



Report
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Evaluation of the national research school scheme

Fredrik Niclas Piro, Siv-Elisabeth Skjelbred, Dag W. Aksnes, Kjersti Nesje
and Pål Børing

NIFU

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Preface

This study was commissioned by the Research Council of Norway in order to enhance the Council's knowledge about the organization of the Norwegian research schools, to investigate to what extent the national research school scheme has contributed to improved completion rate and completion time among PhD students, and to increased national and international cooperation. Our evaluation report provides the RCN with answers on these four dimensions of the scheme, and offers recommendations for further development of the scheme.

The report is written by Siv-Elisabeth Skjelbred and Fredrik Niclas Piro (project leader). Dag W. Aksnes, Kjersti Nesje and Pål Børing have contributed to data collection and analysis. Liv Langfeldt has contributed with quality assurance. Ester Rønsen was responsible for the implementation of the survey to the applicants to the research school scheme. We thank the 18 research schools and the 23 rejected schools for responding to our survey.

Oslo, 27.04.2018

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Summary

The national research school scheme

National research schools or PhD schools have long traditions in other countries, but were first formalized in Norway in 2008 under a national scheme organized by the Research Council of Norway (RCN). The background for the introduction of the scheme was a concern that the strong increase in PhD students had led to reduced completion rate and a higher average age at the time of completion. The purpose of the research schools was to “set a standard for other environments on how to drive PhD students through their research training with good results within estimated time to degree”.

The first five research schools under the national scheme were established in 2008. Since then, another ten schools were established in 2012 and seven schools in 2015.

The main conclusion of this evaluation is that the national research school scheme has led to more national cooperation between research environments, and that the components of the training program provided to the PhD students is of high quality. So far, it is, however, not possible to see any measurable effects of this on completion degree and completion time, which reflects that the schools have been more concerned about increasing the quality rather than the efficiency of the education. The research schools have contributed to internationalization of the teaching, but we find few measurable effects on students’ (long-term) stays abroad or international co-authorship. We recommend that the RCN considers a more differentiated research school scheme with differentiated funding and evaluation criteria.

Main question of the evaluation

This evaluation provides answers to five questions about the national research schools’ results and organizing. *First*, have the research school scheme contributed to fewer students dropping out, i.e. has the completion rate increased? *Second*, has the scheme led to the students using shorter time to complete their doctoral degrees, i.e. has the completion time been reduced? *Third*, has the introduction of the

scheme led to more national cooperation among stakeholders within a given discipline or thematic area? *Fourth*, has the scheme contributed to more internationalization among the involved institutions and students?

The research schools have been given a great degree of freedom in shaping their organization and activities. The *fifth* question is whether any organizational features of the research schools are associated with a higher achievement of objectives.

In answering these questions, we draw upon several data sources. A survey was sent to the research schools (18 out of 22 schools responded) and to environments that had applied for a grant under the scheme, but whose applications were rejected (23 'schools' responded). Based on name lists from the research schools, we have used data from NIFU's Register of Doctoral Degrees to compare completion rate and completion time between PhD students at research schools with other PhD students not affiliated with a research school. The name lists were also used to compare the two student groups' degrees of international co-authorship using data from the national publication database CRISTin (Current Research Information System in Norway).

No effect (yet) on completion rate and completion time from the research school scheme

In our analysis, we have not been able to document any increase in completion rates following the introduction of the national research school scheme. The completion rate for PhD students at the national research schools are practically identical to the completion rates for all other PhD students in Norway. The overall completion rate for schools operating under the scheme is just 0.4 percentage points higher than for all other PhD students. The completion rates differ substantially between the research schools, and are higher in thematically oriented schools compared to discipline oriented schools.

The results for completion time is almost identical. When comparing the research schools operating under the national scheme with other PhD students in Norway, the difference in time spent on the PhD is practically identical. The difference between the two groups can be counted in *days*, not months or years. It should be noted that there are methodological issues in identifying the research school students. Moreover, it is too early to estimate the results from the youngest research schools. Hence, our conclusions on completion time and completion rates come with some reservations.

Many of the research schools are little oriented towards international activities

Many of the respondents in our study were surprised that questions about their international activities were included. They simply did not see this as a main goal for the school. Other schools reported high levels of international activity, and highlighted that one of the key added values of the research school scheme was how it enabled the schools to engage in such activities. Some of the schools have a high degree of international participation, with international lecturers at doctoral courses, their workshops and conferences have participation from abroad etc. The research schools have a larger share of international lecturers as course leaders than PhD courses outside of the scheme, and it seems as the research schools have contributed to more use of international supervisors.

Most of these activities seem rather short-term, i.e. we do not find any added value on long-term mobility across borders for PhD students. PhD students outside of the national scheme are just as likely to have stays abroad as students at the research schools. Furthermore, there is, with some noticeable exceptions, no indication that foreign PhD students are more likely to attend courses at the research schools than at other PhD hosting institutions.

Many respondents emphasize the development and maintenance of international networks as a very important factor of the research schools and report that the senior researchers have expanded their international networks. Still, from the limited evidence we have on the international activity of the PhD students, this does not seem to translate in similar internationalization of the students' research and publication activities. We find no evidence that PhD students at the research schools have more international co-authors than other students, neither during their PhD period or in their publications after completing the PhD.

In sum, the teaching activities and supervision at the research schools have more international contributions than at other schools, but the general observation we make is that given the available resources at the research schools, the amount of international activities/collaboration involving the PhD students is not particularly high compared to other PhD institutions in Norway.

