD fellows who are employed by the institution.

Quite a large number of the PhD programme units, particularly those in the eight universities, use mandatory seminars as a way of monitoring progression and ensuring quality. Of particular importance is the "half way seminar" which provides a formal evaluation of the candidates' work and development; a few units also have mandatory end or "90 per cent" seminars. The universities report more of these formal arrangements than either the university colleges or specialised university institutions.

According to the survey, all but three PhD programme units claim that the progress of PhD candidates not employed by the unit hosting the PhD programme is monitored in the same way as the progress of PhD candidates employed by the host university. However, several of the units report that mid-term seminars and annual meetings between department heads and each candidate are actually only offered to the PhD scholarship holders employed by the institution.

PhD programme units were also asked about the action they take if the candidates' progression is not satisfactory. As seen above, the progression of each candidate is monitored systematically by the programme board and/or department/faculty heads, and action is taken quickly to address potential problems. A lack of sufficient progress is normally dealt with through meetings with the candidate, supervisor, or department head, to map the potential problem and discuss possible remedies. Where this action, combined with closer monitoring and more supervision, is not sufficient, efforts are made to change supervisor or change research project. Terminating the PhD candidates' contract rarely happens, but 14 units (27 per cent) report that it is an option to handle lack of progression.

Incentive schemes to motivate PhD candidates to finish their degree on time are reported by 21 per cent of the units. The most common incentive scheme mentioned is a six month additional stipend, but three units report paying the candidates a bonus, or even awarding them a pay raise, if they submit their dissertations on time.

We also asked units to report on how they handle PhD candidates who have not managed to complete on time. Most units (77 per cent) allow the candidate to keep office/facilities and supervisor, and 58 per cent of the units report that they do offer some support, but that there is a time limit for how long a person can remain registered as a PhD candidate in the programme. Financial support in the form of "finalisation stipends" is offered by half of the surveyed units, 35 per cent of the units offer temporary work, and 23 per cent answer that they provide external project funds. Additional financial support is a particularly popular option provided at the Norwegian University of Science and Technology, the University of Bergen, the University of Tromsø, and the University of Life Sciences, in addition to some of the colleges. The University of Oslo seems to have particularly strict policies for handling PhD candidates who go over time, but this institution also has a very large number of PhD candidates compared to the other institutions.

5.2.2 Self-evaluation of efficiency

Overall the units seem to be relatively satisfied with their current completion rates and do not see drop-out as a big problem (see Table 5.2). Half of the units claim that time-to-degree is decreasing, but a large majority of the units still report that they need to further increase efficiency.

More units within the natural sciences and technology/engineering, and in medical/health sciences, seem to be content with their current completion rates and report that time-to-degree has gone down, than units in the humanities and social science. However, a large proportion of all units report that they will still have to work on cutting time-to-degree amongst their candidates.

Old universities seem to be more critical of their completion rates and time-to-degree than the group of new universities, specialised university institutions and university colleges, but several institutions in the latter group have newly established programmes and, accordingly, have little experience on which to base their assessment (Table 5.3).

Units were also asked if they have planned or implemented tools to improve efficiency. 15 per cent of the PhD programme units, of which the most part have new PhD programmes, do not have such plans.

67 per cent of the units have implemented measures to improve efficiency. In general, it seems that all units are focusing a high level of attention on the issue of candidates' progression, and several report having institution-wide action plans, where many different tools are used to improve efficiency.

Table 5.2 Percentage of PhD programme units that agree, to a great extent or some extent, with statements regarding completion rates and time to completion, over the past 5 years, by field of science.

Statement	Humanities and Social sciences	Medical and health sciences	Natural sciences and Engi-neering	Total
We are satisfied with the current completion rates	52	86	92	67
We have reduced dropout rates	21	14	33	23
We have problems with dropout	24	14	23	22
The time to degree has been reduced among our candidates in recent years	41	57	62	49
We still need to reduce the time to degree	83	71	92	84

Source: Evaluation of PhD education in Norway 2011-2012. NIFU.

Note: The field of science groupings are based on NIFU's discretionary classification. Agricultural and veterinary sciences are included in Natural sciences and Engineering.

Table 5.3 Percentage of PhD programme units that agree, to a great extent or some extent, with statements regarding completion rates and time to completion, over the past 5 years, by institution.

Statement	Old universi-ties	Other universities and university colleges	Total
We are satisfied with the current completion rates	65	70	67
We have reduced dropout rates	31	14	23
We have problems with dropout	31	13	22
The time to degree has been reduced among our candidates in recent years	73	22	49
We still need to reduce the time to degree	88	78	84

Source: Evaluation of PhD education in Norway 2011-2012. NIFU.

Note. The category old universities includes the universities of Oslo, Bergen, Tromsø and the Norwegian University of Science and Technology (Trondheim).

Units were also asked if they have planned or implemented tools to improve efficiency. 15 per cent of the PhD programme units, of which the most part have new PhD programmes, do not have such plans. 67 per cent of the units have implemented measures to improve efficiency. In general, it seems that all units are focusing a high level of attention on the issue of candidates' progression, and several report having institution-wide action plans, where many different tools are used to improve efficiency.

In terms of tools implemented, many of these are described above and focus on closer monitoring of the candidates' progression, making the responsibilities for progression clearer to the PhD candidates, supervisor and department heads, and creating incentives for these groups for ensuring progression.

Improved collaboration between the central institutional level and the faculties, and between faculties and departments, is also seen as a key instrument. As a part of this, some units say that they have worked to improve the quality of data on PhD candidates, including improved reporting of key data on each PhD candidate via a central student administrative register. This provides the institutions and faculties with better information and control than before, enabling them to take action if necessary.

As seen above, many units have implemented more formal structures with defined milestones and assessments along the way. Many are also working on including all PhD candidates in a strong research and learning environment, either in research groups or in research schools.

Quality in recruitment (through efficiency in recruitment procedures and ensuring that candidates have sufficient competencies to complete a PhD) and quality in supervision (through dual supervisors, training of supervisors) are also seen as key tools to improve time-to-degree. Improving the quality of the course portfolio and ensuring that courses are offered regularly are also mentioned, and some units motivate candidates to complete the course part in the first year of their PhD studies.

A few units report that they try to restrict the use of PhD candidates in non-thesis related work (particularly in their duty time), and faculties report that they have been working with the departments to ensure that candidates do not get overloaded with duty work. Some units practice no duty work at all during the last year or six months before the candidate is supposed to hand in their dissertation.

When asked to assess the effectiveness of the tools implemented, most units say that it is too early to tell, or that they do not have enough information. Five units report that the implemented tools have had a significant effect on efficiency in time-to-degree, and only one unit state that effects have been limited.

5.2.3 The ratio between doctoral candidates and supervisors

Another measure of organisational efficiency is the ratio between doctoral candidates and supervisors. Data on this, but only in the four old universities (Oslo, Bergen, NTNU and Tromsø), are available over several years. In Figure 5.1, trends over the last decade in the numbers of full professors, full professors and associate professors, the numbers of PhD candidates holding a scholarship and the total number of PhD candidates, are compared. The figure shows a slight increase in the number of permanent academic staff, the large majority of which will act as supervisors, and a steep increase since 2003 in the numbers of PhD candidates and PhD scholarship holders. The increase in doctoral candidates with funding other than a PhD scholarship has, however, been much stronger than the increase in the number of scholarship holders in these four universities. Compared to the whole PhD candidate population (about 33 per cent that are not scholarship holders), these four universities have about 46 per cent PhD candidates who are not scholarship holders. This difference is due to the fact that several PhD candidates are enrolled in the four universities, but are employed as PhD scholarship holders in the university colleges or in other institutions (university hospitals and research institutes).

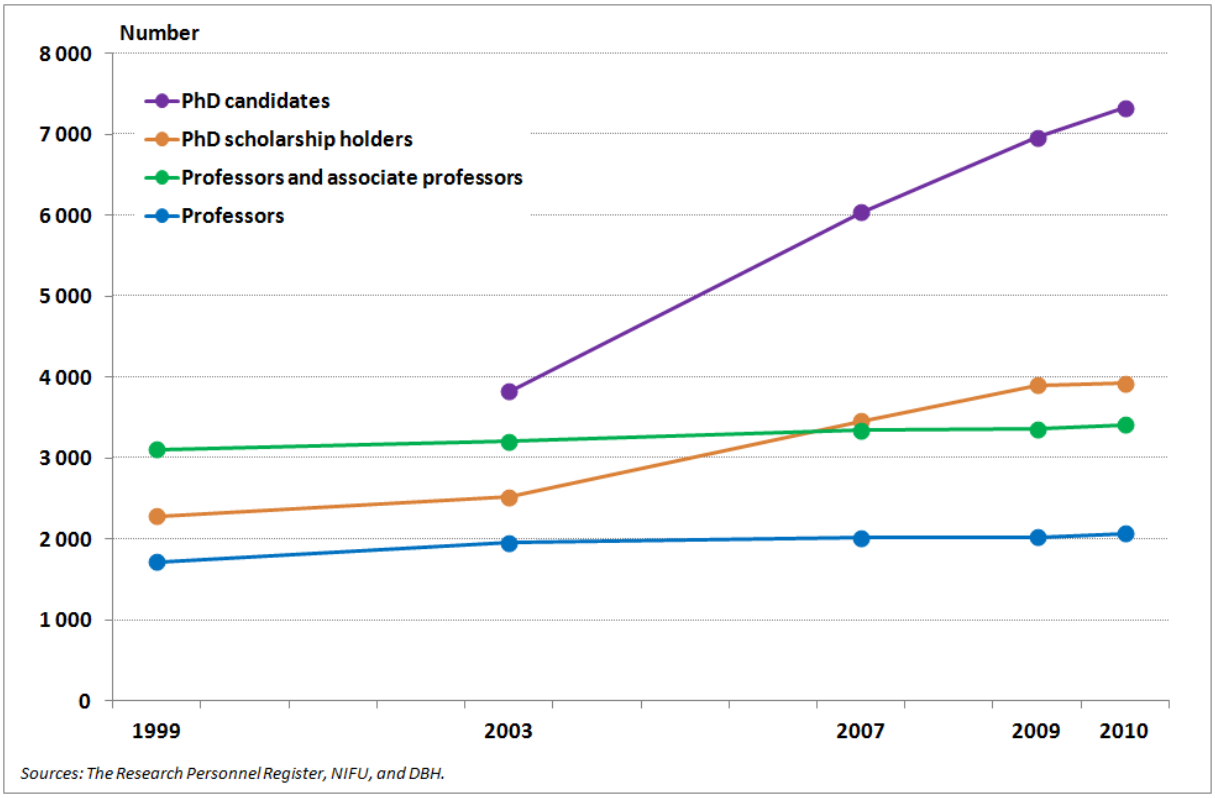

Figure 5.1 Numbers of professors, professors/associate professors, PhD scholarship holders, and total number of PhD candidates at the universities of Oslo, Bergen, Trondheim (NTNU), and Tromsø 1999-2010.

Figure 5.1 clearly illustrates that the universities have experienced a strong expansion in the research training system and that the average professor and associate professor supervise an increasing

number of PhD candidates, and that an increasing number of PhD candidates are not employed by the four universities.

5.3 Efficiency of output

5.3.1 Calculation of completion rates and time-to-degree

The data presented here are drawn from the *Doctoral degree register* and the *Research personnel register*. The former register encompasses all doctoral degrees earned at Norwegian institutions, and includes information about disputation year and month. The latter register, which has been updated every second year up to 2007, encompasses all academic staff, including doctoral candidates holding a scholarship at Norwegian universities. By combining data from these two registers, it is possible to examine completion rates of each cohort.

However, only the approximately 67 per cent of doctoral candidates who have contract as PhD scholarship holder at a higher education institution are registered. The remaining PhD candidates are funded by their non-university employers (research institutes, university colleges, industry, hospitals, etc.), do not normally have the same working conditions as scholarship holders, and generally work on their PhD on a part-time basis. Comparable data on completion rates and time-to-degree are not available for this group of doctoral candidates, but previous studies show that candidates financing their doctorate by means other than a scholarship use substantially more time to complete their doctorate, and a lower percentage of these candidates complete at all (Tvede 2002).

There are considerable difficulties in calculating time-to-degree exactly. This is partly due to insufficient statistical data, and partly due to methodological difficulties in the calculations. Firstly, working conditions vary between doctoral candidates (typically involving 3 years full-time study or 4 years with 25 per cent teaching/duty work). Secondly, a number of candidates are admitted to a doctoral programme having already progressed a relatively long way with their thesis project. In the statistics these will appear to be more efficient than they actually are. Thirdly, many candidates interrupt their doctoral programme temporarily. This may be due to parental leave, temporary posts as university teachers, illness, or a wide range of other reasons. When such interruptions are due to leave of absence that is regulated by labour laws, they should not be counted as part of time-to-degree.

As such, it is important to calculate both the gross time from commencement of the doctoral programme until the thesis is defended, as well as the net time from commencement until submission of the thesis minus periods of law regulated leaves of absence.

5.3.2 Completion rates

Figure 5.2 shows completion rates and gross time-to-degree for doctoral scholarship holders commencing their doctoral training in the years 1994/1995 to 2006/2007. Over this period, there has been a strong increase in the percentage of doctoral scholarship holders completing the doctorate. Of the candidates in the 1994/1995 cohorts, about 50 per cent had graduated within 5 years. Twelve years later this percentage is approximately 60 per cent. Of the candidates in the 1994/1995 cohorts, 64 per cent had graduated within eight years, and of the 2002/2003 cohorts 76 per cent had done so.

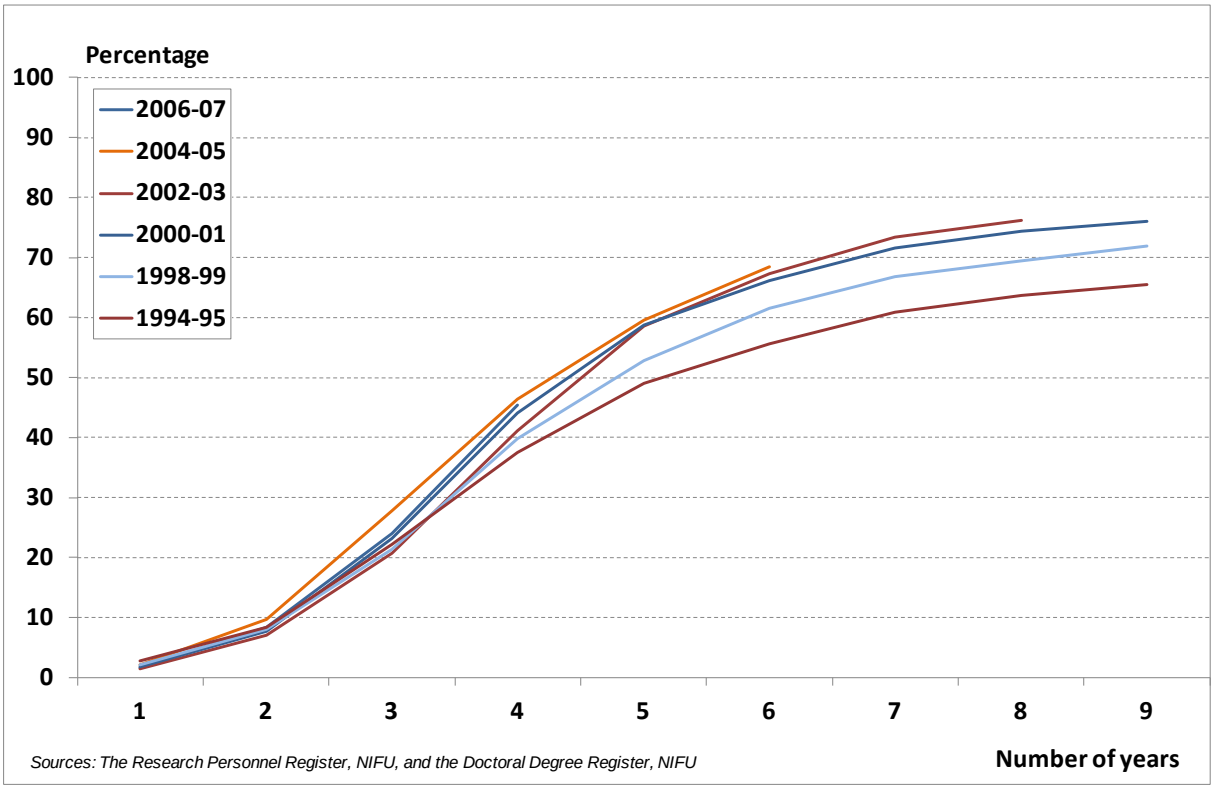

Figure 5.2 Cumulative completion rates among doctoral scholarship holders in Norway, by year of being awarded a scholarship

The main focus of this evaluation is however the period 2000 to 2010. Table 5.4 shows completion rates and time-to-degree for doctoral scholarship holders commencing their doctoral training in the years 2000/2001 to 2006/2007. Over this brief period, there has been a slight increase in the percentage of PhD candidates completing the doctorate.

Based on the trends described approximately 80 per cent of PhD candidates starting their training after 2002 will probably earn a PhD within 10 years.

Table 5.4 Cumulative rate of completion in the doctoral study among scholarship holders, by year of being awarded a scholarship.

First year of scholarship	Scholar-ships (N)	Percentage of scholarship holders having earned a doctoral degree after 4 or more years from the first year of scholarship						
		4	5	6	7	8	9	10
2000-01	1 632	44	59	66	72	74	76	77
2002-03	1 933	41	59	67	73	76		
2004-05	2 269	46	60	68				
2006-07	2 683	45						

Source: The Research Personnel Register, NIFU, and the Doctoral Degree Register, NIFU

Male scholarship holders use one to two years less time for their PhD than their female counterparts on average, but women are no less likely to complete their PhD than men. Of the 2002/2003 cohorts, after 8 years, the same percentage of women and men had completed their degree.

Completion rates and time-to-degree differ considerably between fields of science (Figure 5.3). Of the 2002/2003 cohorts, 84 per cent of PhD candidates in the natural sciences, and 82 per cent in medicine had graduated within 8 years, in contrast to 67 per cent in the social sciences.