National cooperation has been strengthened in discipline oriented schools

Among supervisors and researchers from the partner institutions, there has been an increased contribution to courses, workshops and other academic activities at other partner institutions of the research school. It is not common to have research stays at other partner institutions and few schools reported that participating in a research school had led to increased research cooperation across institutions. It appears that the national cooperation is mainly related to teaching activities.

There are still some research schools that have not taken steps to make their doctoral education more uniform or to harmonize the use of ECTS points for courses offered by the research school. Furthermore, cross-institutional supervision at the research schools' Norwegian partner institutions is just as seldom for PhD students at the research schools as it is for other PhD students.

Notably, the discipline-oriented schools have put far more emphasis on strengthening the national cooperation, than what has been the case in the thematic-oriented schools.

Research schools are promoting academic quality rather than making the education more efficient

Our impression is that the contribution of the research schools is not so much to speed up the educational process, nor to create mechanisms that ensures that fewer students drop out. The scheme is simply not designed as a tool to increase the efficiency of the PhD training. Rather, it seems to be aimed at increasing the academic quality of the doctoral training, but this outcome is not necessarily linked to efficiency. In fact, it could be the opposite. The impression from our survey and from the mid-term evaluations, is that the activities that take place at the schools are of high quality. We have, however, not included any quality indicators related to academic quality in our evaluation.

The schools themselves, but also rejected applicants to the national research school scheme, believe that there has been much added value on increased cooperation between research environments, and that the scheme has enabled the schools to offer a better and more coordinated PhD education, a strong course portfolio (often with contributions from international lecturers), and also PhD education in new thematic areas not covered by existing PhD programmes. Despite these, and many other, positive contributions from the scheme, we have observed some elements that the RCN needs to address in order to improve the goal fulfilment on the main outcome indicators studied here, of which academic quality of the doctoral degree is not one.

A more differentiated scheme, with differentiated funding and evaluation criteria

Our recommendations are mainly related to the funding structure of the scheme, to a more differentiated scheme based on different types of schools and their different needs, and to the introduction of special efforts to improve completion rate and completion time.

We recommend that the funding level may differ between types of research schools, where we argue that thematically oriented schools are costlier to operate

due to the fact they are creating new courses and teaching activities from scratch. Discipline oriented schools can to a much higher degree be cost effective based on utilizing available personnel, courses, etc. Between these two ‘ideal types’ of organizing research schools, there will of course be schools with certain elements of both.

A more fine-tuned funding based on the type of school, may also lead to different evaluation criteria of the two, where international and national cooperation play very different roles. While the thematic schools may need to engage themselves in international cooperation to build up researcher education in a new field (hence, the RCN should use internationalization as a performance indicator), the discipline schools are often far more oriented at national collaboration, trying to unify national resources and teaching within the field (hence, the RCN should use national cooperation as a performance indicator).

Many of the discontinued schools have struggled to maintain their activities after the funding from the RCN ended, or have simply been shut down. We therefore recommend that the RCN consider making the funding level and period more flexible, including e.g. a phase-out after the eight years of funding under the scheme stops, enabling the institutions to take over and find other funding.

Finally, we believe that the RCN should make efforts to ensure that improving completion rate and completion time are specifically addressed in the calls for school grants, in the proposals and in the contract between the RCN and the research schools. More efforts in the calls, and in the schools, should be made on further qualifying of supervisors, for the participating partners in a school to make systems where the students should have two supervisors representing two different institutions inside the school (nationally or internationally, in order to promote academic and social ties across institutions or countries), and that the supervisors should commit to make formal individual plans with the PhD student on how to improve progress and completion, in line with good experiences from Denmark. More work should also be done at the schools to create a ‘research school identity’ among the students, which is lacking at many schools.

Norsk sammendrag

Satsingen på nasjonale forskerskoler

Nasjonale forskerskoler, eller PhD skoler, har lange tradisjoner i andre land, men ble i Norge først formalisert under et nasjonalt program i 2008. Bakgrunnen for satsingen på nasjonale forskerskoler var en økende bekymring knyttet til lav gjennomføring og høy gjennomsnittsalder hos ferdige doktorgradskandidater. Hensikten med forskerskolene var å sette en standard for hvordan man kunne få doktorgradsstudentene til å fullføre doktorgradsløpene med gode resultater på normert tid.

De fem første skolene under satsingen ble etablert i 2008. Deretter fulgte ti skoler i 2012 og syv skoler i 2015. Satsingen organiseres og finansieres gjennom Norges forskningsråd.

Hovedkonklusjonen i denne evalueringen er at forskerskolene har ført til økt nasjonalt samarbeid mellom forskningsmiljøer, og at kvaliteten på tilbudet til doktorgradsstudentene er høy. Så langt har dette imidlertid ikke hatt målbar effekt på studentenes gjennomføring, noe som også reflekterer at kvaliteten på tilbudet har vært en viktigere målsetning for skolene enn en mer effektiv gjennomføring. Forskerskolene har bidratt til internasjonalisering av undervisningen, men har ikke hatt målbare effekter på langvarige utenlandsopphold eller omfanget av internasjonalt samforfatterskap blant studentene. Vår anbefaling er at Forskningsrådet bør vurdere en mer differensiert forskerskoleordning, med differensiert finansiering og differensierte evalueringskriterier.

Evaluerings problemstillinger

Evalueringen gir svar på fem spørsmål om de nasjonale forskerskolenes resultater og organisering. *For det første*, har satsingen på nasjonale forskerskoler bidratt til at færre studenter faller fra, dvs. økt gjennomføringsevne? *For det andre*, har satsingen bidratt til at doktorgradsstudenter bruker kortere tid på å gjennomføre sin doktorgradsutdanning, dvs. redusert gjennomføringstid? *For det tredje*, har fors-

kerskolene bidratt til å styrke samarbeidet innenfor fag-, profesjons- og temaområder med flere mindre forskningsmiljøer nasjonalt? *For det fjerde*, har forskerskolene bidratt til økt internasjonalisering for involverte miljøer og studenter?

Forskerskolene ble gitt stor grad av autonomi i valg av organisering og aktiviteter. Et *femte* spørsmål i evalueringen er således å finne ut om forskerskolene er hensiktsmessig organisert, dvs. om det er visse former for organisering av en skole som virker mer positivt med hensyn til å oppnå gode resultater på de fire indikatorene beskrevet over.

For å besvare disse spørsmålene har vi brukt en rekke datakilder. Vi gjennomførte en spørreundersøkelse blant forskerskolene (18 av 22 skoler besvarte vår survey) og blant miljøer som søkte om å få midler til å etablere forskerskoler, men som fikk avslag på sine søknader (i alt 23 avviste 'skoler' besvarte vår survey). Fra de nasjonale forskerskolene (via Forskningsrådet) mottok vi navnelister over doktorgradsstudentene ved skolene. Disse er blitt koblet med blant annet NIFUs doktorgradsregister, slik at vi har kunnet beregne og sammenligne gjennomføringsgrad og gjennomføringstid blant doktorgradsstudenter ved forskerskolene og totalt sett blant øvrige doktorgradsstudenter i Norge. Navnelistene ble også brukt til en bibliometrisk analyse av internasjonalt samforfatterskap basert på publiseringsdata fra CRISin (Current Research Information System in Norway).

Ingen effekt (så langt) av satsingen på nasjonale forskerskoler på gjennomføringsgrad og gjennomføringstid.

Våre analyser har ikke kunnet dokumentere noen effekter av satsingen på gjennomføringsgrad og gjennomføringstid. Utfall på disse to målene er praktisk talt helt identiske for doktorgradsstudenter som har vært tatt opp ved en nasjonal forskerskole, og doktorgradsstudenter innenfor samme tidsperiode som ikke har vært tilknyttet en slik skole. Riktignok er det enkelte forskerskoler som viser resultater som er langt bedre enn det nasjonale gjennomsnittet, men samlet sett ender forskerskolenes stipendiater opp med en gjennomføringsgrad som bare er 0.4 prosentpoeng høyere enn for de øvrige stipendiatene. Gjennomføringsgraden er høyere i de tematisk orienterte forskerskolene, sammenlignet med de disiplinbaserte.

Resultatene for gjennomføringstid er omtrent identiske med gjennomføringsgrad. Når man sammenligner resultatene for stipendiater ved forskerskoler mot øvrige stipendiater, kan forskjellen mellom de to gruppene kun observeres når man studerer antall *dager*. Det er ingen forskjell uttrykt i måneder eller år. Det må bemerkes at det er enkelte metodologiske forhold som er problematiske ved bruk av slike navnelister for å identifisere forskerskole-stipendiater. Det er også for tidlig å se på resultater fra de nyeste forskerskolene. Våre konklusjoner for gjennomføringsgrad og gjennomføringstid må derfor leses med enkelte forbehold.

Mange av forskerskolene er lite internasjonalt orientert

Mange av respondentene i vår survey var overrasket over at internasjonale aktiviteter var et tema i evalueringen. Dette anså de ikke som et av formålene ved sine skoler. Andre skoler rapporterte om et høyt nivå på internasjonalt rettede aktiviteter, og mente at muligheten til å drive med dette var en av de fremste merverdiene ved skolen, siden slike aktiviteter ikke kunne ha vært gjennomført uten finansieringen som forskerskole. Ved enkelte av skolene er det høy internasjonal deltakelse, skolene finansierer utenlandske forelesere og kursledere, de arrangerer seminarer og konferanser m.m. med utenlandsk deltakelse. Forskerskolene har også en høyere andel internasjonale forelesere enn ved læresteder utenfor satsingen, og et større innslag av utenlandske veiledere.

De fleste av disse aktivitetene er kortvarige. Med det mener vi at de er tidsbegrensede (for eksempel at en utenlandsk forsker tilbringer noen dager i Norge for å delta på et kurs). Det er liten langvarig mobilitet inn og ut av Norge for stipendiater tilknyttet forskerskolene. Doktorgradsstudentene der er ikke mer tilbøyelig enn andre doktorgradsstudenter til å gjennomføre langvarige utenlandsopphold. Med noen merkbare unntak er det heller ikke slik at utenlandske doktorgradsstipendiater deltar oftere i kurs og lignende i regi av forskerskolene enn hva som er tilfellet på doktorgradskurs utenfor satsingen.

Mange av respondentene la stor vekt på at satsningen muliggjorde å knytte internasjonale kontakter og at seniorforskerne ved forskerskolene i stor grad hadde opprettet nettverk internasjonalt. Disse kontaktene synes ikke å inkludere doktorgradsstudentene i like stor grad. Basert på den begrensede informasjonen vi har om studentene ved forskerskolene sine utenlandsaktiviteter er de samlet sett lite involvert i forskningssamarbeid på tvers av landegrenser (det er naturlig nok variasjon blant forskerskolene med hensyn til dette), og når vi ser på internasjonalt medforfatterskap er de ikke mer internasjonalt orientert enn hva doktorgradsstudentene utenfor forskerskolene er.