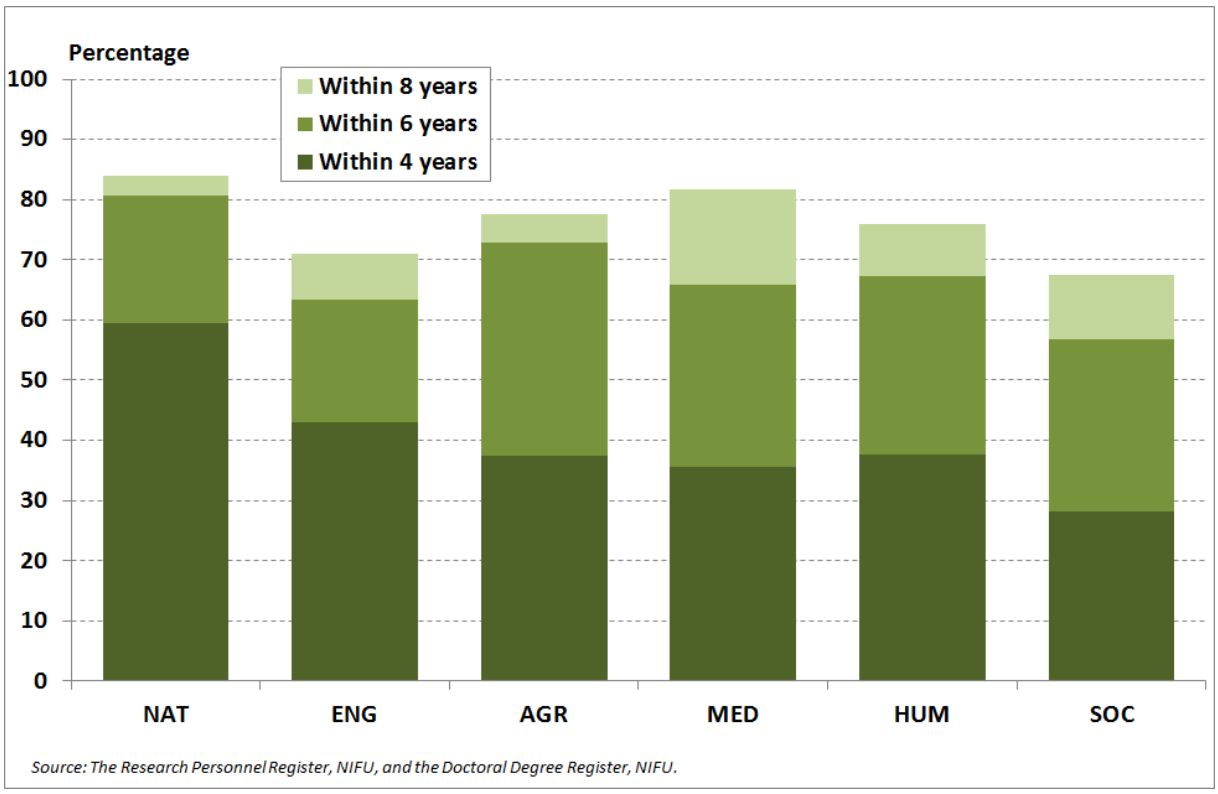

Figure 5.3 **Percentage of new doctoral scholarship holders in 2002/2003 who completed their degree within 4, 6 or 8 years, by field of science.**

When we compare the progress of the 2002-2003 cohorts eight years after admission to the doctoral programme with the progress of previous cohorts, we find that completion rates have shown the strongest increase in the fields of humanities and natural sciences, while in engineering and technology, and agricultural sciences, completion rates have declined.

However, when we look at the progression of the succeeding cohorts, this picture becomes more diffuse. In the humanities, completion rates (within a 4-6 year period) have decreased, while completion rates in engineering and technology are up at the same level as for the 2000-2001 cohorts. In the agricultural sciences, the data indicate that completion rates for the later cohorts may be rising again. On the basis of the prevailing data, we are not able to explain these fluctuations.

Table 5.5 Cumulative completion rates among doctoral scholarship holders in Norway, by year of being awarded a scholarship and field of science.

First year of scholarship	Scholar-ships (N)	Percentage of scholarship holders having earned a doctoral degree after 4 or more years from the first year of scholarship						
		4	5	6	7	8	9	10
Humanities								
2000-01	149	30	48	55	64	68	69	70
2002-03	183	38	57	67	73	76		
2004-05	233	36	47	57				
2006-07	225	32						
Social sciences								
2000-01	357	27	44	53	61	65	68	69
2002-03	421	28	46	57	65	67		
2004-05	425	35	50	60				
2006-07	592	31						
Natural sciences								
2000-01	381	59	70	75	77	78	79	80
2002-03	439	59	74	81	83	84		
2004-05	499	59	68	74				
2006-07	545	63						
Engineering and technology								
2000-01	259	54	66	70	73	76	79	79
2002-03	380	43	57	63	68	71		
2004-05	361	51	63	71				
2006-07	439	51						
Medical and health sciences								
2000-01	364	43	59	70	76	79	80	81
2002-03	403	35	57	66	77	82		
2004-05	650	46	62	72				
2006-07	779	44						
Agricultural sciences								
2000-01	122	48	63	71	78	80	83	83
2002-03	107	37	62	73	74	78		
2004-05	101	46	59	68				
2006-07	103	52						

Source: The Research Personnel Register, NIFU, and the Doctoral Degree Register, NIFU.

5.3.3 Time-to-degree (gross and net time)

As shown in Table 5.6, as of 2011 the average gross time for completing a PhD was 5.1 years; down from 5.5 years in 2002. There are differences between fields, but these have decreased over time; in 2011 they varied between 4.6 years in engineering/technology and 5.9 years in the social sciences. The largest decline in time use has taken place in the humanities and medicine/health, while no significant change can be observed in the natural sciences and engineering/technology. However, the latter fields have had the lowest time-to-degree throughout the last decade.

Table 5.6 Doctoral disputations 2000-2011 by scholarship holders. By field of science. Gross average time-to-degree

Field of science	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total 2000-11
Humanities	7.0	5.9	6.2	6.3	6.6	6.5	6.0	6.0	6.3	5.7	5.6	5.7	6.1
Social science	6.8	6.7	6.4	6.1	6.2	5.9	6.5	6.3	6.3	6.1	6.4	5.9	6.3
Natural science	4.7	5.0	4.5	4.8	4.8	4.9	4.9	4.7	5.1	4.8	4.4	4.6	4.8
Technology	4.1	4.6	4.9	4.5	4.6	4.8	4.5	4.7	5.0	5.0	4.8	4.8	4.7
Medical and health science	5.7	5.7	6.0	5.6	5.9	5.3	5.7	5.2	5.1	4.7	5.0	5.2	5.3
Agriculture and Veterinary science	5.3	4.9	5.4	5.7	5.2	5.0	5.3	5.1	5.8	5.6	4.9	5.0	5.3
Total	5.4	5.5	5.5	5.4	5.5	5.3	5.5	5.3	5.5	5.2	5.1	5.1	5.3
(N)	(507)	(523)	(585)	(580)	(645)	(678)	(690)	(789)	(983)	(884)	(961)	(1,093)	(8,918)

Source: The Doctoral Degree Register, NIFU, and the Research Personnel Register, NIFU. - Cover scholarship years back to 1981 .

So far, we have shown the average *gross time* used by PhD candidates between commencement of doctoral training and disputation. However, it is also important to calculate the *net time* used for doctoral studies. Unfortunately, these kinds of data are not available for the total population of PhD

graduates. We have therefore estimated net time by deducting time for regulated leaves of absence (parental leave, sickness) and time used for the assessment of the PhD thesis.

The previous evaluation of doctoral education in Norway in 2002 showed that the average leave of absence lasted for about four months, and the average time taken to evaluate a thesis varied between two and seven months, dependent upon field of study (Tvede 2002). The assessment period was longest in the humanities and shortest in technology. In consequence, the net time for completing doctoral studies for the average humanities and social sciences candidate in 2002, was one year less than the gross time used.

We do not have complete data on these issues for this evaluation. However, a 2009 survey of PhD candidates who were members of the Norwegian Association of Researchers indicates that regulated leave of absence is common (as also demonstrated by a survey of Tekna in 2011): 45 per cent of the respondents reported one or more leaves of absence, usually due to maternity/paternity leave (Thune & Olsen 2009). The average leave of absence lasted 4.5 months (6 for women and 2 for men).

In terms of the time between submission of a thesis and thesis defence (time taken for assessment), recent data indicate an average of 4 months, but there are large differences between fields and institutions, with a range between two and seven months (Table 5.7).

These data thus indicate that the estimated average net time-to-degree is approximately 8.5 months less than the gross time-to-degree (including average leave of absence and time to assessment of dissertation), although this estimate varies substantially between fields, mainly due to the large differences in the thesis assessment period.

According to these *rough estimates*, the average *net* time-to-degree is approximately 4.3 years, varying between an estimated 5.0 years in the social sciences and 3.8 years in the natural sciences.

These results also indicate that, since the previous evaluation took place, there has neither been any reduction in the total time for leaves of absence, nor in the average time for assessment of theses.

Table 5.7 Period between submission and defence of thesis, by institution and faculty. Median number of months for disputations in 2009 and 2010.

Faculty	Univ. of Oslo	Univ. of Bergen	NTNU	Univ. of Tromsø	UMB	Univ. of Stavanger	Total
Natural sciences and Technology	3	2 1/2	3	2 1/2		2 1/2	3
Humanities and Theology	7	6 1/2	5	7		4	6
Law	6	6		5			6
Medicine and Odontology	6	4	4	3			5
Social sciences, Educational science and Psychology	6	6	5 1/2	5 1/2		3	5 1/2
Total	5 1/2	4	3 1/2	3 1/2	2	3	4

Source: The Doctoral Degree Register, NIFU

5.3.4 The age of PhD graduates

The 2002 evaluation of doctoral education in Norway stated that, in general, doctoral candidates were too old when they were awarded their degree. This applied especially strongly in the humanities, the social sciences, and medicine/health sciences.

Looking only at PhD scholarship holders the average age at disputation is about the same in 2011 as it was ten years earlier. Both in 2010 and 2011 the average age of male and female graduates was 35 and 38 years respectively. There are differences between fields of science, and in the humanities the average age has decreased by three years in this period.

Table 5.8 Average age at the time of disputation by scholarship holders 2000-2011, by field of science.

Field of science	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total 2000-11
Humanities	41	41	39	39	41	39	39	39	38	40	38	38	39
Social science	39	39	40	38	39	38	40	40	39	40	39	39	39
Natural science	33	33	32	33	33	33	33	33	33	33	33	33	33
Technology	32	33	33	33	32	33	33	33	34	34	33	33	33
Medical and health science	38	39	40	38	40	39	39	40	39	38	40	39	39
Agriculture and	35	34	36	35	35	34	36	34	35	36	34	36	35
Total	36	36	36	36	36	36	37	36	37	37	37	36	36
(N)	(507)	(523)	(585)	(580)	(645)	(678)	(690)	(789)	(983)	(884)	(961)	(1,093)	(8,918)

Source: The Doctoral Degree Register, NIFU, and the Research Personnel Register, NIFU. - Cover scholarship years back to 1981 .

5.3.5 International data and trends in time to completion

It is very difficult to compare completion rates and time-to-degree across countries. Firstly, few countries compile relevant statistics; secondly, calculations are done in different ways; and thirdly, doctoral training systems, length of doctoral period, funding, and the status of doctoral candidates vary. In 2009, NIFU made an effort to systematise relevant information from various countries, and in this section we draw on the report in which these data were presented (Kyvik & Olsen 2009). Looking at the countries that are fairly comparable to Norway, completion rates in Norway seemed to be at about the same level as in Sweden, the Netherlands and England, but slightly lower than in Denmark. Time-to-degree was significantly shorter in Denmark than in Norway, even when we take into account that the PhD period in Denmark normally is three years.

5.4 Assessments and recommendations

5.4.1 Organisational efficiency

As seen in chapter two, there has been a strong growth in the numbers of PhD candidates the last ten years, mainly in the old universities and particularly within the natural sciences, medical and health sciences and social sciences. This growth has been accommodated without building up a large administrative apparatus and without any significant increase in the number of senior academic staff to supervise the PhD candidates. Since we also know that it is quite common to have more than one supervisor per PhD candidate, more professors now supervise PhD candidates and are involved in researcher training than before. Although the ratio PhD candidates to supervisors is not likely to be evenly distributed across institutions or fields of science, in general we argue that supervision and administrative resources appear to be used more efficiently than before in Norwegian PhD education.

All the higher education institutions and the PhD programme units surveyed seem to have had a strong focus on efficiency in PhD education during the last decade and have developed different tools to increase completion rates and shorten time-to-degree; these typically involve the introduction of more structures, milestones and more formal reporting throughout the PhD period. Some of the units have also introduced incentive schemes to promote timely completion of degrees, but these mainly target the PhD candidates. Making the responsibilities for the progression of PhD candidates clearer is also seen as important and increasing collaboration between institutional levels has taken place, to ensure that the different units within higher education institutions do not work against each other.

Most of the tools implemented are administrative in nature and, according to the information submitted, all PhD candidates regardless of employment status are subjected to the same requirements and procedures. In practice, however, PhD scholarship holders employed by the same university where they are PhD candidates are likely to be subject to tighter control, not only based on administrative follow up and formal milestones, but with closer input from their supervisor, research group and the leadership of the institute and faculty.

Most of the tools seem to have been introduced fairly recently, and according to the information submitted by the programme units, it might be too early to see the effects of them. The programme units state that completion rates have improved over the last few years, but that they need to work further on improving efficiency.

5.4.2 Improvements in completion rates and time-to-degree?

The macro-data tells us that over the last decade, there has been a slight increase in the percentage of doctoral scholarship holders completing their doctorate. Based on this, approximately 80 per cent of the PhD candidates starting their training after 2002 are likely to earn a PhD within 10 years. However, there are differences between fields: completion rates are significantly higher in the natural and medical sciences than in the social sciences. In the agricultural sciences, the data may indicate a small temporary decline in completion rates, or a prolonged time-to-degree. In engineering/technology we find a decline in completion rates among PhD candidates starting their training in 2002/2003, but an increase in completion rates among succeeding cohorts. In the humanities, the trend is the opposite: a strong increase in completion rates is apparent in the 2002-2003 cohorts, with a decline in the succeeding cohorts. We have no good explanations for these fluctuations, but the prevailing data indicate that a further increase in the long-term, positive trend in completion rates should not be taken for granted.

In the previous white paper on research (Ministry of Education and Research 2009), the government stated that completion rates should increase and that time-to-degree should decline substantially, and set out targets for the percentages of PhD scholarship holders by field, who should complete within six years of gross study time. In Table 5.9, we have compared these target figures with the percentages of candidates from the 2002/2003 cohorts who graduated within six and eight years. The table shows that governmental targets for completion within six years were not achieved in any of the fields. However, in the humanities, the natural, medical and agricultural sciences, the field-specific targets have been achieved within eight years, while completion rates in the social sciences and technology are far from being achieved.

Table 5.9 Governmental target for completion rates for PhD scholarship holders within 6 years, and actual completion rates within 6 and 8 years for those who commenced their doctoral training in 2002/2003, by field of science

Field of science	Target - within 6 years	Graduated within 6 years	Graduated within 8 years
Humanities	75%	67%	76%
Social science	75%	57%	67%
Natural science	85%	81%	84%
Technology	85%	63%	71%
Medical and health science	80%	66%	82%
Agriculture and Veterinary science	80%	73%	78%

The previous evaluation report also stated that the period between submission of the thesis and disputation was excessive in the humanities, social sciences and medicine (at 6-7 months compared to 2-3 months in the natural sciences and engineering). However, little seems to have changed in this respect. According to the information submitted by the programme units in the institutional survey, recruiting external committee members and organising the evaluation procedure are the main reasons for long assessment periods for PhD theses. The principle that PhD theses should be evaluated by external experts, and preferably by one international committee member, therefore contributes to long assessment periods. However, the large differences between fields of science have no obvious explanations and are probably due to routines in certain faculties being weaker; this kind of variation and delay should be easily remedied with better administrative routines.

Furthermore, there is some cause for concern in terms of overall efficiency in PhD education: the average age of PhD graduates who have held a scholarship (36 years) has not decreased significantly over the last decade, and the gross average time-to-degree is still high. There are various reasons for the relatively high age of PhD graduates: students that complete a master's degree are relatively old; there is typically a relatively long time between completion of the master's degree and admission to a doctoral programme; the PhD study period is relatively long; and there remains a relatively long period between submission of the thesis and the disputation.

An important factor, and one that distinguishes Norway from many other countries, is the fact that PhD candidates have the status of employees and not students, and so have rights to prolonged study periods due to legally regulated provisions for leaves of absence. Due to limited wage differences in

Norway, the wage premium for completing a PhD might be lower than in some countries, which might also have an adverse effect on completion rates.

It is important to question if the higher average age for Norwegian PhD holders should be seen as a problem. The previous evaluation of doctoral education in Norway considered the higher average age to represent a comparative disadvantage for Norway, and this evaluation supports this argument. The main reason that a higher average age is problematic is that the time available for developing an academic career is inevitably shortened. Based on international patterns, academic careers usually consist of several training periods at the post-doctoral level, with one of these periods often being taken abroad. If PhD scholarship holders are, on average, 36 when they graduate, Norwegian PhD holders *might* be regarded as too old to be attractive in an international academic labour market. The previous evaluation also argued that, if increasing numbers of PhD graduates are intended to work in the private sector, many candidates might be regarded as too old for starting their careers and be less attractive to recruit.

In the data available to us, it seems that the higher education institutions are working on increasing the efficiency of the actual PhD period, in terms of cutting time-to-degree and ensuring more efficient assessment periods, but that there are structural factors that are important in explaining the persistent, high average age of PhD graduates. This is vital as it affects the kinds of efficiency gains that are possible; the kinds of administrative tools being implemented will, in all likelihood, have marginal effects on average age although they might have a positive effect on time-to-degree, particularly for PhD scholarship holders. The employee status of PhD candidates is one factor that explains the relatively high age of PhD recipients and the relatively high proportion of PhD candidates who are not scholarship holders. These structural factors might inhibit efficiency, but at the same time seem likely to promote quality and relevance in PhD education.