Samlet sett er det større utenlandsk innslag i forbindelse med kurs, forelesninger og veiledning ved forskerskolene enn det er ellers for norske stipendiater, og gitt ressursene som forskerskolene har til rådighet er dette ikke uventet. Utover dette synes ikke internasjonalt samarbeid som involverer studentene å være særlig høyt i forhold til øvrige miljøer i Norge med doktorgradsutdanning.

Det nasjonale samarbeidet er styrket i disiplinorienterte skoler

Blant veiledere og forskere ved partnerinstitusjonene har det vært en sterk vekst i deltakelse på kurs, workshoper og andre akademiske aktiviteter ved de andre deltakerinstitusjonene ved skolen. Det er fortsatt ikke vanlig med forskeropphold ved andre norske partnerinstitusjoner, og få skoler rapporterer om noe forsterket

forskningssamarbeid nasjonalt, det er heller snakk om at man samarbeider om å styrke utdanningstilbudet.

Det er fortsatt mange av forskerskolene som ikke har fulgt opp anbefalingene fra midtveisevalueringene og samkjørt de administrative kjørereglene for studentene ved sine kurs, som for eksempel at det gis lik uttelling av studiepoeng ved institusjonene for gjennomføring av det samme doktorgradskurset. Det er ikke mer vanlig at stipendiater ved en forskerskole har veiledere fra to forskjellige norske institusjoner, enn hva tilfellet er for andre stipendiater i Norge.

Det er særlig de disiplin-orienterte forskerskolene som har vektlagt at det nasjonale samarbeidet skal styrkes – ikke så mye de tematisk styrte skolene.

Forskerskolene er mer opptatt av akademisk kvalitet enn effektivitet

Vårt inntrykk er at forskerskolene ikke har bidratt til en mer effektiv doktorgrads-utdanning, og det virker heller ikke som om skolene har vært spesielt opptatt av å utarbeide mekanismer som bidrar til redusert drop-out og kortere gjennomføringstid. Satsingen på nasjonale forskerskoler, med stor grad av institusjonell autonomi ved forskerskolene, er simpelthen ikke konstruert på en måte som automatisk fremmer effektivitet i doktorgradsløpet. Det synes derimot som om skolene har vært opptatt av å styrke den innholdsmessige kvaliteten i det de tilbyr studenter av læring. Det er ikke nødvendigvis noen kausal sammenheng mellom økt kvalitet og økt effektivitet. Forholdet kan faktisk være motsatt. Inntrykket fra vår survey og fra tidligere midtveisevalueringer av forskerskolene er at det er høy kvalitet på de kurs, forelesninger og andre aktiviteter som studentene tilbys. I våre analyser er imidlertid ikke en slik type kvalitet en indikator som skolene har blitt evaluert opp mot.

Skolene selv, men også de avviste søkerne til forskerskoleordningen, mener at satsingen på nasjonale forskerskoler har hatt en stor merverdi med tanke på økt nasjonalt samarbeid, muligheten til å tilby en bedre og mer koordinert doktorgrads-utdanning, en sterkere og mer variert kursportefølje (ofte med innslag av utenlandske forelesere), og at det er blitt mulig å opprette helt nye doktorgradskurs innen nye tematiske områder. Til tross for dette, og mange andre positive sider ved ordningen, har vi observert enkelte elementer som vi mener Norges forskningsråd bør se nærmere på dersom man ønsker større grad av måloppnåelse for satsingen på nasjonale forskerskoler. Ingen av disse er relatert til den innholdsmessige kvaliteten på studentenes arbeider, som vi ikke har data om i denne evalueringen.

Forskningsrådet bør vurdere en mer differensiert ordning, med differensiert finansiering og evalueringskriterier

Våre anbefalinger er hovedsakelig relatert til finansieringsstruktur for skolene, en mer differensiert ordning mht. forskjeller i type skole og behov, samt å introdusere særskilte tiltak for å heve gjennomføringsgrad og redusere gjennomføringstiden.

Vi anbefaler at finansieringsnivået differensieres mellom ulike typer skoler. De tematisk styrte skolene er i hovedsak dyrere å etablere siden de ofte oppretter et helt nytt kurstilbud som ofte ikke er basert på eksisterende aktiviteter. De disiplinbaserte skolene tar derimot i større grad utgangspunkt i eksisterende utdanningsmateriale, lærekrefter osv., og har større mulighet for å være kostnadseffektive. Mellom disse to 'idealtypene' finnes det selvsagt hybrider med elementer og behov fra begge typer.

En mer differensiert finansiering ut fra profil ved skolen bør også ha betydning for hvilke indikatorer for måloppnåelse som vektlegges. Nasjonalt og internasjonalt samarbeid spiller ulike roller i tema- og disiplinorienterte skoler. For de tematiske skolene vil det ofte være viktig å involvere seg i et bredt spekter av internasjonale partnere (og de bør måles på sin grad av internasjonalisering), mens de disiplinbaserte skolene ofte er mer nasjonalt orientert, med formål å forene de relevante norske miljøene i én skole (og de bør i større grad måles på sin grad av styrket nasjonalt samarbeid).

Mange av skolene som ikke lengre mottar finansiering gjennom den nasjonale satsingen har ikke klart å opprettholde aktivitetene sine. De har enten fortsatt med et redusert tilbud, eller de har opphørt fullstendig. Vi anbefaler derfor Forskningsrådet å vurdere større fleksibilitet i forskerskolenes finansieringsperiode (som i dag er tidsbegrenset), og eksempelvis gir mulighet for en utfasingsperiode, som gir deltakerinstitusjonene tid til å finne andre finansieringskilder/andre som kan overta finansieringsansvaret.

Til slutt ønsker vi å trekke fram at Forskningsrådet i større grad bør sikre seg at konkrete tiltak for å forbedre gjennomføringsgraden og gjennomføringstiden vektlegges av skolene i sine søknader og i sin drift av skolene, men også av Forskningsrådet selv i framtidige utlysninger. Det bør videre jobbes mer med kvalitetsfremmende tiltak for veiledere ved deltakerinstitusjonene. Det bør også bli mer vanlig at en doktorgradsstudent ved en forskerskole har to veiledere fra to ulike institusjoner innad i skolen, nasjonalt eller internasjonalt, for å fremme akademiske og sosiale bånd på tvers av institusjoner og land. I tråd med danske erfaringer, mener vi det også vil være positivt for gjennomføringen dersom det etableres formelle individuelle avtaler for veiledningsforhold mellom veileder og stipendiat, der progresjon og gjennomføring vektlegges. Det bør også jobbes for å skape en 'forskerskoleidentitet' hos studenter og veiledere, hvilket mangler ved mange skoler i dag.

1 Introduction

The National Research School scheme was initiated by the Norwegian Government¹ in 2005, as a response to an evaluation of the research education in Norway a few years earlier.² The evaluation concluded that certain areas of the research education needed attention, e.g. the fact that too few doctoral students completed their degrees and that those who did complete spent too long time. In the white paper from the Government, the Research Council of Norway (RCN) was asked to investigate a potential national scheme for graduate-level researcher schools. The first set of national research schools in Norway was established in 2008. Since then, a total of 22 national research schools have been funded by the national scheme. Approximately 3.5 million euro is granted each year for the scheme.

The purpose of this evaluation is to investigate whether national research schools have contributed to increased quality of Norwegian research education. Quality in this context is defined as high completion rates, low completion time, high degree of internationalization and national cooperation – both regarding education and research. These indicators (or proxies) of quality will also be used to discuss whether the national research schools are organized in a suitable manner to achieve the goal of increased quality and whether the level of resources and grants are efficient. The research schools who receive funding from the RCN are all being mid-term evaluated, and these evaluations address the schools one by one, highlighting their strengths and weaknesses, proposing areas that need to be improved. This is not the case in this report. Here, we evaluate *the national research school scheme*, not the schools themselves.

¹ In the white paper *Commitment to Research*, Report No. 20 (2004-2005) to the Parliament.

² Norges forskningsråd (2002): Evaluering av norsk forskerutdanning.

1.1 About the research schools

The Research Council of Norway (RCN) together with The Norwegian Association of Higher Education Institutions (UHR) outlined the guidelines for the establishment of the national research school scheme.³ The first call for proposals was in 2008 and since then there has been calls in 2012 and 2015. The research school grant has been awarded in three rounds to give the scholar communities time to create networks and qualify to apply for the grants. This model seems to have worked well as many of the environments that applied, but did not receive a grant in the first round, received a grant in a later round.

The national research schools are built on the network model. This means that each research school consists of a network of institutions that have committed to cooperate on the doctoral education within a given discipline or topic, but that the students and the staff are still connected to their own institutions. The network structure is a response to the evaluation of the Norwegian research education which showed that many doctoral students were not satisfied with the supervision and/or that they were in small research environments that struggled to maintain professional quality and breadth of competence.⁴ The research schools cooperate on activities such as doctoral courses, seminars and summer schools, and they may also use each other's laboratory facilities. The research school scheme is intended to make the institutions able to offer a broader research education than what each institution alone has the possibility to do.

The research school is a supplement to the institutions' own doctoral programmes. The individual institutions within the research school network are responsible for the doctoral candidates' employment terms/personnel management and it is the individual universities/university colleges that award the degrees. Each research school is administered by one of the institutions which has status as the host institution. The host institution should be an institution with a high-quality research environment. The partner institutions are universities, university colleges, research institutes and (only to a very limited extent) also the business community. In situations where the Norwegian environment is small, Nordic or international cooperation is seen as a pre-requisite for the development of good research environments and these environments are thus encouraged to incorporate international partners in their research school.

A total of 22 research schools has been established. The first call resulted in five research schools, the second call resulted in ten research schools and the last call resulted in seven research schools.⁵ The research schools are funded for eight

³ Norges forskningsråd (2006): Utredning av ordningen med Nasjonale forskerskoler i Norge.

⁴ Norges forskningsråd (2002): Evaluering av norsk forskerutdanning (Chapter 6.5).

⁵ In addition, the RCN is funding some research schools through other programs. Those research schools are not included in our evaluation of the research school scheme.

years and the funding for the last three years is contingent on a positive outcome of a mid-term evaluation after four years. Two mid-term evaluations have been conducted so far, one in 2012 and one in 2017. All the evaluated research schools were granted further funding.

The research school grant is intended to fund quality enhancing measures aimed towards doctoral students. The research schools are allowed to use the grant to cover international and national common activities and necessary personnel costs, but it is not meant to cover all expenses associated with the doctoral education. The research schools' total budget depends on the schools' size and level of ambition, but it is maximum 3 million NOK per year. The size of the annual maximum budget for the grant has varied with each call, but most research schools receive more than 20 million NOK over an eight-year period.

The Government wanted research schools in different disciplines. All disciplines and research areas were welcome to apply for a research school grant. Applicants were asked to document a likely added value compared to the existing activities and programmes. The aim of the research school scheme is to gather individuals and environments to more robust and broader research groups as many of the environments are too small on their own (and size can be considered a critical factor in order to build high quality environments). In creating the scheme, the RCN thus recommended a minimum size of 20 doctoral students and four supervisors. It was also considered important that the scheme allowed institutions with limited resources for research to participate in the research school.