5.4.3 Recommendations on improving efficiency

Since there have been positive developments in increasing the structures and monitoring for PhD candidates, the evaluation recommends that the higher education institutions build on the initiatives that they have implemented recently. However, since the overall goals in completion and time to degree are not met, there is still need to improve practices.

- **Recommendation**: Each institution should develop individual level data on the total PhD candidate group that is good enough to allow for monitoring and internal evaluation of the initiatives being implemented. The institutions need to develop better indicators for net time-to-degree, including data on leaves of absence.
- **Recommendation**: A common standard of what type of data, and how and when data should be recorded is necessary, and the Ministry of Education and Research should promote the development of common data registration procedures.

A particularly important issue is the need for improved information on completion rates for the large PhD candidate group who are not scholarship holders. To be able to improve efficiency and completion rates in this group, one needs much better information about the characteristics of these PhD candidates and their working conditions, and how this impacts on time-to-degree. Clear requirements on admission to PhD programmes, and better communication between employers of external PhD candidates and the institutions and PhD programmes where they study, is also needed.

Prior research indicates that supervisors' attitudes to a large extent influence the PhD candidates' engagement and compliance with regulations of PhD programmes (Humphrey et al 2012). Consequently, incentive schemes implemented by higher education institutions might be more effective if they target academic supervisors rather than PhD candidates.

- **Recommendation**: It is of vital importance that the academic supervisors acknowledge that they have a key responsibility for following up their PhD candidates in such a way that the thesis can be completed on time

Another step that higher education institutions could take to decrease the age of PhD graduates is recruiting younger PhD candidates, by motivating able master's students, providing incentives for

them to go directly into PhDs and by ensuring a better integration between master's and PhD level programmes. As discussed in chapter 4, the evaluation recommends that the issue of input quality, recruitment procedures and better integration between educational levels is addressed both at the national and institutional levels.

- **Recommendation**: The higher education institutions need to make much stronger efforts in reducing time used on evaluating PhD dissertations by adoption of firm standards and good practices.

6 The relevance of PhD education

6.1 Introduction

The third performance criterion on which this evaluation will assess PhD education in Norway is relevance. According to the terms of reference, the evaluation shall assess how the current system of doctoral education in Norway performs in terms of relevance; with regard to whether society receives appropriate and necessary competencies. Since it is not part of the mandate to assess the number of PhDs that should be educated in Norway or within what fields of science (UHR 2012), this evaluation has looked into the content of PhD education rather than the volume of it. In particular, this evaluation focuses on labour market trajectories for PhD holders and assessment of relevance of competencies acquired in the PhD period, both for the ability to complete a PhD, but more importantly, how competencies are used in post-graduation employment. We also discuss relevance of PhD education in terms of different labour markets and occupations for PhD holders (Kyvik & Olsen 2012), and also include information on how employers assess relevance of the PhD degree.

Table 6.1 Operationalisation of the performance criterion relevance.

Performance criterion	Dimensions	Operationalisation
Relevance	Relevance of competences acquired for successful PhD training	Relevance of coursework and training for completion of a PhD
	Relevance of qualifications for post-PhD work	Career ambitions and career trajectories of PhD holders. Use of competences in different labour markets and occupations (R&D and non R&D jobs). Assessment of relevance from employers.

With increasing numbers of PhD holders entering labour markets outside academia, the relevance of the PhD degree for employment in research institutes and industrial laboratories, not to mention in non-research jobs in industry and the public sector, has been questioned. In particular, the debate has focused on whether doctoral education add sufficient value on top of the skills held by those with a master's degree, or whether more PhD level training will just contribute to credential inflation and an overeducated labour force.

In the literature on doctoral training, the term "generic or transferable skills" has been used to describe types of ability that do not specifically relate to the development of disciplinary knowledge or methodological competence. According to Metcalfe a doctorate is increasingly "seen as a generic qualification – as an indicator of intellectual abilities, such as advanced problem-solving skills and reasoning. These competencies are increasingly attractive to a wider employer base, such as the financial, public and consultancy services" (Metcalfe 2007, p. 79).

A report on doctoral careers in industry argues that, in addition to the skills naturally acquired through research, there is a group of competencies common to all fields that are likely to make a doctorate holder more employable outside an academic context. These include communication and management skills, the capacity to deal with complex problems, to engage in multidisciplinary work, and, often, the experience of working in international environments (Borrell-Damian 2009). PhD recipients themselves tend to agree with criticisms about the relevance of their training, and explicitly recommend that doctoral programmes offer greater opportunities for developing generic skills by fostering collaborative and teamwork environments, and by teaching organisational and managerial skills (Nerad 2004, Vuolanto et al. 2006). Halse and Mowbray (2011; 2010) provide a critical discussion about skills and the impact of doctoral training.

The dilemma for higher education institutions with PhD programmes is whether they should try to prepare all PhD candidates for an academic career, in order to have a pool of qualified applicants for vacant positions, or on the other hand should universities strive to meet the demands of PhD candidates with non-academic aspirations, by offering training more geared to the needs of non-research labour markets. It remains unclear if the traditional academic training model is sufficiently flexible to encompass different needs and demands in different types of labour markets.

To shed light on the different dimensions of relevance, the evaluation has compiled different sources of data and perspectives from different stakeholders:

- In the institutional survey, the programme units were asked to report on institutional policies and practices geared towards ensuring relevance
- Interview and survey data were used to describe PhD candidates' and graduates' career expectations, actual career destinations, and the relevance of competencies acquired during the PhD period for work life
- Register data was used to present employment statistics and information about career trajectories of PhD holders in Norway (as well as some comparative data through the CHD project)
- Documentary analysis, literature reviews and interviews with firms also shed light on firm recruitment strategies towards PhD holders, and employers' assessment of the relevance of their abilities.

6.2 The relevance of PhD education - the institutional perspective

In the institutional survey the PhD programme units were asked to assess the relevance of the PhD education that they provide, in terms of the relevance of the PhD courses offered, and the relevance of the overall PhD education for later employment, within and outside the higher education sector. PhD programme units were also asked if they regularly collected information about the relevance of the qualifications from former PhD graduates and employers.

As seen in the Table 6.2, most PhD programme units indicate that the PhD courses are relevant for the research carried out by the PhD candidates, and that they see PhD education as generally relevant for research work inside and outside the higher education sector. Fewer units (60 per cent) see PhD education as relevant for work other than research work, but there are large discrepancies between fields of science on this point. Few units systematically collect information about relevance from PhD graduates or employers. Units within STEM subjects, where many PhD candidates find work outside the higher education sector, more often collect information about relevance particularly from employers.

Table 6.2 Percentage of PhD programme units that agree, to a great extent or some extent, with statements regarding the relevance of doctoral education, by subject area.

Statement	Humanities and Social sciences	Medical and health sciences	Natural sciences and Engi-neering	Total
PhD courses are perceived as being relevant for the PhD candidates' research	93	100	100	96
The PhD programme is perceived as being relevant as preparation for work in the higher education sector	100	100	93	98
The PhD programme is perceived as being relevant as preparation for research occupations outside the university/college sector	80	86	100	87
The PhD programme is perceived as being relevant as preparation for other (non-R&D related) work	43	86	80	60
The faculty/college regularly gathers views from previous PhD candidates about the relevance of the program	21	0	7	14
The faculty/college regularly gathers views from employers of PhD holders, about the relevance of the program	10	0	40	17

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

Note: The field of science groupings are based on NIFU's discretionary classification. Agricultural and veterinary sciences are included in Natural sciences and Engineering.

The differences between types of institutions are not very large. A few more units among the new universities and university colleges think that their PhD education will be relevant for work other than research work, and research work outside the higher education sector; as many of these units have a professional or applied profile, this fits their expected role well.

Table 6.3 Percentage of PhD programme units that agree, to a great extent or some extent, with statements regarding the relevance of doctoral education, by type of institution.

Statement	Old universi-ties	Other universities or university colleges	Total
PhD courses are perceived as being relevant for the PhD candidates' research	96	96	96
The PhD programme is perceived as being relevant as preparation for work in the higher education sector	100	96	98
The PhD programme is perceived as being relevant as preparation for research occupations outside the university/college sector	77	96	87
The PhD programme is perceived as being relevant as preparation for other (non-R&D related) work	58	62	60
The faculty/college regularly gathers views from previous PhD candidates about the relevance of the program	12	16	14
The faculty/college regularly gathers views from employers of PhD holders, about the relevance of the program	15	19	17

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

Note. The category old universities includes the universities of Oslo, Bergen, Tromsø and the Norwegian University of Science and Technology (Trondheim).

We also asked the programme units whether they monitored the employment status and employment areas of candidates once they graduate, whether they offer PhD candidates career guidance, and what kinds of guidance this involved.

Only 21 per cent of the PhD programme units collect information about where their PhD graduates work, and 38 per cent of the units say they offer PhD candidates career guidance during the PhD period. The units that offer career guidance claim to do so through the regular supervision that PhD candidates receive, or through informal advice. Very few units (all at the University of Bergen) report that the PhD candidates are offered career guidance in a structured manner.

When it comes to efforts to improve relevance, 23 per cent of the units are planning initiatives and about half of the 52 units report that they have implemented tools to improve relevance. When asked to specify what they are doing or planning to do, most units say that this is a focus area due to the

implementation of the National Qualification Framework[15], but most units seem to have few specific initiatives planned.

There are exemptions to this, with a few units expressing a strong focus on the relevance of their PhDs for different career trajectories and saying that they frequently engage in dialogue with prospective employers, offer courses/training modules in generic skills, and engage in different forms of collaboration with the private and public sector.

Finally, when the higher education institutions were asked if they provided training opportunities to promote general or transferable skills, such as research management, project management or communication skills, as a mandatory part of PhD training, half of the units claim to offer such training, with academic writing and scientific and popular communication particularly popular kinds of transferable skills training. From their responses, it seems that the universities of Bergen and Tromsø have had a particular focus on this, as most faculties in these institutions report offering training in such skills, usually as part of other mandatory seminars/activities. Many of the other units offer similar courses, but not as part of their mandatory course activities.

6.3 PhD candidates' and graduates' perspective on the relevance of PhDs

6.3.1 Career expectations of PhD candidates

The most up-to-date, although not comprehensive, surveys of career expectations among PhD candidates are the 2009 survey of PhD scholarship holders, organised by the Norwegian Association of Researchers (Thune & Olsen 2009) and a similar survey made by The Norwegian Society of Graduate Technical and Scientific Professionals (Tekna), in 2011. These two labour unions organise about 50 per cent of all PhD scholarship holders, and together they provide a broad coverage of different institutions and fields of science. Tekna mainly organises PhD fellows in STEM subjects and the Norwegian Association of Researchers (NAR) covers many fields of science, with a large number of their members who are PhD scholarship holders being based in the social science and humanities.

In the Norwegian Association of Researcher's survey (Thune & Olsen 2009), 78 per cent of PhD candidates state that their aim is a research career/academic career, and this is in line with previous investigations of PhD candidates in Norway and in Denmark (Kyvik & Olsen 2007, Ministry of science, technology and innovation 2006). As seen in Table 6.4, half of the respondents (51 per cent) would prefer a job in the higher education sector, while 27 per cent would prefer a job in the research institute sector (mainly applied research), or a research position in the private sector. Only 9 per cent of the PhD candidates aimed at other types of jobs (non R&D jobs) in the private or public sector.

In the Tekna survey (Tekna 2011), 64 per cent of the respondents aim to work in the industry/private sector (a 4 percentage point increase since 2009), followed in popularity by work in a research position in the research institute sector, and post-doctoral positions in the higher education sector.

Career expectations differ across fields of science, partly depending on the kinds of job opportunities available to different types of candidates, as seen in Table 6.4. Academic positions in the higher education sector is the primary career goal for PhD candidates in all fields, but research positions in the institute sector and the private sector are also common career choices by PhD candidates in most fields of science.

[15] The Norwegian adaptation to the European Qualification Framework, describes for each level of education, learning objectives in terms of knowledge, skills and general competencies. http://www.regjeringen.no/upload/KD/Vedlegg/Kompetanse/NKR2011mvedlegg.pdf

Table 6.4 Career expectations after completion of PhD, by field of science. Percentages.

Career expectations	Field of science						All
	Hum.	Soc.sci.	Maths/Sci.	Tech./Eng.	Med.	Agri./ Vet.	
Academic position in the HE sector	70	57	36	40	37	27	51
Research position in the institute sector	9	20	26	7	23	27	19
Research position in the private sector	3	2	13	33	13	24	8
Other position in the public sector	6	7	6	7	6	3	6
Other position in the private sector	3	1	3	13	6	6	3
Don't know/too early to say	10	12	16	0	15	12	13
Total	100	100	100	100	100	100	100
(N)	(186)	(321)	(176)	(15)	(158)	(33)	(889)

Source: PhD scholarship holders' working conditions and career expectations. Survey of PhD scholarship holders who are members in the Norwegian Association of Researchers (Forskerforbundet). NIFU, 2009.

In the survey of PhD scholarship holders that were members of Norwegian Association of Researchers, the candidates were asked to indicate how realistic they thought their career expectations were, in terms of how optimistic they were about realising their career ambitions. Overall, 34 per cent of respondents were optimistic about realising their career ambitions, but there are differences between fields of science. Candidates doing a PhD in technology are most optimistic, and PhD candidates in natural sciences and humanities are most pessimistic, about realising their career ambitions. Candidates aiming for a job in the higher education sector and the private sector are most pessimistic, whereas candidates aiming for a job in the research institute sector and other occupations in the public sector are the most optimistic about realising their career ambitions.

In general, very few respondents in the Norwegian Association of Researchers survey – only 7 per cent - claim to have received career guidance or career information from the institutions where they are PhD candidates. As shown above, 38 per cent of the PhD programme units surveyed claim to offer career guidance, usually through other courses or regular supervision activities; the PhD candidate surveys appear to question whether such career guidance is being systematically offered.

6.3.2 The careers of doctoral degree holders

Employment status of doctoral degree holders

The most recent employment statistics for PhD holders in Norway (Olsen 2011) demonstrate that almost everyone with a doctoral degree is employed. Only about 1 per cent of doctoral degree holders who received their degree after 1990 were registered as unemployed in 2009. In the 2007-2009 period, 3423 persons were awarded a doctoral degree in Norway. We have career data on 3086 of them, and most of the remainders have probably emigrated[16]. Among the 3086, only 51 individuals (1.7 per cent) were registered as unemployed in 2009. The majority of those registered as unemployed in 2009 had graduated in 2009. Thus in general, PhD holders find work, and even this small level of unemployment is likely to be temporary.

Table 6.5 Doctorate holders in Norway 2000-2009 by employment status. Percentages.

Employment status	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Employed	97.4	97.3	97.1	96.2	95.6	95.9	96.1	95.2	96.1	96.1
Inactive	2.2	2.4	2.2	3.1	3.6	3.3	3.1	4.1	3.2	3.0
Unemployed	0.4	0.3	0.6	0.7	0.8	0.8	0.8	0.7	0.7	0.9
Totalt	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(N)	(7,790)	(8,307)	(8,853)	(9,455)	(10,042)	(10,647)	(11,321)	(12,033)	(12,847)	(13,791)

Source: NIFU, unpublished statistics

Note: The tables include DHs awarded at a Norwegian institution before the year of employment.

Most doctoral degree holders are employed rather than self-employed, and most work full-time. Of those doctoral degree holders who graduated after 2000, 94 per cent were employed and 2 per cent

[16] For further information about employment patterns of international PhD candidates in Norway, see Gunnes (2011) and Børing & Gunnes (2012).

were self-employed. Of those who were employed 94 per cent worked full-time and 6 per cent worked part-time.

Table 6.6 Economically active doctorate holders in Norway in 2009 by employment status. Awarded in Norway 2000-2009.

	Situation in employment			Working time				Unem-ployed	Inactive	Total
	Em-ployees	Self-em-ployed workers	Total	Full-time employ-ment	Part-time employ-ment	Unspec working time	Total			
Number	7 289	132	7 421	6 632	453	336	7 421	99	252	7 772
Per cent	94	2	95	85	6	4	95	1	3	100

Source: CDH-statistics for Norway, unpublished table.

There are a significant number of persons working in the higher education sector that have temporary positions. A recent analysis indicates that almost 20 per cent of research and teaching staff in higher education institutions have temporary contracts (excluding post-doctoral positions). Similar numbers are not available for the private sector and the institute sector, but the share of temporary employment in these sectors is generally lower. This means that although unemployment rates for PhD holders are very low, temporary positions are common, particularly for PhD holders working in the higher education sector and the health sector (Ministry of Education and Research 2010).

Sectors of employment and occupations of doctoral degree holders

Figure 6.1 shows the economic sectors where doctoral degree holders in Norway worked in 2009. All economically active doctors who obtained their degree in Norway in the period 1970-2008 are included.

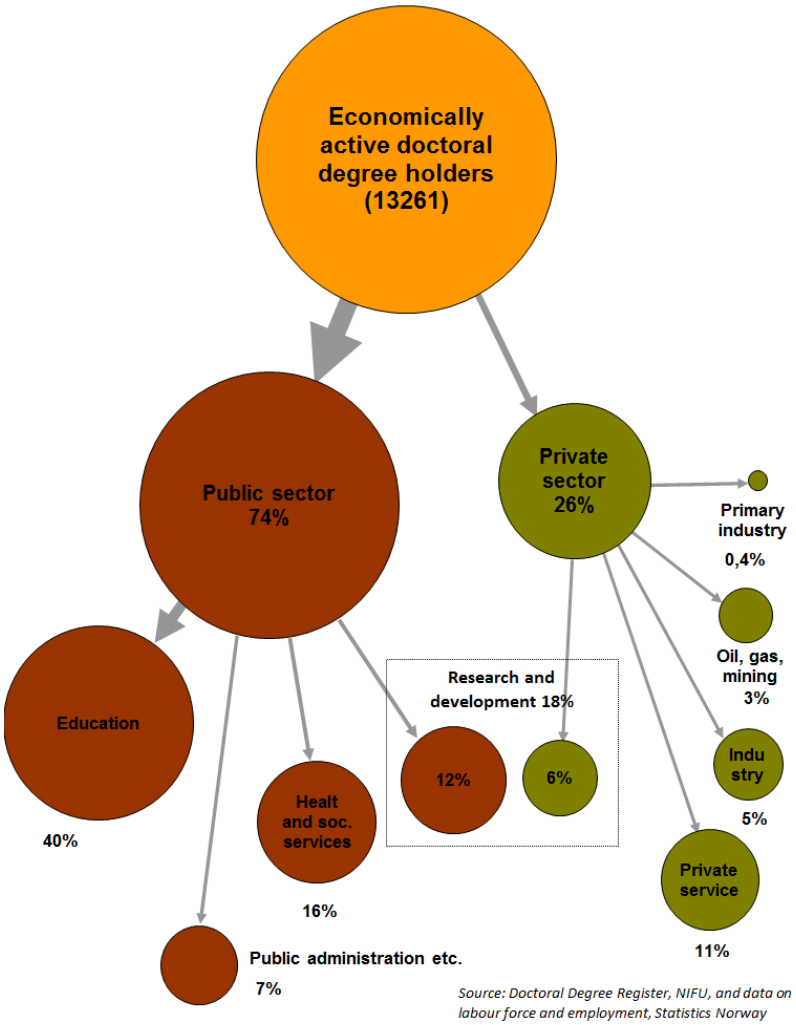

Figure 6.1 Sectoral affiliation for economically active PhD holders in Norway in 2009.