The research school should be on the frontier within the academic field and use the best researchers within the field for teaching and supervision. The research schools should emphasize a good research environment and have a committed programme for internationalization. Furthermore, the research schools should emphasize the role of the supervisor and develop good models for supervision. The research schools are expected to contribute to improved rate of completion and reduced time-to-degree as well as ensuring a broader base in research training.

National research schools in Norway

Schools established in 2008:

- Business Economics and Administration
- Climate Dynamics
- Educational Research
- Medical Imaging
- Structural Biology

Schools established in 2012:

- Norwegian Research School in General Practice
- Norwegian PhD School of Pharmacy
- Norwegian PhD Network on Nanotechnology for Microsystems
- Norwegian PhD School of Heart Research
- Research School on Peace and Conflict
- Norwegian Graduate Researcher School in Linguistics and Philology
- International Research School in Applied Ecology
- Research School of Computer and Information Security
- National Research School in Population-based Epidemiology
- Norwegian Research School of Neuroscience

Schools established in 2015:

- Petroleum Research School of Norway
- The Norwegian Research School for Research and Development of Municipal Health and Care
- Norwegian Graduate School in Biocatalysis
- Norwegian Research School on Dynamics and Evolution of Earth and Planets
- The national interdisciplinary Research School Religion-Values-Society
- Authorative Texts and their reception - National Research School on Textual Interpretation
- Norwegian Research School in Infection Biology and Antimicrobials

In addition, several other research schools are funded by other programmes at the RCN.

The first group of (five) research schools have completed their eight-year period. The second group of (ten) research schools have been mid-term evaluated. A total of 15 research schools has thus been evaluated half-way through. The evaluations

have resulted in several recommendations, of which some of the most important were the creation of stronger formal links between the institutions and the research schools, and that the research schools should have a formal agreement that ensured stronger involvement on the part of the supervisors. Also, the evaluation committee of the 2012 schools recommended that the PhD candidates should be more included in the management of the research school and be represented on the research schools' boards. The research schools were encouraged to draw up concrete plans for the continued operation of the research schools' activities after the funding ended.

During the three calls, the RCN has in total received 89 applications, with schools operating within technological fields accounting for the largest part (37 per cent), but by far also with the lowest success rate (Table 1.1). In medicine and health science and mathematics and natural sciences, on the other hand, almost half of the applicants have so far been backed by funding to establish research schools. It is important to note that the same research environment can be involved in more than one application as environments that were rejected in one round were welcomed to re-apply in a later round.

Table 1.1 Applicants and grants across scientific domains

Scientific field	Applications	Grants	Success rate
Technology	33	2	6 %
Social Sciences	14	3	21 %
Medicine and Health Sciences	18	8	44 %
Mathematics and Natural Sciences	17	7	41 %
Humanities	7	2	29 %
Total	89	22	25 %

1.2 The evaluation questions

The purpose of this evaluation is not to evaluate 22 unique research schools, rather it is to investigate to what extent the national scheme has contributed to increase the quality of the Norwegian researcher education by meeting the following objectives, defined by the RCN:

- Increased completion rates (alternatively: reduced drop-outs)
- Reduced completion time
- Increased internationalization
- Strengthening of national cooperation within scientific fields, including more (small) national institutions in larger research networks

- Raising the activity and the capacity of the cooperative environments, e.g. through increased supply of courses and better access to research networks and guidance

Another main objective of the scheme is to promote the recruitment of PhD students. This goal, however, given the terms of reference for this evaluation, will not be subject to our evaluation. Rather, the current evaluation was specifically asked to respond to the following four questions:

1. Is the completion rate (i.e. absence of drop-out) higher among PhD students affiliated with national research schools, compared to PhD students that have not been affiliated with any research schools?
2. Is the time-to-degree of completed PhDs, i.e., completion time, lower among PhD students at the national research schools, compared to PhD students that have not been affiliated with any research schools?
3. To what extent have the national research schools contributed to internationalization, by for example travel grants, support to stays abroad, international course instructors, supervisors, etc.?
4. Have the research schools contributed to strengthening national cooperation within scientific fields, professions and thematic areas; including more (small) national institutions, and in what ways?

In addition to investigating the success of the research school scheme on these results-oriented tasks, the design of the national research school scheme was to be evaluated. More specifically, the evaluation addresses these questions:

1. Evaluate whether the national research school scheme is organized in an appropriate way to achieve the goals that were set for the scheme (number 1-4 above)
2. Evaluate whether the resources and funding made available to the schools is appropriate
3. Consider various aspects that may explain the research schools' goal achievement, such as:
 - a. Scientific and administrative leadership
 - b. Cooperation between the partner institutions
 - c. Number of members (size of the research school, i.e., number of partner institutions and/or number of PhD students affiliated with the school)
 - d. Procedures for recruiting PhD candidates
 - e. Work on internationalization
 - f. Involvement of supervisors and other scientific personnel at the participating institutions

The methodological design developed by NIFU to answer the questions above are outlined in the next sections. Below we define two key measures in the evaluation

that may be understood and measured in several ways: completion rate and completion time.

The **completion rate** measures how many of the PhD students that completes their doctoral training, that is, submit their thesis and get their doctoral dissertation approved. High completion rates imply that the number of unfinished PhDs – or drop outs – is low.

There are several measurement problems when estimating the completion rates of PhD students. Former studies have often used a ten-year threshold to calculate completion rates. That is, PhD students that have not handed in their thesis for approval within ten years after they started the PhD education are considered drop-outs (and considered likely never to complete). This definition cannot be used to evaluate the research school scheme as most students in the scheme have started their doctoral work only two to six years ago. The first five schools were established in 2008, but most students at these schools were admitted in later years. The same applies for students at the schools established in 2012. Only for PhD students that began their research training before 2013/2014 would it be possible to complete their PhDs within estimated time to degree (four or three years) by late 2017, which is our last observation point.

In a NIFU report from 2012 (Kyvik & Olsen, 2012) found that the completion curve flats out after 5-6 years, so that a reasonable choice of completion cut-off could be six years. Six years is also the choice made by the Norwegian Ministry of Knowledge (see e.g. the Ministry's annual 'Condition reports for Higher Education'). In this report the available data has restricted us to use a cut-off of five years. Given the admission time for most students at the national research schools, a cut-off of the more preferable six years (or ideally ten years), would have excluded too many students for meaningful comparisons to be made. A cut-off of four years would have included even more students, but the comparison of completion rates would then be pointless since practically no one completes their degree within four years.

The **completion time** is far more unambiguous, since the selection of PhD students is fixed: all those PhD students that *have* complete their PhDs, regardless of when they were admitted to a PhD programme or how long time that they have used. The disadvantage of this method, is that in many schools few PhD students have completed their PhDs, so that the completion time may be somewhat artificially low as more PhD students will complete at a later time, thus increasing the average completion time. The advantage of this method, is that if we use this definition while comparing PhD students from the research schools with other PhD students (see section 1.3.1), this artefact will be the same in both groups, thus making them comparable.

1.3 The evaluation methods

In order to investigate whether the national research schools have contributed to increased quality in the Norwegian doctoral training, and to fulfil the ambitions set out by the Research Council regarding completion rates, completion time, internationalization and national cooperation, we draw upon a methodological framework that triangulates between 1) statistical approaches where the research schools are compared with a control group, that is ‘control schools’ (see section 1.3.2), i.e. the scientific communities who applied for the research school grants but were rejected, and the research school students are compared to non-research school students, and 2) qualitative approaches where the schools’ target achievements are studied based on a more case study-like approach.

For this evaluation we have made three main data collections: 1) a statistical analysis of data from the Norwegian Register of Doctoral Degrees combined with data from NSD’s (Norwegian Centre for Research Data) database DBH⁶, 2) a bibliometric study of international co-authorship in published works by Norwegian PhD students using data from Web of Science and the national Norwegian publication database CRISTin, combined with data from NSD/DBH, and 3) a survey aimed at all national research schools since 2008 and all rejected applicants for research school funding. These data sources, and how they have been utilized, will be presented in the upcoming sections, where we present them according to the research question that they address. In answering RCN’s research questions, we have separated our tasks into four work packages (WPs) presented below.

1.3.1 Effect on completion rate and completion time (WP1)

The first main research question of the evaluation is to study whether PhD students affiliated with national research schools have higher completion rates and lower completion time compared to other PhD students, according to the definitions presented in Chapter 1.2.

All national research schools were required to provide RCN with a list of the names of all PhD students affiliated with the school. Based on these lists some schools have ended up with a surprisingly low level of candidates, which means that we are unsure of the quality of the lists in some schools. Another problem with the lists was a substantial amount of misspellings, names not written out in full, etc. Given that there is no ‘national register’ that documents the participants at research schools, these lists, no matter how incomplete they may be, is the only available tool we have to study the outcomes of PhD students that have attended a research school.

⁶ Database for statistikk om høgre utdanning (in English: Database for Higher Education Statistics).

The lists were 'cleaned' for misspellings etc. at NIFU and coupled with NIFU's Register of Doctoral Degrees. All students that took their research education at an institution outside Norway were excluded from the sample as we do not have information about their outcomes, and they are therefore not part of our statistical analyses.

NIFU's Register of Doctoral Degrees only provides us with information about those students that have completed their PhDs. In order to include all those PhD students that have begun their PhD careers, but have not completed, the datafile was combined with data from DBH (see section 1.3), where there is information about all PhD students' start date for their PhD projects, as well as their scientific background. This matching was approved by the NSD following our application. In analyses of completion rate and – time, the start of a PhD track is defined as the date where the PhD funding began (data taken from DBH). The data do not offer any information about factors such as parental and sick leave. This is unfortunate, but since we operate with a large sample ($n=10,656$), we do not believe this represents a problem in our analysis as we don't expect any skewed distribution of such leaves between PhD students at research schools ($n=1,169$) and other PhD students ($n=9,487$). The sample of PhD students contains all students that 1) began their PhDs in 2008 or later, and 2) by December 2017 would have had the chance to be enrolled at a PhD programme for five years or more at some point between 2008 and 2017, unless they 3) had completed their PhDs within a shorter time-frame (and was therefore included in the analysis of completion time).

Completion rates are calculated as the ratio between those who have completed their PhDs within five years after the start date, and those who are registered in DBH but have not completed their PhDs within five years after start. For the analysis of completion time, the sample is simply the duration of the PhD period for those *who have completed* their PhDs. Given that the first research schools were established in 2008 and the second set was established in 2012, a substantial share of the doctoral candidates will still be in the process of finishing their dissertations.