The category "research and development" mainly covers research institutions outside the higher education sector. Most of these are chiefly financed and controlled by the government. These institutions would most reasonably be considered a part of the public sector, even though they are technically classified as part of the private sector. As seen in chapter 2, the research institute sector is also an important arena for researcher training, in collaboration with the higher education institutions. At least a part of those with a doctoral degree in the institute sector, probably worked there also before they earned the PhD degree.

About three out of four doctorate degree holders worked in the public sector in 2009, and one in four in the private sector. Among the doctorate degree holders in the public sector, more than the half were attached to the subsector of education, one in five worked in the area of health and social services, and one in six in research institutes. Among the doctorate holders in the private sector, two out of five worked in private services; one in five in research institutes primarily serving enterprises, and one in four in industry.

Compared to the employment situation for doctoral degree holders a decade ago (and before the implementation of the PhD degree) there have only been very moderate changes in sectors of employment for doctoral degree holders, although the number of economically active doctoral degree holders has increased significantly in each sector. Consequently, there has been a strong growth in the number of PhD holders in all sectors – also the private section – but the overall distribution is stable.

In terms of occupations, Norwegian PhD holders are mainly classified as "professionals" (82 per cent), 9 per cent as managers and 9 per cent under other/unknown occupations (unpublished figures in CDH statistics for Norway, otherwise see Olsen 2011). Within the broad category of professionals, 26 per cent are science and engineering professionals, 16 per cent are health professionals, 47 per cent are teaching professionals, 3 per cent are business/administration professionals, 1.8 per cent are ICT professionals, 1 per cent are legal/social/cultural professionals and 5.5 per cent are unspecified, other professionals.

R&D and non-R&D jobs for PhD holders

Among the doctoral degree holders in work in 2008, approximately 65 per cent were employed as researchers and 35 per cent were employed in work that is not classified as research and development (Olsen 2011).

In a survey of two cohorts of doctoral degree holders, graduating in 2002 and 2005 (Kyvik & Olsen 2007), respondents were also asked to classify the type of job they performed in terms of its R&D intensity. A high proportion, 68 per cent of respondents stated that they performed a job with "high R&D components" and 32 per cent said they had a job with little or no R&D tasks, mirroring the pattern for all doctoral degree holders (Olsen 2011).

The highest proportions of degree holders stating that they have a job with high R&D intensity are within the social sciences and natural sciences (81 and 75 per cent respectively). In medicine and health sciences only 53 per cent of doctoral degree holders report having a job with high R&D intensity, and 31 per cent state that they have a job with mainly clinical tasks (Kyvik & Olsen 2007).

Interviews with PhD holders working on clinical tasks indicate that they feel considerable frustration about the lack of research opportunities in their jobs, but that they consider the PhD qualifications to be valuable and relevant for clinical practice, and that having a PhD has improved their clinical skills.

In terms of sectors of employments, jobs with high R&D intensity are most common for doctoral degree holders who work in the research institute sector. Research in combination with teaching is just as common as pure R&D jobs in the higher education sector. For doctoral degree holders who work outside the research system, 63 per cent state that they have jobs with low or no R&D components, the most common tasks being advisory/consultancy functions, "other tasks" and clinical tasks.

Careers of doctoral degree holders – international perspectives

Many countries in Europe and elsewhere have experienced the same rapid increase in numbers of PhD candidates that Norway has seen. As a result of rapidly increasing numbers of PhD holders (around a 40 per cent increase from 1998 to 2006) in the OECD area, discussions about the careers of PhD degree holders, and particularly the careers of PhD holders outside the academic sector, have been high on the agenda for the OECD, the EU and the European University Association. A comparative project on the careers of doctoral degree holders has been carried out by the OECD and Eurostat, and this provides comparative statistical data on employment status, sectors of employment, occupations and degree of relevant work for doctoral holders in several OECD countries (the CDH project, Auriol 2010).

Unemployment rates for doctoral degree holders are generally low across all OECD countries, but temporary employment contracts are common in several countries. It is also a general trend that doctoral degree holders find work which is relevant and related to their doctoral degree work, but about 10 per cent of doctoral degree holders are employed in unrelated or lower qualified occupations (Auriol 2010; Neumann & Tan 2011). Most PhD holders work in the higher education sector in all countries, with this share ranging between 30 to 80 per cent of all doctoral holders in the OECD survey, followed by the government sector. The business enterprise sector mainly employs doctoral holders from the natural sciences and engineering.

In the UK, the organisation Vitae has carried out several surveys about the career aspirations and career trajectories of British PhD holders (Vitae 2011, 2012). Their survey of career paths is particularly interesting, as it utilises longitudinal data to track career development over time. This study indicates that the shares of PhD holders working in different employment clusters have been fairly static over

time. About 40 per cent of their respondents worked in higher education and 13 per cent worked in research outside the higher education sector, leaving almost 50 per cent of respondents who worked with non-research tasks in the private and public sectors. However, the survey does find a relatively high degree of mobility between these employment clusters.

Compared to OECD data, the Norwegian situation follows similar general trends with low unemployment rates, a high degree of relevant employment, and increasing numbers of PhD holders that work outside the higher education sector.

6.3.3 The relevance of qualifications for post-graduation jobs

To shed light on this issue, we have data from PhD candidates and PhD graduates. The PhD graduates' opinions are most important and we have survey data on two cohorts of doctoral degree holders, interview data with graduates from the eight case studies

PhD candidates have quite positive expectations about the relevance of their qualifications for post-graduation work: 86 per cent of them think their qualifications will be very, or to some extent, relevant for future work (Thune & Olsen 2009).

Data indicates that these expectations are not unrealistic, as 90 per cent of the informants in the cohort survey stated that they had obtained employment relevant to their doctoral degree, with no significant differences apparent between those who continue in research and those who do not (Kyvik & Olsen 2009).

Doctoral degree holders employed in the higher education sector or the research institute sector see the qualifications obtained during the PhD as having great relevance to their work, whereas only about half of doctoral degree holders who work outside these sectors feel the same. In general though, the assessment of relevance, and particularly of the competencies obtained through working on a PhD dissertation, is high across all types of jobs and sectors of employment (Kyvik & Olsen 2007, 2012).

In terms of the assessment of the most important areas of competencies achieved in PhD education, PhD candidates and PhD graduates have quite similar views (Thune & Olsen 2009, Kyvik & Olsen 2007). Both groups emphasise that the PhD period has given them training in systematic and analytic thinking, in scientific publishing and in how to handle complex problems (these were rated as the most important areas of competence achieved, by both groups).

Slightly more than half of the PhD candidates also think that they have gained competencies regarding the philosophy of science, research ethics, and thorough theoretical and methodological training. PhD candidates in the humanities and technology are somewhat less positive in their assessments of competencies acquired, and PhD candidates are more positive than PhD graduates in their assessments of these issues. Overall, PhD candidates who carry out their PhD work in a research group think that they acquire more competencies during the PhD period than PhD candidates who work mainly independently (Thune & Olsen 2009).

Fewer PhD candidates and PhD graduates think that the PhD period has given them competencies in terms of the management of R&D (25 per cent of candidates and 43 per cent of graduates feel they have gained these) or project planning/management (42 per cent of candidates and 58 per cent of graduates).

Doctoral degree holders think the most useful competencies acquired are those related to systematic and analytic thinking and training in how to handle complex problems (Kyvik & Olsen 2007). Doctoral degree holders who work in higher education and research institutes see greater relevance overall in the types of competence they have acquired, and also see more relevance of theoretical and methodological training, as well as training in academic publishing. Doctoral degree holders working outside of the research institutes and higher education sectors, also see high relevance of collaborating with industry during the PhD for post-graduation work.

Doctoral degree holders generally see the qualifications achieved during their PhD period as highly relevant, particularly those that they acquired while working with the PhD dissertation. PhD holders also consider the competence acquired when writing the thesis to be particularly relevant for post-

graduation work. A substantial group, 37 per cent, think that the PhD courses/taught part has also been relevant to a very high degree or a high degree, for their post-graduation work (Kyvik & Olsen 2007)

In the cohort survey (Kyvik & Olsen 2007), doctoral degree holders were asked about areas of competence that they think doctoral programmes should focus on more. The doctoral degree holders do not generally think that radical changes are needed; rather that certain elements should be strengthened. In general, doctoral degree holders think that generic skills should be strengthened, particularly project planning and research management (3 out of 4 agree with this) as should career planning (62 per cent) and collaborative research (67 per cent). More than 50 per cent of the respondents do not think that philosophy of science, theory, or research ethics should be further emphasised in doctoral training.

A recent survey conducted at the University of Oslo (2012) asked current PhD candidates about the perceived relevance of their PhD training in terms of different generic skills. According to the PhD candidates, further training in academic skills (academic writing, English for academics, "how to complete a PhD", literature search techniques etc., are the most important areas to strengthen. Interestingly, generic skills and skills focused on post-graduation work (such as entrepreneurship, team work, career planning, time and project management) are generally not seen as important areas to improve by the PhD candidates. Essentially, it seems that doctoral degree holders and PhD candidates have contrasting opinions about what content and qualifications should be strengthened in PhD education, with PhD candidates (at least at the University of Oslo) not particularly interested in more generic skills training and preparation for future work life, reflecting of course the two groups' most important demands "here and now".

The relevance of qualifications – supervisors' perspectives

The field visits to different institutions and PhD programmes reveal that the PhD candidates aim towards different career paths, from environments where candidates are frequently absorbed to the industry and business, to more typical, academically-oriented environments. While some PhD programmes, particularly technology programmes and programmes in economics and business administration, report to have well-developed relations for external cooperation and contacts on the recruitment side, future career paths are given little attention elsewhere. In general it appears that supervisors of PhD candidates in the eight cases are much more concerned about the quality of the qualifications obtained by candidates, than the relevance of those qualifications for post-graduation jobs. Most of the supervisors are concerned about keeping the most talented PhD candidates in their research group, are concerned about the lack of post-doctoral positions, and accept it is likely that the majority of the candidates will have to look for work outside the universities. Although some of the supervisors interviewed said that they do discuss career opportunities with their PhD candidates, the majority of them do not and do not see this as part of their role.

Some PhD programmes are quite fragmented and broad and candidates from these therefore tend to have very diverse career paths. This is the case at the PhD programme within The Oslo School of Architecture and Design, which produces both practice-oriented candidates who might return to work as professional architects, as well as candidates with an art history background who will likely go back to academia. A similar challenge in accommodating groups of PhD candidates with very different career ambitions is also faced in the PhD programme in medicine at the University of Oslo, and in all the engineering programmes. Within some of the health professions, integrated models for PhD and certified specialist training have emerged, the purpose being to provide a new generation of researchers who have both clinical and research skills, for instance the Integrated Clinical Specialist and PhD-training in psychology[17].

[17] http://org.uib.no/dobbelkompetanse/english_info.htm

6.4 Firm and employer perspectives on the relevance of PhD qualifications

Few international analyses have been conducted of firm recruitment strategies for staff with PhD qualifications. These studies show that firms prefer to recruit PhD candidates that not only have high level research skills, but also possess broader, more industry-relevant competencies (Lam 2000, Beltramo et al 2001, Cruz-Castro & Sanz-Mendes 2005, Garcia-Quevedo et al 2011). Such competencies are best developed, according to the firms, by collaboration between the PhD candidate and the firm during their PhD period (Borrell-Damian 2009; Cruz-Castro & Sanz-Mendes 2005, Garcia-Quevedo et al 2011).

On the demand side, there are several studies that indicate that even though firms see the value and relevance of PhD qualifications, this does not means that they will necessarily recruit PhD holders (Thune 2009). A survey among a sample of Norwegian enterprises and firms in 2001 indicated that doctorate holders were not highly sought-after in the non-academic labour market (Tvede 2002). Even though the enterprises selected for the survey were those with high R&D activity, only one in four believed that a doctorate holder would be able to add value in their work to a large degree beyond that of a person holding a master's degree, and only a minority specifically sought PhDs in their job advertisements.

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 (Garcia-Quevedo et al. 2011). In their empirical study of firm recruitment strategies, Garcia-Quevedo et al. 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. A finding of particular interest is what they define as a cumulative effect of PhD recruitment in firms: "once a certain number of PhDs have been reached, it is more likely that a firm will recruit new PhDs".

The apparent lack of relevant training for employment in industry might be explained as a mismatch between the content of research training programmes and the perceived needs of the employers and the labour market. However, several scholars have warned that sceptical employer statements regarding the usefulness of doctorate holders outside academia are too often accepted as providing objective information on the needs for PhD candidates and their skills (e.g. Enders 2002). Reasons to be vary of this approach include that there is a general shortage of people with a PhD in industry and that therefore managers often have little knowledge about the types of skill doctorate holders possesses. Actual recruitment practices are likely to be the best indicators of demand for PhDs in industry, as employers' statements about the relevance and interest in PhD recruitment does not necessarily mean that they will recruit candidates with PhD qualifications.

Since 2001 there has not been a systematic investigation into employers' assessment of the relevance of the PhD degree, or firms' recruitment practices in Norway. Statistical data show that number of doctoral degree holders who work outside academic institutions has risen over a 20 year period, even though the proportion of doctoral degree holders that work in the private sector has not grown in recent years; instead, increasing shares of PhD holders work in the public sector, particularly in the health sector and public administration. There has also been an increase in PhD holders in the business service sector.

There is not a lot of new data on firm recruitment strategies for PhD holders in Norway. A new study reported in Thune et al (2012) collected information from 20 Norwegian firms that hosted a collaborative research project with universities, involving one or several PhD candidates. The firms interviewed should, in theory, be amongst the most motivated firms to recruit PhD holders, since they already perform R&D and collaborate with universities and PhD candidates. The study found that, in general the firms see great value in including PhD candidates in collaborative research for the firm, and they also claim that the PhD candidates develop a range of competencies they would not necessarily get outside of collaborating with the firms. When asked about their interest in recruitment, the firms respond positively and even claim that they see the PhD period as a prolonged recruitment phase where they can "really test the abilities of the candidate". However, when asked whether they had recruited or had concrete plans to recruit the PhD candidates involved, surprisingly few were absolutely

positive, and they were generally hesitant. The main reason, according to the informants, is that recruitment strategies are shaped by other factors than supply of high quality PhD graduates.

Private enterprises, including R&D intensive firms that already have R&D staff employed, find that there are considerable costs and risks involved in research and innovation processes, and in many cases prefer to collaborate with outside partners rather than build up large, internal R&D facilities. Increased global competition and more the use of more collaborative innovation strategies by the most R&D intensive parts of industry might in fact deter firms from investing in in-house R&D capacity, by recruiting PhDs.

Due to this, demand-oriented tools that link PhD training to on-going firm R&D and innovation activities, such as the Industrial PhD programmes in Denmark and Norway[18], are seen as particularly important. Demand-oriented tools are thought to be more effective in building up competencies in firms, which over time is hoped to lead to increased recruitment of PhD holders and increased investments in R&D in firms.

Overall, the limited data that is available indicates that there is no reason at present for uncritical optimism concerning the increased industrial recruitment of PhD holders. However, if there is indeed a "threshold effect" in such recruitment trends, a small increase in the numbers of PhD candidates who find their way into the private sector, might lead to substantially higher recruitment levels of PhDs in the private sector over time. The current Norwegian data does, however, seem to indicate that the increased supply of PhDs in the economy has largely been absorbed in the education and health sectors, in public administration and in private services.

6.5 Assessments and recommendations

The terms of reference for the evaluation posed a question about the relevance of PhD education in Norway, in terms of whether it supplied society with appropriate and necessary competencies. The general answer to this question is a simple "yes": Norwegian PhD holders find work and the large majority of PhD holders claim that the qualifications they obtained are relevant for their work. The majority of PhD holders work in the public sector (two thirds), mainly in the education and health care sectors, as well as in the institute sector.

The shares of PhD holders in different sectors have been quite stable over the last decade, even though the number of PhD holders has risen significantly in this period. In terms of occupations, 65 per cent of PhD holders perform research as part of their job, while around 30-35 per cent of doctoral holders do not have research as their main work. There is, at present, a relatively good match between the career ambitions of PhD candidates and their actual career destinations.

Regardless of sector and occupations, doctoral degree holders find the competencies and knowledge obtained in the doctoral study period to be highly relevant for post graduate work, particularly the competencies acquired by carrying out their doctoral dissertation. However, PhD holders do think that generic skills, particularly communication and management skills, should be emphasised more during PhD studies.

The generally positive employment situation for doctoral degree holders in Norway does not mean that there are no concerns about future developments. Despite a policy goal to increase the distribution of doctoral level qualifications across the labour market, particularly the shares going into the private sector, the current trend is not positive. Lower shares to recruitment of PhD holders in the private sector must also be seen in light of the institute sector’s role in the Norwegian R&D system and the innovation profile of Norwegian firms, which shows comparatively low investments in R&D. However the situation needs to be monitored carefully, and the Ministry of Education, in collaboration with partners in industry, should look into factors that inhibit and promote recruitment of PhD graduates in the private sector.

[18] And similar initiatives like CASE, CIFRE, Marie Curie Actions.

Demand-oriented tools, such as the Industrial PhD scheme, would likely be more effective than supply-oriented tools to increase the recruitment of PhD holders in industry, but the long term effects of such schemes and whether or not the so-called "threshold effect" will come into play, needs to be carefully monitored by the Norwegian Research Council and the Ministry of Education.

Despite the limited changes in the distribution of PhDs across employment sectors over time, the absolute numbers of PhD holders working in the private sector has increased significantly, particularly in the service sector; the numbers (and shares) of PhD holders in the health sector and public administration have also risen. The statistical data therefore indicate that increasing numbers of PhD holders will work outside the research and higher education sectors, in a range of clinical, advisory and managerial jobs – jobs which require sophisticated scientific knowledge and analytical skills.

Due to this, there is a need for the higher education institutions to strengthen their focus on the different career trajectories for their PhD holders and consider how PhD qualifications are used in different occupations and sectors. A focus on the relevance of PhD qualifications for different sectors and occupations is an emerging agenda in Norwegian higher education institutions, due to the implementation of the National Qualification Framework, but neither PhD programme units nor supervisors have paid sufficient attention to the future careers of PhD graduates or how competencies are used in post-graduation employment, so far.

As far as we can see, most higher education institutions do not have strong policies or tools to enhance relevance. Very few institutions monitor the careers of their doctorate holders, involve prospective employers in PhD training, offer career guidance or have a systematic focus on generic skills at present. There are some notable exemptions, particularly the University of Bergen, but this is an area requiring more focus in most institutions.

- **Recommendation**: The higher education institutions should take steps to acquire more knowledge about the careers of their doctoral degree holders.

There are different ways that this can be achieved, for instance by using PhD graduate surveys; either cohort surveys or, even better, longitudinal graduate surveys (e.g. Vitae 2011). Higher education institutions should also consider using employer surveys or other means to collect information from employers of those with PhD qualifications.

- **Recommendation**: Generic skills training is another area where institutions need to develop better practices.

Generic skills seem to be offered as part of introductory courses or other general courses, which are often not seen as relevant by PhD candidates. At the same time, PhD graduates think that their programmes lacked a focus on generic skills. Strengthening generic skills, such as project management, leadership or communication skills, would be beneficial for post-graduation employment, both outside and inside the academic sector, but is also relevant for success in PhD training.

Generic skills' training is probably best provided through practice-based learning, rather than via courses at the start of the PhD training period, even though courses can be a supplement for PhD candidates and supervisors alike. The use of individual study plans, focusing on learning objectives and leaving room for different ways to acquire and document competencies, is probably a good way to strengthen the focus on generic skills, because generic skills training should ideally be closely related to learning scientific skills. Good integration of PhD candidates in active research communities, support from peers and colleagues and good supervision practices are all probably more important for developing generic skills than offering particular courses. This view is stressed by several groups in this evaluation.

- **Recommendation**: There have been positive developments and emerging good practices in how to promote generic skills in PhD education, and the national authorities, such as the Ministry of Education and Research, the Research Council of Norway and NOKUT, should take steps to gather information and promote emerging international best practices.

A final point that should be made about relevance is that the Norwegian doctoral training system (and not only the PhD education system) has comparative advantages which help to explain why PhD holders in Norway have high employment rates and most have relevant work. The system for PhD training in Norway is quite flexible and about 33 per cent of PhD candidates work during their PhD in the institute sector, the health sector or in non-degree granting higher education institutions. The presence of these different "training sites" for PhD candidates beyond the universities ensures the wider distribution and relevance of PhD competencies, for different occupations and sectors of society, but needs to be better coordinated.

- **Recommendation**: Collaboration between the institute sector, health sector and the higher education institutions in the provision of research training appears to be a benefit, supporting a flexible Norwegian doctoral training system; in light of this, even better mechanisms for collaboration between the sectors (but also the division of roles) should be promoted.

7 PhD education in Norway – performance, recommendations and emerging issues

7.1 The performance of the PhD education system in Norway

7.1.1 The PhD education system

Based on the data collected, experiences from other countries and input from international experts on PhD education, the overall assessment is that Norway has a high quality PhD education system. Compared to many other countries in the current economic climate, the PhD education system in Norway is well-funded, well-organised and offers very good working and learning conditions for PhD candidates, as well as good career prospects for PhD graduates. In many respects, Norway and the other Nordic countries, represent model PhD training systems when viewed in an international context.

The Norwegian system has grown rapidly, and has more than doubled the numbers of PhD candidates over the course of eight years, although the number of PhD candidates is still lagging behind some neighbouring countries like Sweden and Finland. The large growth in PhD candidate numbers has been accommodated without a substantial growth in academic positions.

Alongside the rapid growth in PhD candidate numbers, the higher education institutions have taken many steps to streamline PhD education by adapting common guidelines and principles for PhD training, and they have also promoted good practices in organisation and management of PhD training, which has also been a result of implementation of quality assurance systems at all levels of education.

As a result of many different developments over the last decade, PhD education in Norway has taken a definitive step towards becoming a more standardised PhD education system. Although PhD education is now more streamlined, a high degree of variety and adaptation to disciplinary characteristics and professional goals is necessary in PhD training, and Norwegian PhD education seems to be flexible enough to accommodate different approaches and goals within the one degree system.

In terms of output, the strong increase in PhD dissertations has not lead to a significant drop in completion rates or quality. Completion rates for each cohort have increased significantly over the last twenty years, although there are indications that this trend is levelling off, and current completion rates are still behind the governmental targets.

International committee members who assess the scientific quality of Norwegian PhD dissertations generally find their quality is of a high, international standard. There are variations across fields of science and higher education institutions in terms of the quality of output, but this must be expected in a diverse PhD education system.

Compared to other countries, in Norway, PhD education also takes place in university colleges. There is also diversity in research training sites outside the higher education institutions. The increasing number of higher education institutions offering PhD training and a high number of PhD candidates working outside the higher education sector will, in all likelihood, lead to increasing diversity in outputs, both in terms of scientific quality and in the career trajectories of PhD graduates.

This represents a challenge for quality control and efficiency in resource use, but also the strength of the Norwegian system, as it ensures that PhD education is adapted to different uses, both inside and outside the higher education institutions. Variation is not necessarily a sign of varied quality or performance, but may be an outcome of a complex situation where many different paths and approaches can lead to quality and relevance in PhD education; in this case, variation may be a sign of quality and relevance where differences are responses to disciplinary characteristics and societal needs.

7.1.2 Developments in PhD education at higher education institutions

The many positive developments that have occurred in Norwegian PhD education over the last decade are mainly due to the efforts made by the higher education institutions and the different academic

communities and disciplines in charge of PhD education; they have worked to develop better and more efficient PhD education, supported by initiatives from the Ministry of Education, the National Agency for Quality Assurance in Education and the Norwegian Association of Higher Education Institutions.

PhD education in Norway is, however, very much an area of responsibility for the higher education institutions and the different academic units within them. It does appear that PhD education has become much more of a strategic institutional concern over the last decade. As far as this evaluation has been able to document , PhD education is now seen by all higher education institutions as an integrated part of their education and research activities, and a priority area for the institutional leadership. At the same time, PhD education is closely connected to research activities in different disciplines and research environments, and a lot of the initiatives to improve the quality of PhD education have emerged through bottom up processes.

Over time, the higher education institutions have developed common regulations for the PhD degree, a clear division of responsibilities between institutional levels, arenas for coordination across faculties, institutes and PhD programs, and adequate levels of administrative support. Several institutions, and especially the older comprehensive universities that enrol the majority of Norwegian PhD candidates, have implemented institution-wide development projects to promote high quality PhD training.

As a result of these developments, we can see an increased professionalisation and standardisation in the provision of PhD education in all higher education institutions, for instance in the establishment of common and transparent admission procedures, common regulations of degree, programme and course requirements, common practices for supervisor arrangements, and different initiatives to promote a good learning environment for PhD candidates, adapted to the particular characteristics and needs of different fields of science.

The higher education institutions have fairly recently introduced measures to increase efficiency, and seem to be focusing more on managing and monitoring the candidates' progression and introducing mechanisms to ensure the timely completion of degrees. It is generally still too early to tell what the results of these initiatives will be, and they should be monitored closely, preferably to provide good individual-level data on all PhD candidates.

The relevance of PhD degrees for different occupations and labour markets is the area that has received the least attention from the higher education institutions, but this appears to be an emerging issue due to the implementation of the National Qualification Framework. Most institutions have little knowledge about where their PhD candidates work after they graduate from the PhD programmes and most institutions do not prepare candidates for different career prospects.

7.2 Assessment of performance on each dimension

As seen in the introductory chapter, the mandate of the evaluation was to assess the performance of Norwegian PhD education in terms of quality, efficiency and relevance. Based on international literature on research training and PhD education, we developed a set of dimensions for each criterion and discussed performance on each of these. Here we will briefly summarise the main observations on each dimension.

7.2.1 Quality of input

Overall, the recruitment situation of new PhD candidates is generally positive, but there are concerns about the recruitment situation of PhD candidates in natural science and engineering, both in terms of the qualifications of the applicants and the resource intensive recruitment procedures involved when PhD candidates are mainly recruited from abroad. Across all institutions, the majority of new applicants in STEM subjects are recruited from institutions outside Norway, and in certain PhD programmes up to 80 per cent of new PhD candidates are non-Norwegian.

Although international recruitment of PhD candidates is generally perceived to be positive, the universities and colleges are concerned about attracting the best candidates and that recruitment procedures are not too resource demanding for the higher education institutions. There is the risk that the PhD programmes within natural sciences and technology will not secure well qualified international

applicants unless thorough vetting of academic qualifications and "face-to-face" interviews with candidates is maintained and strengthened and the costs of such international recruitment procedures adequately compensated to higher education institutions.

The higher education institutions are also concerned about ensuring some degree of integration between master's and PhD level programmes; they are therefore experimenting with initiatives to motivate able master's students to continue in research careers and go straight into a PhD, via recruitment campaigns and research track initiatives, also mirroring international trends towards integrated master and PhD level programmes.

7.2.2 Quality of training and research processes

There is a high degree of concern about the quality and relevance of *PhD courses*, and efforts are being made to strengthen the quality of course portfolios. Quality of PhD courses is, however, the area of PhD training where PhD candidates and supervisors are the least satisfied, particularly in the social sciences and humanities.

Research schools obviously have an important role to play in the provision of PhD courses in a small country with highly dispersed PhD training. The national research school scheme has promoted the development of high quality PhD education, often linked to international research centres and world leading experts. However, relatively few PhD candidates are involved in these initiatives at present and there remains uncertainty about their status in the PhD education system.

Supervision is often held up as a problem area in PhD education. Good supervision is not only important for the PhD candidates, but of vital importance for the quality of research outputs in universities and other research institutions. It seems that most of the higher education units that provided information to this evaluation agree that supervision should be regulated and that PhD candidates should not depend on just one supervisor. Across the different institutions, team based supervision seems to be an emerging practice, not only in experimental sciences. Furthermore, most PhD candidates seem to offer a positive assessment of the supervision they receive. Despite this, there is a cause for concern that a considerable minority of PhD candidates claim that they receive less guidance than expected and that the quality of supervision is not satisfactory.

Creating positive *learning environments* for PhD candidates – by integrating PhD candidates in research groups in experimental sciences or networks of PhD candidates – is another approach pursued by many units with a PhD programme, and one being adapted to the needs and features of the different fields of science. This is highly recommendable, as PhD candidates who have the support of a larger research environment score better on all accounts.

On the issue of *internationalisation* in PhD education, data collected indicate that the number of PhD candidates who have a longer stay abroad may still be well below government targets and be decreasing in certain fields of science. However, this development has to be seen in light of increasing recruitment of international PhD candidates and the development of tools that bring internationally leading scientists to Norway, such as national and international research schools and centres of excellence. Participating in activities such as international conferences, networks, PhD courses and summer schools is seen as a more attainable and efficient way of allowing PhD candidates to get experiences of working in international research communities.

7.2.3 Quality of research output

Even though formal requirements for the volume of *doctoral dissertations* have been reduced since the previous evaluation in 2002, there is no empirical evidence to show that the quality of the research undertaken has decreased. There are, however, concerns about the decreasing numbers of papers and the contribution of PhD candidates in article-based PhD dissertations – a trend which is also seen internationally - particularly in the natural sciences and medical sciences.

The survey of foreign members of the assessment committees indicates that the majority of PhD theses (about 60 per cent) are of a very high standard, and additional comments made by the

respondents to this survey indicate that, in general, Norwegian PhD theses are of a high standard on the international level.

The results of the survey indicate that PhD theses in the social and agricultural sciences were rated significantly less favourably than average, but even in these fields about half of theses were regarded being "very good" or "excellent". The survey data also indicate that the quality of theses from the four old universities seems to be generally higher than those from other institutions.

In terms of the *quality of assessment procedures* for PhD theses, the overall impression from comments by international examiners is that the assessment procedures are rigorous and fair to the candidate, but that they lack the interactive feedback mechanisms central to scientific peer review.

7.2.4 Organisational efficiency

There has been a strong growth in the numbers of PhD candidates over the last ten years and this growth has been accommodated without any significant increase in the number of senior academic staff to supervise the PhD candidates. Since we also know that it is quite common to have more than one supervisor per PhD candidate, more professors must be supervising PhD candidates and be involved in researcher training than before. Although the ratio of PhD candidates to supervisors is not likely to be evenly distributed across institutions or fields of science, in general we argue that resources must be being used more efficiently than previously in Norwegian PhD education.

All the higher education institutions and the PhD programme units seem to have had a strong focus on efficiency in PhD education over the last decade and developed different tools to increase completion rates and efficiency in time-to-degree; tools that typically involve the introduction of more structure, milestones and more formal reporting throughout the PhD period. Making the responsibilities for the progression of PhD candidates clear is also seen as important, as is increasing collaboration between institutional levels to ensure that the different units within higher education institutions have the same agenda in promoting timely completion of degrees.

7.2.5 Efficiency in production of PhD degrees

Over the last decade, there has been a slight increase in the percentage of doctoral scholarship holders completing their doctorate: approximately 80 per cent of the PhD candidates starting their training after 2002 are likely to complete their PhD within 10 years (as discussed in Chapter 5.4.2). There are, however, differences between fields. Completion rates are significantly higher in the natural and medical sciences than in the social sciences. In the agricultural sciences and engineering, data may indicate a small decline in completion rates, and in the humanities the trend is the opposite with a strong increase in completion rates in the 2002-2003 cohorts.

In terms of the targets established by the government in the 2005 White Paper, data shows that in the governmental targets for PhDs being achieved within six years have not been met in any of the fields of science. However, in the humanities, the natural, medical and agricultural sciences, the field-specific completion targets have been achieved within eight years, while the completion rates in the social sciences and technology are far from being achieved.

Similarly, we find no real decrease in the average age of PhD graduates (at about 36 for PhD scholarship holders). The main reason that high average age represents a problem is that the time available for developing an academic career is cut shorter, as academic careers usually consist of further training during the post-doc period. A high age at completion might also be regarded as a disadvantage for a career in the private sector, as discussed in Chapter 5.

7.2.6 Relevance of PhD education

In general, the employment situation for PhD holders in Norway is very good. The majority of PhD holders work in the public sector (two thirds), mainly in the education and health care sectors. A significant number (18 per cent) work in the institute sector, classified as being partly public and partly private.

As it has been a policy goal to increase the distribution of doctoral level qualifications particularly in increasing shares in the private enterprise sector the current trend of decreasing relative shares of PhD holders in the private sector should be looked into more closely. Lower levels of recruitment of PhD holders in the private sector must be considered in light of role the institute sector plays in the Norwegian R&D system, and the innovation profile of Norwegian industry which shows comparatively low investments in R&D. We also know very little about the actual recruitment strategies used by Norwegian firms for R&D personnel and personnel with PhD qualifications.

The shares of PhD holders in different sectors have been quite stable over the last decade, even though the number of PhD holders has risen significantly in the same period. In terms of occupations, 65 per cent of PhD holders perform research as part of their job, while around 30-35 per cent of doctoral holders do not have research as their main work. At present there appears to be a relatively good match between the career ambitions of PhD candidates and their actual career destinations, which do not indicate a general problem with skills mismatch.

Regardless of sector and occupations, doctoral degree holders find the knowledge and skills obtained in the doctoral study period to be highly relevant for post-graduate work, and particularly the competencies acquired by carrying out the doctoral dissertation. PhD holders do however think that generic skills, particularly communication and management skills, should be emphasised more during PhD studies.

As far as we can see, most higher education institutions do not have strong policies or tools to enhance relevance. Very few institutions monitor the careers of their doctoral holders, involve prospective employers in PhD training, offer careers guidance or have a systematic focus on generic skills at present.

7.3 Emerging issues in PhD education in Norway

Although the general picture of Norwegian PhD education is highly positive, there remain issues that cause concerns and need to be addressed. Most of these are not grave problems that need immediate responses, rather they represent dilemmas or long-term challenges that might, over time, lead to an undesirable developments. These issues emerge in areas where there are tensions between goals and a thorough debate about these issues will be necessary for making long-terms strategies and policies concerning PhD education in Norway. We discuss four such issues, to promote such a constructive debate among key stakeholders about the future development of Norwegian PhD education.

7.3.1 Diversity of PhD training institutions and critical mass

Compared to most other countries, Norway has allowed university colleges to offer PhD training, not only universities and specialised university institutions. Norway also has great flexibility in research training sites and a large number of PhD candidates who spend the majority of their PhD training outside higher education institutions. Such diversity in the provision of PhD training certainly has some benefits, particularly for enhancing the relevance of PhD qualifications for different sectors of society and different occupations. On the other hand, a large number of relatively small PhD training units give rise to concerns about the quality, costs and efficiency of the system.

The evaluation mandate asked whether systematic differences in the quality of PhD training are apparent between types of higher education institutions. The terms of reference particularly point to potential concerns about the quality of PhD education in new PhD programmes in the university colleges and in the "new" universities. With reference to public documents and evaluation reports which question the quality of research training in these environments, the terms of reference also ask whether there is a problem with "critical mass" (too few PhD candidates in research communities that are too small), leading to lower quality of PhD training, in terms of courses and supervision.

In line with other trends on the European level and in the wake of the Bologna process (especially the Salzburg principles from 2005), the Norwegian central government has argued for the importance of researcher training communities of a certain minimum size, in efforts to achieve greater quality and efficiency. The Research Council of Norway's report on national research schools (2006) suggested

that these should have a minimum of 20 candidates and between four and eight advisors. A national commission on higher education (Ministry of Education and Research 2008) also argued that larger researcher training communities provide: better opportunities for critical reflection and debate, developing joint courses and providing candidates with access to larger networks (so they do not become too dependent on a supervisor), increased internationalization as a result of multiple contact surfaces, better rates of completion and shortened periods of study. The Ministry of Education and Science has now adopted a "critical minimum size" requirement that doctoral education should not take place in units of less than 20 candidates and eight staff. This rule is intended to ensure that doctoral programmes take place in research-active environments of good quality, which are able to consistently attract PhD candidates over time, and where there is sufficient scientific activity and breadth to give candidates a good framework for their own projects and training. Furthermore, the Ministry emphasises that the establishment of doctoral programmes must take place in areas where investment is economically justified. As mentioned earlier in this report, establishing research schools has been a key national effort over the past decade, offering a key tool to increase the quality of PhD education in small and fragmented programmes.

To shed light on the question of whether there are clear differences in the quality of PhD education across different institutional environments, the evaluation carried out field visits to eight PhD programmes. Programmes were selected partly based on the results of the institutional survey, the aim being to select programmes from different types of institutions and different disciplines. One of the key observations from these case studies was that PhD programmes in similar disciplines shared similar experiences and concerns, regardless of the type of institutions they were based at.

The differences in the quality of provision of PhD education, in terms of PhD programme structure, requirements, supervision and support, appear to be less striking than differences between fields of science. Problems with critical mass in PhD training seem to be a particular issue in offering relevant PhD courses, as smaller programmes report challenges in offering enough high quality PhD courses. Multi-institutional collaboration in networks or research schools obviously has a role to play here. However, we find no indications that supervision is more or less of a problem in new universities and university colleges than old universities; in contrast, the new universities and university colleges with PhD programmes that were visited often had very enthusiastic and ambitious supervisors, and the candidates were generally satisfied with their supervision. However, some of the new universities and university colleges do report challenges in the organisation and leadership of PhD education, and as yet there is limited information available about their completion rates, offering no concrete grounds for comparing the efficiency of different types of institutions and disciplines. In general, however, the survey of foreign members of PhD assessment committees indicates that dissertations from new universities might be of a lower quality than those from old universities.

Another possible concern is the relatively large share of PhD candidates who are not scholarship holders within the PhD training system, accounting for around 33 per cent of all PhD candidates. Unfortunately, we have limited information and knowledge about this group of candidates, other than the fact that most of them are found in medical and health sciences and in engineering. Having PhD candidates that are employed in the university colleges, hospitals and research institutes, is a good way of ensuring that PhD competencies are spread to different sectors of society and that PhD education is relevant for different societal needs. At the same time, there might be legitimate concerns about the PhD training experiences that these PhD candidates receive, and about their time-to-degree and the scientific quality of dissertations in this group. It is not possible to compare these different groups of PhD candidates as individual level data on all PhD candidates is lacking.

From the institutional survey, survey data from the University of Oslo and interviews with PhD candidates, there do not appear to be grounds for strong concerns about the quality of research training experienced by this particular group at present. The admission of PhD candidates and requirements in PhD programmes are stricter and each candidate is monitored more closely than in the past. Rights to supervision and access to courses and other resources have also improved. The PhD programme units report treating all PhD candidates similarly - at least in terms of formal procedures. Information from the University of Oslo indicates that PhD candidates who are not employed as

scholarship holders in the University of Oslo are equally satisfied with their PhD courses and supervision as PhD employed scholarship holders.

7.3.2 Pressure on time-to-degree and concerns about the potential negative impact on scientific quality

Another concern expressed by many supervisors is a perceived dilemma or tension between the demands to reduce time-to-degree and increased focus on generic skills training, and the potential negative impact this could have on the scientific quality of PhD work. This is a key debate in the natural sciences and medical sciences on the international level, and most informants we interviewed in these fields of science in Norway are concerned about the increasing level of requirements and decreasing time to do research. Time-to-degree has been cut dramatically over time and requirements for training and mandatory activities have increased. However these developments mainly occurred before the implementation of the PhD degree, meaning that these concerns reflect broader developments within doctoral education, and should not be seen as negative effects of the implementation of the PhD degree itself.

Supervisors are concerned that the time available for doing research work, particularly in time-consuming experimental fields of science, is becoming sub-critical and is negatively affecting research results and researcher training. Internationally and in Norway, there are indications that the volume of scientific work and the independence of the PhD candidates' work is being reduced, particularly in the natural sciences and medical sciences. The supervisors we interviewed support these concerns, stating that the more risky and ground-breaking research that used to be a key part of PhD studies is now being dropped because there is not enough time to conduct it. These supervisors see bringing in additional concerns, such as generic skills training, as a further watering-down of the PhD period for research training. In these fields supervisors often state that learning to become an independent researcher and doing more complicated and potentially risky and less incremental research projects occurs at the post-doc level. Consequently, increased numbers of post-doc positions are asked for, because research training for high quality scientific output requires additional time to develop broader skills and maturity as a researcher. Within the same fields of science and for the same reasons, supervisors also ask for better integration between the master's and PhD levels, to select, motivate and prepare potential PhD candidates for research work as early as possible.

Although, these concerns are legitimate, it is also important to bear in mind that increased focus on relevance does not entail that the structure and content of PhD education radically changes. Rather, the changes asked for is that the PhD programmes to being more explicit about what is learned during the PhD and how it can be applied in different settings and for different tasks.

7.3.3 Internationalisation in a global academic world

Efforts promoting internationalisation in PhD education have been built on the premise that Norway needs to be better integrated in the international research community, because international mobility and international collaboration are key tools to increase quality in PhD education and in research. At the same time, it is important to realise that Norwegian PhD education is already fairly international in several respects: there are an increasing share of international PhD candidates; doctoral dissertations in many fields of science are mainly written in English and published internationally; and, committee members who assess dissertations usually include at least one international member. These developments have, however, affected the different parts of the research system quite differently, which means that further developments to promote internationalisation need to include diverse foci and approaches.

Research is becoming a global activity and markets for academic labour are certainly global. Norway should have an obvious attraction in a global market for academic labour due to its good working conditions, but the scientific quality of the Norwegian research environments is also key to attracting the best international candidates – and for keeping them after they graduate. Data indicates that Norwegian higher education institutions, particularly within STEM subjects but also in economics, receive quite a lot of interest from international applicants. This is seen as a positive development, but

at the same time leads to both short term and long term challenges for academic communities in these fields. Addressing short term challenges mainly involves shortages of resources, whereas longer term impacts involve research and teaching practices in research communities where up to 80 per cent of PhD candidates and post-docs are non-Norwegian. In the humanities and social sciences, and in health and medical sciences, the situation is quite different, as PhD candidates are typically recruited from the same universities where they were master's students, and academic communities are fairly "national" in their orientation and publication practices.

It is within this context that the issue of internationalisation and international mobility needs to be unpacked and policy developed. Internationalisation does not only concern sending Norwegian PhD candidates overseas, it increasingly involves integrating international PhD candidates, post-docs and academic staff into Norwegian research communities. It is also about promoting high quality research communities that are able to attract the best international PhD candidates and keep them in Norway after they graduate. International collaboration in the provision of PhD training is also becoming a more significant issue, not only the mobility of candidates between institutions. A key question is whether a small country like Norway should educate PhD candidates in all scientific disciplines, or whether it is possible to promote arrangements where PhD candidates in some subjects are educated in other countries, or through multi-institutional arrangements. At the EU-level, there is currently a discussion about the portability of research grants across boundaries, which will be of relevance to this debate.

What seems clear from the data collected is that Norway needs to be thinking more broadly about how the internationalisation of PhD education is occurring and how it should be promoted – with a focus that goes beyond concerns for outward mobility and longer stays abroad.

7.3.4 The status of the PhD in the knowledge society

A final point to be made concerns the overall perspective about what the role of PhD education in society is, and what it should be. Answers to this question touch directly on the desired balance (and probably trade-offs) between the criteria of efficiency, quality and relevance in PhD education. Current Norwegian policy, reflecting the on-going debate at the European level, suggests that PhD education is not only intended to train the next generation of academic researchers, but must be seen as advanced training aimed at preparing people for different occupations, sectors and roles in society.

With this perspective in mind, having a relatively high number of PhD holders and a relatively good distribution of PhD holders outside the academic sector are steps that would appear to be necessary in fulfilling these aims and which are in line with the further development of the knowledge society. Ensuring that PhD graduates are seen as relevant by employers outside the academic sector and that the competencies PhD candidates acquire match the needs of work life is an important job for higher education institutions, because non-academic employers stress that PhD graduates are attractive when they possess these broader competencies in addition to excellent scientific skills and good contacts in academic communities.

In Norway, the number of PhD holders still lags behind other countries such as Finland and Sweden, but the absorption of graduated PhDs into the labour market is generally very good. With the knowledge society perspective in mind, further growth in the number of PhD holders is often seen as justified in order to increase competitiveness. At the same time, the Norwegian economic structure and current levels of R&D investment in Norwegian firms might indicate a mismatch between the demand and supply of PhD graduates that will be exacerbated if growth in the number of PhDs is intensified, at least in the short term. On the other hand, the public sector, particularly the health sector and public administration, have received higher levels of competence and changes in recruitment and the career trajectories of PhD holders are likely to change due to increased supply.

Higher numbers of PhD graduates will inevitably lead to greater debates concerning the devaluation of PhD degrees, skills mismatch and patterns of temporary employment. However, transitional unemployment and temporary employment for PhD holders should not be seen as a failure of the PhD education system, but as one part of broader transitions taking place in the academic labour market, where the status of the PhD in the academic career system is fundamentally changing. This represents

perhaps the greatest challenge for PhD education today, and certainly one that reflects the increasing challenges involved in balancing quality, efficiency and relevance in PhD education.

7.4 Recommendations for areas of improvement in Norwegian PhD education

Overall recommendation

In light of the overall positive assessment of the Norwegian PhD system, the many positive developments that have occurred and the processes that are underway in the higher education institutions, a general recommendation is to build on the positive developments implemented over the last decade. In some instances, for instance concerning efficiency and quality of output in new providers of PhD education, it might still be too early to tell what impact these initiatives have had based on macro data, and steps should be taken by the **higher education institutions** to continue monitoring developments and promoting learning across institutions.

The **Norwegian Association of Higher Education Institutions** has played a vital role in promoting learning and should continue to do so, in collaboration with **NOKUT** and the **Ministry of Education and Research**. In many respects Norway has unique data on PhD education and also has a well-developed PhD education system. Collaboration with international organisations such as the European University Association or the European Commission to further promote learning and quality development in PhD education is recommended, as many countries and higher education institutions are facing and handling the same challenges in doctoral education.

As seen in the concluding parts of chapters 4, 5 and 6, we have made several recommendations for the national authorities and the higher education institutions responsible for PhD education, about areas that could be improved. To conclude, our recommendations are summarised:

To promote input quality

- We recommend improving practices in international recruitment at the PhD level, and finding ways of reducing the administrative burden of international recruitment of PhD candidates (**Higher education institutions, NOKUT**)
- We recommend that steps are taken to investigate the effects of initiatives that promote the recruitment of master's students and better integration between master's and PhD levels (**Higher education institutions**).

To promote quality of PhD courses

- To the **higher education institutions**, the evaluation recommends the use of individual study plans at the PhD level, when the programme units have an operational PhD programme board that can assess each study plan in light of programme requirements.
- To the **Research Council of Norway**, the evaluation recommends that the present national research school programme is evaluated, focusing on the added value of research schools not only for the candidates who belong to them, but also focusing on the broader impact of research schools.
- To the **Ministry of Education and Research**, the evaluation recommends that a national research training network scheme is implemented to supplement the research schools, and to provide basic funding for national PhD courses and research training networks that can promote further collaboration between higher education institutions in the provision of PhD courses.

To promote better supervision and support for PhD candidates

- To the **higher education institutions,** the evaluation recommends that supervisor training is made a formal requirement for being a main supervisor of a PhD candidate, and that supervisors and prospective supervisors are given training and professional development opportunities.

- To the **higher education institutions**, to create good and active learning environments for PhD candidates we recommend that they distribute new PhD positions to allow for concentration of resources in research groups, based on institutional strategies and prioritised research areas.
- Ensuring access to resources to finance participation in national and international research networks and communities should be a goal for all PhD candidates. Due to this, resources to cover participation in international networks/conferences should be specified for all PhD candidates (**Research Council**, **Ministry of Education** and **higher education institutions**).

To promote quality of PhD dissertation and the thesis evaluation system

- The **higher education institutions** through the **Norwegian Association of Higher Education Institutions** should look into the possibilities of changing regulations to allow candidates to take account of committee members' comments and advice on their thesis, before publication, also in dissertations that formally pass.
- A review of the present regulations for the assessment of PhD dissertations should also consider removing the trial lecture in its present form.

To promote organisational efficiency and completion rates

- It is of vital importance that the **academic supervisors** acknowledge that they have a responsibility for following up their PhD candidates in such a way that the thesis can be completed on time, as their attitudes to this issue likely has an effect on PhD candidates' completion. Incentive schemes implemented by **higher education institutions** might be more effective if they target academic supervisors rather than PhD candidates.
- To monitor the completion rates of all PhD candidates, the **higher education institutions** should develop individual-level data on the whole PhD candidate group that is good enough to allow for monitoring and internal evaluation of the initiatives implemented to increase efficiency. The institutions need to develop better indicators on net time-to-degree, including leave of absence data, and in particular need better data on completion rates for the relatively large group of PhD candidates who are not scholarship holders.
- The **Ministry of Education and Research** should have a role in ensuring common standards in data registration and standard ways of calculating completion rates and time to degree.
- **Higher education institutions** should set out clear requirements for employers of externally employed PhD candidates on their admission and establish better communication between the employers of external PhD candidates, the institutions and the PhD programmes where PhD candidates are enrolled.

To promote relevance

- **Higher education institutions** should take steps to acquire more knowledge about the careers of their doctoral degree holders, for instance by using PhD graduate surveys; either through cohort surveys or longitudinal graduate surveys. **Higher education institutions** could also consider using employer surveys or other means to collect information from employers of those with PhD qualifications.
- Generic skills training is another area where **higher education institutions** need to develop better practices. The use of individual study plans focusing on learning objectives, leaving room for different ways to acquire and document competencies, is probably a good way to strengthen the focus on generic skills in PhD programmes.
- Good integration of PhD candidates into active research communities, support from colleagues, and good supervision practices are important in developing candidates' generic skills.

- There are good practices promoted internationally, and the **Ministry of Education and Research** along with the **Norwegian Association of Higher Education Institution** should promote learning and good practices in generic skills training at PhD level.
- Collaboration between the institute sector, health sector and the higher education institutions in the provision of research training is a benefit offered by the flexible Norwegian doctoral training system, and better mechanisms for collaboration between these sectors (but also the division of roles) should be promoted. The **Ministry of Education and Research** should have a coordinating role here.
- The **Ministry of Education and Research**, in collaboration with partners in the private sector, should look into factors that inhibit and promote the recruitment of PhD graduates in the private sector to develop better and more effective tools.

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Appendix 1: Interviews and informants

Interviews with key stakeholders

- **Ministry of Education and Research:** Bente Lie, Anders Trodal, Rolf I. Larsen
- **Research Council of Norway**: Hege Torp
- **Norwegian Association of Higher Education Institutions:** Ola Stave**,** Rakel Christina Granaas, Ragnar Lie
- **Norwegian agency for quality assurance in education:** Tove Blytt-Holmen, Stein Erik Lid, Terje Mørland, Ole-Jacob Skodvin
- **The Federation of Norwegian Professional Associations:** Tove Storrødvann, Ivar Munch Clausen
- **Norwegian Association of Researchers:** Sigrid Lem
- **Association of doctoral organisations in Norway:** Ricardo Rosario, Stine Huseby
- **The Norwegian Society of Graduate Technical and Scientific Professionals :** Erik Strøm
- **Confederation of Research Institutes[19] (Forskningsinstituttenes fellesarena):** Gunnar Jordfall
- **The Confederation of Norwegian Enterprise:** Are Turmo
- **Association of medical doctors in scientific positions[20] (Forening for leger i vitenskapelige stillinger):** Kirsti Ytrehus
- **Liaison Committee between the Central Norway Regional Health Authority (RHA) and the Norwegian University of Science and Technology (NTNU):** Helge Klungland

Interviews with management at the universities

- **University of Oslo:** Berit Hyllseth
- **Norwegian University of Science and Technology:** Kari Melby, Ragnhild Lofthus
- **University of Bergen**: Svein Åge Dahl
- **University of Tromsø**: Curt Rice, Sølvi B. Anderssen
- **University of Stavanger**: Kristoffer Henrichsen
- **University of Life Sciences**: Kari Moxnes
- **University of Nordland:** Jan Atle Toska, Petter Øien
- **University of Agder**: Dag Aasland, Simone Heinz, Øyvind Nystøl

Interviews at selected PhD programmes

- **Norwegian University of Science and Technology, Faculty of Information Technology, Mathematics and Electrical Engineering**: PhD programme in electronics and telecommunication: 4 supervisors, 7 PhD candidates, 2 PhD graduates and 1 PhD coordinator
- **University of Agder, Faculty of Economics and Social Sciences**: PhD programme in International Management: 4 Supervisors, 4 PhD candidates, 2 PhD graduates, 1 PhD coordinator
- **Oslo School of Architecture and Design, PhD programme:** 1 Supervisor, 2 PhD candidates, 1 PhD coordinator
- **University of Tromsø, PhD programme in theoretical linguistics:** 2 supervisors, 1 PhD candidate, 1 PhD coordinator

[19] Our translation as we were not able to find an official English name.
[20] Cf. Footnote 19

- **Vestfold University College, PhD programme in nano and micro technology:** 4 supervisors, 7 PhD candidates, 3 PhD coordinators/leadership
- **Norwegian School of Economics, PhD programme:** 3 supervisors, 3 PhD candidates, 2 PhD coordinators
- **University of Oslo, PhD programme in medicine and health sciences:** 4 supervisors, 5 PhD candidates, 4 PhD graduates, 1 PhD coordinator
- **University of Stavanger, PhD programme in Petroleum Technology:** 5 supervisors, 5 PhD candidates, 1 PhD coordinator

Appendix 2: Survey of providers of PhD programmes (in Norwegian)

Evaluering av ph.d.-utdanningen i Norge

Dokumentasjon og selv-evaluering fra universiteter og høgskoler som tilbyr ph.d.-utdanning

Spørreundersøkelsen utgjør en sentral del av evalueringen av ph.d.-utdanningen i Norge. Evalueringen utføres av NIFU på oppdrag av Norges Forskingsråd.
Hvert fakultet ved universitetene samt alle høgskoler som tilbyr ph.d.-utdanning er bedt om å fylle ut skjemaet. Alle spørsmål gjelder samlede tall og samlede vurderinger fra hvert fakultet på universitetet, og samlet for hele universitetet/høgskolen. Du har fått tilsendt lenken til skjemaet fordi du er utnevnt som kontaktperson for et fakultet ved universitetene eller for en høgskole som tilbyr doktorgradsutdanning.
Skjemaet består av seks deler med spørsmål knyttet til ulike sider ved ph.d.-utdanningen:

1) Rekruttering og opptak på ph.d-utdanningen
2) Organisering og innhold i ph.d.-utdanningen
3) Veiledning og oppfølging av ph.d.-kandidater
4) Ph.d.-kandidatenes forskning
5) Avhandlingen og vurdering av doktorgrader
6) Egen-evaluering av kvalitet, effektivitet ogrelevans av ph.d.-utdanningen

Det vil ta tid å finne fram relevante data samt gjennomføre konsultasjon med berørte parter ved fakultetet/høgskolen, og vi anbefaler at dere starter arbeidet snarest.

Skjemaet vil være åpent i seks uker og dere kan gå inn og ut av skjemaet så mange ganger dere vil (men husk å ikke trykke på «Avslutt»-knappen på siste siden før skjemaet er ferdig utfylt). Det betyr at dere kan gjøre ferdig deler av undersøkelsen, lukke den og gå inn seinere. Surveyen vil da automatisk åpne seg på den siden dere sist var inne på. Det er også mulig å gå tilbake i skjemaet og endre svarene.
Du kan laste ned skjemaet i pdf-versjon for intern distribusjon og for bruk som «kladd» før innsendingav svar:
Hvis dere har spørsmål vedrørende innholdet i skjemaet eller utfylling av skjemaet kan de rettes til prosjektleder for evalueringen ved NIFU: Taran Thune, taran.thune@nifu.no
For tekniske spørsmål om skjemaet vennligst kontakt Erica Waagene på erica.waagene@nifu.no
Kontaktperson for evalueringen i Norges Forskningsråd er Birgitta Szanday Bøhn, bsb@forskningsradet.no
Frist for innsending av skjemaet er **fredag 11.11.11.**

På forhånd takk for hjelpen!

1. Rekruttering og opptak av nye ph.d.-kandidater

Q1: Hvor mange nye ph.d.-kandidater ble tatt opp på fakultetets/høgskolens ph.d.-programmer i 2010?

Antall nye ph.d.-kandidater: ☐

Q2: Hvor mange stipendiatstillinger lyste fakultetet/høgskolen ut i 2010?

Antall utlyste stipendiatstillinger: ☐

Q3: Hvor mange søkere fikk i gjennomsnitt hver utlyst stipendiatstilling i 2010?

Gjennomsnittlig antall søkere: ☐

Q4: Hvor mange av ph.d.-kandidatene som ble tatt opp i 2010 hadde utdanningen sin fra henholdsvis:

	Antall
eget lærested?	
annet lærested i Norge?	
lærested i utlandet?	

Q5: I hvilken grad stemmer de følgende utsagn med rekrutteringen av ph.d.-kandidater ved fakultetet/høgskolen?

	I høy grad	I noen grad	Verken/eller	I liten grad	Ikke i det hele tatt
Vi får for få søkere til utlyste stipendiatstillinger	○	○	○	○	○
Mange søkere har ikke relevant utdanningsbakgrunn	○	○	○	○	○
Mange søkere har ikke gode nok kvalifikasjoner	○	○	○	○	○
Vi har jevnt over mange relevante søkere til utlyste stillinger	○	○	○	○	○

Søknadsmassen er for ensidig sammensatt kjønnsmessig	○	○	○	○	○
Det er for få søkere med utdanning fra norske læresteder	○	○	○	○	○
Vi lyser alltid ut stipendiatstillinger internasjonalt	○	○	○	○	○
Vi har en overvekt av utenlandske ph.d.-kandidater	○	○	○	○	○
Vi praktiserer kjønnskvotering ved innstilling av søkere til stipendiatstillinger	○	○	○	○	○

Q6: Hvor mange av ph.d.-kandidatene som var opptatt på ph.d.-programmene i 2010 har fakultetet / høgskolen som sin hovedarbeidsplass (dvs. har mer enn 50% stilling)?

Antall: ☐

Q7: Hvor mange av ph.d.-kandidatene som var opptatt på ph.d.-programmet i 2010 har 4-årige avtaler med arbeidsplikt?

Antall: ☐

2. Organisering og innhold i ph.d.-utdanningen

Q8: Hva slags stilling har personen med det overordnede lederansvaret for ph.d.-utdanningen ved fakultetet/høgskolen?

☐

Q9: Er doktorgradsutdanningen ved fakultetet/høgskolen organisert i ph.d.-programmer?

○ Ja ○ Nei

Q10: Er det opprettet en programkomite for doktorgradsutdanningen på fakultetsnivå/høgskolenivå?

○ Ja ○ Nei

Q11: Hvor mange årsverk er avsatt til administrasjon av ph.d.-utdanningen på fakultetsnivå/høgskolenivå?

Antall årsverk: ☐

Q12: Hvor mange ph.d.-programmer tilbys ved fakultetet/høgskolen?

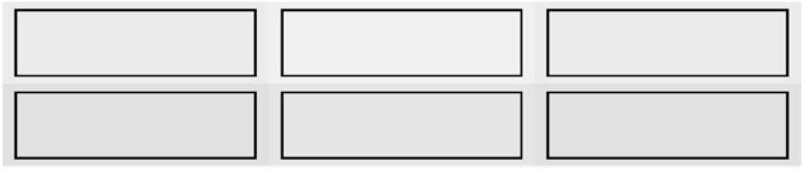
Antall ph.d.-programmer: ☐

Q13: Hvis programmene er ytterligere inndelt i spesialiseringer, hvor mange linjer/studieretninger finnes totalt ved fakultetet/høgskolen?

Antall linjer/studieretninger: ☐

Q14: For hvert av ph.d.-programmene vennligst oppgi følgende informasjon:

Navn på ph.d.-program	Antall kandidater som er opptatt på programmet (totalt antall kandidater per september 2011)	Totalt antall kandidater uteksaminert i perioden 2006-2010



Q15: Er ph.d.-utdanningen ved fakultetet/høgskolen organisert i form av forskerskoler?
Flere kryss er mulig.

- ☐ Ja, vi vi deltar i en (eller flere) institusjons- eller fakultetsinitiert forskerskole
- ☐ Ja, vi deltar i en (eller flere) nasjonal forskerskole
- ☐ Ja, vi deltar i en (eller flere) internasjonal/nordisk forskerskole
- ☐ Nei

Note: if you have answered/chosen none of the following items: [1, 2, 3] in question 15, skip the following question

Q16: Oppgi navn på alle forskerskoler fakultetet/høgskolen inngår i. Kryss også av for hvilken type forskerskole hver av dem er.

Navn	Institusjonell	Nasjonal	Internasjonal
	○	○	○
	○	○	○
	○	○	○
	○	○	○
	○	○	○
	○	○	○
	○	○	○
	○	○	○
	○	○	○
	○	○	○

Note: if you have answered/chosen none of the following items: [1, 2, 3] in question 15, skip the following question

Q17: Hvor mange av ph.d.-kandidatene ved fakultetet/høgskolen deltar i forskerskolen/e?

Antall: ☐

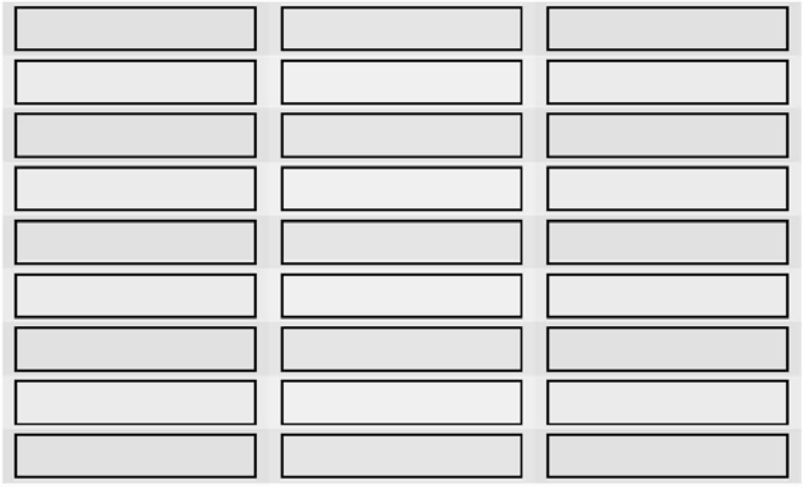
Note: if you have answered/chosen none of the following items: [1, 2, 3] in question 15, skip the following question

Q18: I hvilken grad stemmer følgende utsagn vedrørende forskerskolen?

	I høy grad	I noen grad	Verken/eller	I liten grad	Ikke i det hele tatt
Forskerskolen gir kandidatene tilgang til faglige nettverk	○	○	○	○	○
Forskerskolen bidrar til internasjonalisering	○	○	○	○	○
Forskerskolen gir kandidatene innsikt i tverrfaglige problemstillinger	○	○	○	○	○
Forskerskolen tilbyr relevante ph.d.-kurs av høy kvalitet	○	○	○	○	○
Forskerskolen gir kandidatene tilgang til kvalifiserte veiledere	○	○	○	○	○
Forskerskolen gir kandidatene tilgang til utstyr og ressurser	○	○	○	○	○
Forskerskolen gir kandidatene et godt sosialt miljø	○	○	○	○	○
Forskerskolen fører til god gjennomstrømning	○	○	○	○	○
Forskerskolen bidrar til større samfunns-/arbeidslivsrelevans	○	○	○	○	○

Q19: Hvor stort er omfanget av opplæringsdelen ved fakultets/høgskolens ph.d.-programmer?

Program	Antall studiepoeng obligatoriske kurs	Antall studiepoeng valgfrie kurs



Q20: Hva slags kurs er vanligvis obligatoriske?
Flere kryss er mulig

☐ Vitenskapsteori ☐ Forskningsetikk ☐ Forskningsmetode ☐ Fagspesifikke kurs
☐ Laboratoriekurs ☐ Andre kurs, angi hvilke

If you have chosen "other", please specify:

Q21: Beskriv evt. andre obligatoriske aktiviteter enn kurs i boksen nedenfor

Q22: Har ph.d.-kandidatene anledning til å ta valgfrie kurs utenfor lærestedet?

○ Ja ○ Nei

Q23: Tilbys ph.d-kandidatene opplæring i generelle/overførbare ferdigheter som f.eks. prosjektledelse, forskningsledelse, kommunikasjon/formidling el. som en obligatorisk del av ph.d.-utdanningen?

◯ Nei ◯ Ja, spesifiser

If you have chosen "other", please specify:

3. Veiledning av ph.d.-kandidater

Q24: Er det nedfelt retningslinjer for omfanget av veiledning (antall timer) hver ph.d.-kandidat opptatt på ph.d.-programmene skal ha?

◯ Ja ◯ Nei

Q25: Fører fakultetene/høgskolene oversikt over hvor mye veiledning ph.d.-kandidatene mottar?

◯ Ja ◯ Nei

Q26: Tilbys veiledere av ph.d.-kandidater opplæring?

◯ Nei ◯ Ja, spesifiser hva slags opplæring

If you have chosen "other", please specify:

Q27: Hvor mange av ph.d.-kandidatene som er opptatt på programmet (2010-2011) har flere enn én formell veileder(dvs. studenten har én eller flere formelle medveiledere)?

Antall med formelle medveiledere:

Q28: Forekommer det at ph.d.-kandidatene har medveiledere utenfor lærestedet?

◯ Ja ◯ Nei

Q29: Forekommer det klager på veiledningen som tilbys?

◯ Ja, jevnlig ◯ Ja, av og til ◯ Nei, aldri

Q30: Hvordan følges evt. klager på veiledning opp?
Flere kryss er mulig

☐ Bytte av veileder ☐ Opplæring av veileder ☐ Bruk av medveileder ☐ Annet, spesifiser

If you have chosen "other", please specify:

4. Ph.d.-kandidatenes forskning

Q31: I hvilken grad vektlegger fakultetet/høgskolen ved opptak av ph.d.-kandidater at tema for ph.d.-kandidatenes forskningsprosjekter er forankret i fagstrategier eller prioriterte forskningstema?

○ I høy grad ○ I noen grad ○ Verken/eller ○ I liten grad
○ Ikke i det hele tatt

Q32: Vektlegger faktultetet / høgskolen integrasjon av ph.d.-kandidater i forskergrupper og/eller forskningssentre?

○ Nei
○ Ja, beskriv kort hvordan dette foregår i boksen nedenfor

Q33: Beskriv her:

Q34: Har fakultetet/høgskolen utviklet prosedyrer for å følge opp kandidatenes framdrift underveis i ph.d.-løpet, som framdriftsrapportering, midteveisevaluering o.l.?

○ Nei ○ Ja, beskriv kort hvilke i boksen nedenfor

Q35: Beskriv her:

Q36: Følger fakultetet/høgskolen opp framdriften til eksterne ph.d.-kandidater (som er opptatt på programmet men ikke ansatt ved høgskolen/fakultetet) på lik linje som egne stipendiater?

- ○ Ja
- ○ Nei, framdriften til eksterne kandidater følges ikke opp
- ○ Nei, framdriften til eksterne kandidater følges opp på en annen måte. Vennligst spesifiser

If you have chosen "other", please specify:

Q37: Hva gjør fakultetet/høgskolen hvis vesentlige avvik fra fremdriften rapporteres?
Flere kryss er mulig

- ☐ Gir tettere oppfølging av framdriften
- ☐ Følger opp ph.d-kandidatens veileder
- ☐ Annet, spesifiser
- ☐ Gir advarsel til ph.d.-kandidaten
- ☐ Avslutter avtalen

If you have chosen "other", please specify:

Q38: Har fakultetet/høgskolen incentivordninger for å få kandidatene til å gjennomføre ph.d.-graden på normert tid?

○ Nei ○ Ja, spesifiser

If you have chosen "other", please specify:

Q39: Hvis ph.d.-kandidatene ikke greier å ferdigstille ph.d.-arbeidet innen den tiden de har til rådighet (avhenger av type finansiering), tilrettelegger fakultetet/høgskolen for at ph.d.-kandidatene kan sluttføre arbeidet sitt?
Flere kryss er mulig

- ☐ Ja, vi gir tilleggsfinansiering eller fullføringsstipend finansiert over institusjonens grunnbudsjett
- ☐ Ja, vi tilbyr ph.d.-kandidater som ikke er ferdig midlertidig arbeid som forskningsassistent, universitetslektor e.l.
- ☐ Ja, vi skaffer til veie eksterne prosjektmidler slik at stipendiaten kan sluttføre arbeidet sitt
- ☐ Ja, vi lar stipendiatene beholde arbeidsplass og gir veiledning men gir ikke lønn eller stipendmidler
- ☐ Ja, men vi praktiserer en øvre grense for hvor lenge ph.d.-kandidaten kan være registrert i programmet etter normert tid
- ☐ Nei

Q40: I hvilken grad tilrettelegger fakultetet/høgskolen at ph.d.-kandidatene får et faglig utenlandsopphold i løpet av doktorgradsstudiene?

○ I høy grad ○ I noen grad ○ Verken/eller ○ I liten grad
○ Ikke i det hele tatt

Q41: Hvor mange av ph.d.-kandidatene ved fakultetet/høgskolen hadde utenlandsopphold i løpet av 2010?

	Antall
utenlandsopphold på minst tre uker, og inntil 2 mnd.:	
utenlandsopphold på 2-5 mnd:	
utenlandsopphold på mer enn 5 mnd.:	

5. Avhandlingen og vurdering av avhandlinger

Q42: Hvor mange av avhandlingene som kandidatene leverte i 2010 var henholdsvis artikkelbaserte og monografier?

	Antall
Artikkelbaserte avhandlinger i 2010:	
Monografier i 2010:	

Q43: Finnes det skriftlige retningslinjer for artikkelbaserte avhandlinger med tanke på antall artikler, om artiklene må være publiserte og samforfatterskap?

○ Nei ○ Ja, spesifiser i boksen nedenfor

Q44: Spesifiser her:

Q45: Hvor stor andel av avhandlingene som ble levert i løpet av 2010 ble skrevet på engelsk (eventuelt på andre fremmedspråk)?

Andel (%): ☐

Q46: Retningslinjene ved mange institusjoner fastslår at tiden fra kandidaten innleverer avhandlingen til disputas ikke skal overstige tre måneder. Oppdaterte tall fra NIFU viser at gjennomsnittstiden fortsatt er ca 6 mnd, men det er stor variasjon mellom fagområder.

Hvis dette gjelder din institusjon, hva mener du er hovedgrunnen til at perioden fra kandidaten leverer avhandling til disputas er så lang?
Flere kryss er mulig

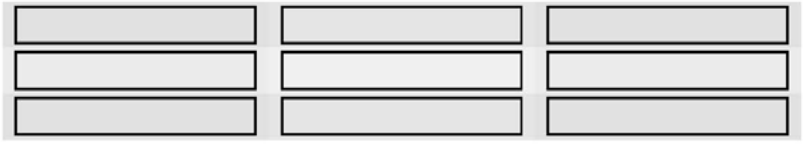
- ☐ Ikke relevant for oss
- ☐ Det er vanskelig å få etablert en vurderingskomite
- ☐ Det tar tid å få behandlet komiteoppnevnelsen på institutt/fakultet
- ☐ Det tar tid å beramme et tidspunkt for disputas
- ☐ Det er mer arbeidskrevende å vurdere en doktorgradsavhandling enn antatt
- ☐ Komitéene er ofte uenige
- ☐ Avhandlingen returneres ofte til kandidaten for ytterligere arbeid før disputas kan gjennomføres
- ☐ Annet, spesifiser

If you have chosen "other", please specify:

Q47: Vennligst oppgi navn, institusjonstilknytning og kontaktinformasjon på alle eksterne medlemmer fra læresteder utenfor Norge som satt i vurderingskomiteer for ph.d.-graden i 2010.

Vi trenger disse opplysningene for å gjennomføre en spørreundersøkelse til utenlandske komitemedlemmer i løpet av vinteren 2011. Vi vil kontakte institusjonene med sikte på å bestille en særskilt rapport fra FS. Dersom du ikke får plass på skjemaet nedenfor, kan du sende en fullstendig oversikt direkte til taran.thune@nifu.no

Navn	Institusjon	Epostadresse



6. Selv-evaluering av ph.d.-utdanningen

Effektivitet

Q48: Vi vil gjerne vite noe om hvordan fakultetet/høgskolen vurderer effektiviteten i doktorgradsutdanningen, sett i lys av antall kandidater som uteksamineres (gjennomføringsgrad) og kandidatenes gjennomføringstid de siste 5 årene.

Hvor enig er du i følgende utsagn?

	Helt enig	Delvis enig	Verken/eller	Noe uenig	Helt uenig
Vi er godt fornøyd med gjennomføringsgraden	○	○	○	○	○
Vi har redusert frafall fra programmet de siste årene	○	○	○	○	○
Vi har et problem med frafall underveis i programmet	○	○	○	○	○
Gjennomføringstiden har gått ned blant våre kandidater de siste årene	○	○	○	○	○
Vi har fortsatt behov for å korte ned på tidsbruk blant våre kandidater	○	○	○	○	○

Q49: Har det vært igangsatt eller planlagt spesielle tiltak for å sikre/øke effektiviteten?

○ Ja, igangsatt ○ Ja, planlagt ○ Nei

Note: if you have answered/chosen item [3] in question 49, skip the following question

Q50: Beskriv kort hva som har vært gjort for øke gjennomføringsgraden, minske frafall og lang gjennomføringstid?

Note: if you have answered/chosen item [3] in question 49, skip the following question

Q51: Hvordan vurderer høgskolen/fakultetet effekten av evt. tiltak for å øke effektiviteten?

○ Betydelig effekt ○ Moderat effekt ○ Liten effekt ○ Ingen effekt
○ Vet ikke/for tidlig å si

Kvalitet

Q52: Hvordan vurderer fakultetet/høgskolen kvaliteten i doktorgradsutdanningen?

Hvor enig er du i følgende utsagn?

	Helt enig	Delvis enig	Verken/eller	Noe uenig	Helt uenig
Vi er fornøyd med kvaliteten på doktorgradsutdanningen	○	○	○	○	○
Vi er fornøyd med kvaliteten på doktorgradskursene som tilbys	○	○	○	○	○
Vi er fornøyd med kvaliteten på veiledningen ph.d.-kandidatene tilbys	○	○	○	○	○
Vi er fornøyd med kvaliteten på avhandlingene til kandidatene som uteksamineres	○	○	○	○	○
Det er behov for kvalitetsheving på ph.d.-programmene	○	○	○	○	○
Det er behov for kvalitetsheving på kursporteføljen kandidatene tilbys	○	○	○	○	○
Det er behov for kvalitetsheving på veiledning av ph.d.-kandidater	○	○	○	○	○
Det har vært en økning i antall kandidater som ikke får sine avhandlinger godkjent	○	○	○	○	○

Q53: Beskriv gjerne mer utfyllende i boksen nedenfor

Q54: Har det vært igangsatt eller planlagt spesielle tiltak for å sikre/øke kvaliteten i forskeropplæringen?

○ Ja, igangsatt ○ Ja, planlagt ○ Nei

Note: if you have answered/chosen item [3] in question 54, skip the following question

Q55: Beskriv kort hva som har vært gjort for å heve kvaliteten?

Note: if you have answered/chosen item [3] in question 54, skip the following question

Q56: Hvordan vurderer fakultetet / høgskolen effekten av evt. tiltak for å heve kvaliteten?

○ Betydelig effekt ○ Moderat effekt ○ Liten effekt ○ Ingen effekt
○ Vet ikke/for tidlig å si

Relevans

Q57: Hvordan vurderer fakultetet/høgskolen relevansen i doktorgradsutdanningen, både med tanke på relevansen av opplæringen for kandidatenes forskningsarbeid og relevansen av ph.d.-utdanningen for framtidig yrkesliv?

Hvor enig er du i følgende utsagn?

	Helt enig	Delvis enig	Verken/eller	Noe uenig	Helt uenig
Ph.d.-kursene oppleves som relevante for ph.d.-kandidatenes forskning	○	○	○	○	○

Ph.d.-utdanningen oppleves som relevant som forberedelse til arbeid i UH-sektoren	○	○	○	○	○
Ph.d.-utdanningen oppleves som relevant som forberedelse til forskningsarbeid utenfor UH-sektoren	○	○	○	○	○
Ph.d.-utdanningen oppleves som relevant som forberedelse til annet arbeid	○	○	○	○	○
Fakultetet/høgskolen henter jevnlig inn synspunkter på relevans fra tidligere ph.d.-kandidater	○	○	○	○	○
Fakultetet/høgskolen henter jevnlig inn synspunkter på relevans fra aktuelle arbeidsgivere	○	○	○	○	○

Q58: Fører fakultetet/høgskolen oversikt over hvor kandidatene får jobb etter avlagt grad?

○ Ja ○ Nei

Q59: Tilbys ph.d.-kandidatene karriereveiledning i løpet av ph.d.-perioden?

○ Nei ○ Ja, spesifiser

If you have chosen "other", please specify:

Q60: Har det vært igangsatt eller planlagt tiltak for å sikre/øke relevansen i forskeropplæringen?

○ Ja, igangsatt ○ Ja, planlagt ○ Nei

Note: if you have answered/chosen item [3] in question 60, skip the following question

Q61: Beskriv kort hva som har vært gjort for å sikre relevans?

Note: if you have answered/chosen item [3] in question 60, skip the following question

Q62: Hvordan vurderer fakultetet / høgskolen effekten av evt. tiltak for å heve relevansen?

- ◯ Betydelig effekt
- ◯ Moderat effekt
- ◯ Liten effekt
- ◯ Ingen effekt
- ◯ Vet ikke/for tidlig å si

Q63: Er det noen planlagte eller igangsatte større endringer av ph.d.-utdanningen ved fakultetet/høgskolen?

- ◯ Ja. Gi en kort beskrivelse av de viktigste endringene i boksen nedenfor
- ◯ Nei

Q64: Hvis Ja på forrige spørsmål, gi en kort beskrivelse her:

Q65: Nevn minst ett eksempel fra ph.d.-utdanningen ved fakultetet / høgskolen som kan tjene som et godt eksempel på hvordan fakultetet/høgskolen jobber med forskeropplæring.

Det kan være et kurs, program, møteplass for ph.d.-kandidater, et opplæringstiltak, veiledning, karriereveiledning, samarbeid mellom læresteder, internasjonalt samarbeid, samarbeid med næringslivet el.

Gi en kort beskrivelse av tiltaket og beskriv hvorfor dette er et godt eksempel på lærestedets arbeid med forskeropplæring. Legg vekt på hva det er ved tiltaket som har ført til forbedring av kvalitet, effektivitet eller relevans i ph.d-utdanningen.

Appendix 3: Survey of non-Norwegian members of thesis evaluation committees

Survey to foreign members of evaluation committees for Norwegian PhD dissertations

We will kindly ask you to answer the six questions below. This will not take more than a couple of minutes. Your answer will be treated confidentially and the information will be used for statistical purposes only.

1. How would you describe the quality of the latest Norwegian PhD thesis that you evaluated, when it comes to:

	Excellent	Very good	Good	Acceptable	Poor	Not relevant/uncertain
Depth and coverage	●	●	●	●	●	
Originality	●	●	●	●	●	
Theoretical level	●	●	●	●	●	
Methodological level	●	●	●	●	●	
Skills in written presentation	●	●	●	●	●	
Contribution to the advancement of the field	●	●	●	●	●	
External (applied/societal/cultural/industrial) relevance	●	●	●	●	●	●

2. Within which field would the PhD thesis be classified?
   - ● Humanities
   - ● Social sciences, incl. law and educational science
   - ● Natural sciences, incl. mathematics
   - ● Medical and health sciences
   - ● Engineering and technology
   - ● Agricultural and veterinary sciences
   - ● Other, please specify

3. In total, how many PhD thesis have you evaluated in the last 10 years?
   - Total number:
   - Hereby from outside your country of residence:
   - Hereby from Norway:

4. Please indicate why you think you were asked to serve on the PhD thesis evaluation committee in Norway (several options applicable):
   - ☐ I knew the supervisor of the PhD student whose thesis I evaluated
   - ☐ I was (probably) recommended by colleagues of the supervisor
   - ☐ I was familiar with parts of the PhD thesis before I was asked
   - ☐ I have previously served on other evaluation committees at the same university
   - ☐ I have published on the same topic as the PhD thesis I evaluated
   - ☐ Other reasons, please indicate

5.In which country are you presently employed?

6.Do you have any comments on the assessment procedure for doctoral candidates in Norway?

Appendix 4: PhD programmes at Norwegian institutions (in Norwegian)

Institusjon/fakultet	Ph.d.-program	Antall kandidater	
		opptatt på programmet per september 2011	uteksaminert i perioden 2006-2009
Universitetet i Oslo			
Hum	Humanistiske fag	192	187
SV	Samfunnsvitenskap	410	218
MN	Realfag	769	525
Med	Ph.d.-program ved Det medisinske fakultet	1 237	706
Jus	Rettsvitenskap	95	63
Odont	Odontologi	32	26
Teol	Ph.d.-program ved Det teologiske fakultet	35	22
UV	Utdanningsvitenskap	168	80
Totalt UiO		2 938	1 827
Universitetet i Bergen			
Hum	Ph.D.-program ved De humanistiske fakultet	178	96
SV	Samfunnsvitenskap	174	108
MN	Naturvitenskap	420	298
Jus	Rettsvitenskap	37	26
Med/odont	Ph.D. medisin/helsefag	489	274
	Ph.D. odontologi	14	24
Psyk	Har ikke eget program	120	110
Totalt UiB		1 432	936
NTNU			
Hum	Estetiske fag	36	23
	Språkvitenskap	19	23
	Historie og kulturfag	54	28
	Tverrfaglige kulturstudier	31	16
Med	Klinisk medisin	112	56
	Medisinsk teknologi	56	24
	Molekylærmedisin	71	31
	Nevromedisin	29	19
	Samfunnsmedisin	63	11
	International PhD in Palliative Medicine	7	0
	Helsevitenskap	7	1

Institusjon/fakultet	Ph.d.-program	Antall kandidater	
		opptatt på programmet per september 2011	uteksaminert i perioden 2006-2009
Ark/kunst	Arkitektur	42	15
SVT	13 ulike programmer	410	210
IME	Elektronikk og telekommunikasjon	91	59
	Elkraftteknikk	60	23
	Informasjonsteknologi	94	53
	Matematiske fag	61	42
	Teknisk kybernetikk	43	50
	Telematikk	53	21
	Medisinsk teknologi	1	0
IT	Bygg, anlegg og transport	57	38
	Energi- og prosessteknikk	102	64
	Geologi og bergteknikk	17	20
	Industriell design	14	3
	Industriell økologi	12	3
	Konstruksjonsteknikk	47	29
	Marin teknikk	97	51
	Petroleumsteknologi og anvendt geofysikk	58	27
	Produksjons- og kvalitetsteknikk	40	18
	Produktutvikling og materialer	32	20
	Vann- og miljøteknikk	24	13
NT	Biologi	74	54
	Bioteknologi	32	22
	Biofysikk	7	4
	Fysikk	54	45
	Kjemi	33	35
	Kjemisk prosessteknologi	82	75
	Materialteknologi	91	52
	Naturvitskapenes didaktikk	6	1
	Medisinsk teknologi	5	3
Totalt NTNU		2 224	1 282
Universitetet i Tromsø			
Biovit, fisk og øk	Naturvitenskap	78	39
	Samfunnsvitenskap	35	10
Helse	Helsevitenskapelige fag	264	197
Jus	Ph.d-program ved Det juridiske fakultet	21	8
NT	Realfag	196	64
Hum, SV og lærerutd.	Humaniora og samfunnsvitenskap	186	57
Totalt UiT		780	375

Institusjon/fakultet	Ph.d.-program	Antall kandidater	
		opptatt på programmet per september 2011	uteksaminert i perioden 2006-2009
UMB	Husdyr- og akvakulturvitenskap	67	64
	Plante- og miljøvitenskap	79	51
	Kjemi, bioteknologi og matvitenskap	83	43
	Naturforvaltning	59	51
	Matematiske realfag og teknologi	69	21
	Økonomi og ressursforvaltning	34	18
	Internasjonale miljø og utviklingsstudier (Noragric)	39	14
	Landskapsplanlegging	18	8
Totalt UMB		448	270
Universitetet i Stavanger			
Hum	Lesevitenskap	23	1
	Spesialpedagogikk/utdannings-vitenskap	38	16
SV	Ledelse	33	11
	Risikostyring og samfunnssikkerhet	13	11
	Samfunnsvitenskap	17	0
Tek-nat	Biologisk Kjemi	22	7
	Informasjonsteknologi	13	6
	Offshoreteknologi	24	14
	Petroleumsteknologi	33	17
Totalt UiS		216	83
Universitetet i Agder			
Helse	Helsevitenskap	6	0
Hum ped	Religion, etikk og samfunn	0	0
	Litteraturvitenskap	0	3
	Språkvitenskap	0	2
	Nordisk litteratur- og språkvitenskap (utgått)	0	6
Kunst	Utøvende rytmisk musikk	8	0
Tek-nat	IKT (inkl Mobilkommunikasjon)	30	6
	Matematikkdidaktikk	33	9
	Mekatronikk	6	0
	Risiko og samfunnssikkerhet	18	16
Øk/Samf	Int. Management	20	3
	Public Administration	6	0
	Information Systems	11	0
Totalt UiA		138	45
Universitetet i Nordland			
SV	Sosiologi	27	4
Biovit/akva	Akvakultur	17	0
Handelshøgskolen	Bedriftsøkonomi	36	28
Profesjonshøgskolen	Studier av profesjonspraksis	29	1
Totalt UiN		109	33

Institusjon/fakultet	Ph.d.-program	Antall kandidater	
		opptatt på programmet per september 2011	uteksaminert i perioden 2006-2009
Andre institusjoner			
Norges veterinærhøgskole	Ph.d.-program	-	-
Norges Handelshøyskole	Ph.d.-program	112	70
Norges idrettshøgskole	Idrettsvitenskap	72	35
Norges musikkhøgskole	Musikkpedagogikk og musikkterapi	15	6
	Oppføringspraksis	10	8
Arkitekt- og designhøgskolen	Ph.d.-program	43	33
Høgskolen i Molde	Logistics	30	18
Høgskolen i Oslo	Profesjonsstudier	30	2
	Sosialt arbeid og sosialpolitikk	5	0
	Adferdsanalyse	8	0
Høgskolen i Gjøvik	Informasjonssikkerhet	14	0
Høgskolen i Lillehammer	Barns og unges deltakelse og kompetanseutvikling	4	-
Høgskolen i Vestfold	Anvendte mikro- og nanosystemer	11	0
Menighetsfakultetet	Teologi og religionskunnskap	56	30
Handelshøyskolen BI	Business and Economics	82	52
Misjonshøgskolen	Teologi	24	9
Totalt		8 801	5 114

Source: Evaluation of PhD education in Norway, 2012. NIFU. - Institution survey.

Appendix 5: Key terms, acronyms and abbreviations

Key terms

- **PhD candidate**: A person undertaking PhD education
- **PhD scholarship holder**: A person with a temporary position, usually 3-4 years during the PhD studies, funded by a scholarship from the higher education institution, Research Council or other external sources (medical funds etc)
- **PhD graduate**: A person who has received a PhD degree
- **PhD programme unit**: The legal and administrative unit responsible for a PhD programme; in most universities a faculty, but in some universities, specialised university institutions and colleges, the higher education institution only has one PhD programme, and consequently only one PhD programme unit
- **Old universities:** Universities established before 2002: University of Oslo, University of Bergen, University of Tromsø and Norwegian University of Science and Technology
- **New universities:** Universities established after 2002: University of Life Sciences, University of Agder, University of Stavanger, and University of Nordland

Acronyms and abbreviations

- DBH: Database for Statistics on Higher Education
- ERA: European Research Area
- EU: European Union
- EUA: European University Association
- HEI/HE: Higher education institution/higher education
- LERU: League of European Research Universities
- NAR: Norwegian Association of Researchers
- NHH: Norwegian School of Economics
- NIFU: Nordic Institute for Studies in Higher Education
- NOKUT: Norwegian Agency for Quality Assurance in Education
- NORBAL: Nordic and Baltic database on doctoral education
- NTNU: Norwegian University of Science and Technology
- OECD: Organisation for Economic Cooperation and Development
- ORPHEUS: Organisation for PhD Education in Biomedicine and Health Sciences in the European System
- PhD: Philosophiae doctor
- R&D: Research and development
- RCN: Research Council of Norway
- STEM: Science, technology, engineering and mathematics
- Tekna: The Norwegian Society of Graduate Technical and Scientific Professionals
- UHR: Norwegian Association of Higher Education Institutions
- UiB: University of Bergen
- UiO: University of Oslo
- UiT: University of Tromsø
- UMB: University of Life Sciences

Tables

Figures

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