The national research schools represent a broad spectre of academic disciplines who may not always be comparable. For example, PhD students in general practice medicine are usually older than e.g. PhD students in pharmacy, and spend longer time on their doctoral work as it is typically done part-time, next to clinical work. Therefore, it is important to take discipline into account. Based on DBH-data we use the following categories when comparing PhD students at national research schools with other PhD students: 1) Architecture, 2) Arts, 3) Dentistry, 4) Economics and Business Administration, 5) Educational Sciences, 6) Health Sciences, 7) Humanities, 8) Law, 9) Library Science, 10) Medicine, 11) Music, 12) Natural Sciences, 13) Pharmacy, 14) Psychology, 15) Social Sciences, 16) Technology, 17)

Theology, 18) Veterinary Sciences, and 19) Other. Thus, in addition to conducting national analyses, we also present results stratified by the doctoral candidates' academic disciplines. The idea is that the PhD students from the research schools should be compared to other doctoral candidates within the same scientific disciplines.

1.3.2 Effect on international collaboration (WP2)

In this part of the evaluation we investigate how and to what extent the national research schools have contributed to internationalization. Unlike WP1 which is only based on statistical analyses with clear-cut definitions and indicators, this WP concerns a more complex issue where choice of indicators and their interpretations are more based on qualitative assessments. For this WP, two components need to be addressed.

Firstly, it is obvious that all research schools have introduced elements of internationalization (regardless of how they are defined). The presence of such activities, however, does not allow us to draw conclusions about whether the establishing of the *research schools* have led to increased internationalization. We therefore need to compare the research schools to a control-group. The chosen control-group are the environments that have applied to the RCN for research school funding but whose applications were rejected⁷. The environments that were able to apply for grants to create a national research school, may differ substantially from the average academic environments. In our opinion, the best available comparison group is therefore the other academic environments that applied to become a research school, but did not receive a grant. These 'rejected schools' are large enough to generate an application and should be similar to those that received a grant in many domains.

In 2008, 22 applications were rejected; in 2012 there were 10 rejected applications and in 2015, 29 applications were rejected. Some of the rejected applications in 2008 and 2012 were submitted again and approved or rejected in the next call, so that the total number of unique 'schools' that have received a rejection is somewhat lower. Our survey to the research schools (18 out of 22 schools responded) was sent in a modified and reduced version to the rejected schools, with a total of 23 rejected schools responding. The electronic survey was carried out in January 2018. Data from the surveys are used in WP2, WP3 (see section 1.3.3) and WP4 (see section 1.3.4). The survey was sent to the academic leader of the research schools/the rejected applicants, who were asked to respond on behalf of the

⁷ The students from the rejected schools have not been used in WP1, for the very simple reason that no-one knows who the PhD students are/would have been had the school been materialized.

school itself, not just his/her own institution. We do not believe it would be expedient to have each school represented by the voices of some 5-15 partners. This would also potentially trigger a skewed sample of respondents, as those being most or least satisfied with the work of the schools may have become disproportionately represented.

The survey to the control-group needed some modifications vis-à-vis the main survey to the research schools, as it would have been difficult for the rejected schools to respond to some of the questions. The environments which did not receive a grant do not exist as a national research school and we could not ask questions about the development of the 'potential research school', as the potential project leader would not readily have information about the development of all the institutions within the intended research school network. To make the survey easy to answer and to ensure a sufficient response rate we asked the representatives at the rejected schools to answer questions about national cooperation and internationalization at his/her environment at the institution/faculty, i.e. the environment that applied for the research school grant. The responses of the control schools are thus based on answers/impressions from the potential host institution. When comparing the research schools with 'rejected schools', it is therefore important to keep in mind that the latter schools constitute a rather strict control group. At the research schools, the leaders of the schools responded to the survey on behalf of all units at the schools (big and small, strong and not so strong environments), while the 'rejected schools' are represented by the voice of what would have been the host institution, reflecting on the status at his/her institution – not on behalf of all partners in the rejected application. This host institution is typically the largest and most internationally oriented environment among the partners. It is thus a skewness in responses from the research schools compared to the rejected host institutions that may represent a methodological source of error, but it also provides us with a reference point of high quality to which we compare the research schools.

Despite having a comparison group, it is important to note the small number of units involved. Hence, the comparisons that we make are more qualitative with a case-based approach than quantitative. Furthermore, the schools are very differently organized with different profiles and aims which add to the complexity of the comparison.

Secondly, we must address how to define internationalization. In this study we do not use any composite measures of internationalization, nor do we seek to define specifically what it is. Rather, our evaluation is based on multiple sets of relevant aspects of international work and cooperation that are highlighted in the background material of the research school scheme and the mid-term evaluations

of the scheme, such as foreign personnel's participation in teaching and supervision, research cooperation between Norwegian and international partner institutions and support for short and long-term stays abroad. A key element of the doctoral training at most Norwegian higher education institutions is that the PhD students should have a longer stay abroad at a relevant institution. Tømte & Vabø (2010), however, find that this is not well communicated to the students, and we therefore also study whether the schools have contributed to a more conscious plan for stays abroad.

In addition to these factors that were covered in our survey, we have made a special bibliometric analysis of international co-authorship of the PhD students' publications. A simple hypothesis is that the more internationally oriented a research school is (or any other PhD awarding institution, through its use of foreign teachers, stays abroad etc.), the stronger the likelihood that the students will engage in collaborative projects with foreign researchers, thus potentially leading to co-authored publications with international partners. Therefore, we look at the percentage of publications from PhD students with international co-authors. We compare the percentages of the research schools' students with all other PhD students in Norway, in total and by academic discipline (cf. the methods in WP1).

Data is taken from the national Norwegian publication database CRISTin and from Web of Science for the period 2008-2017⁸. We have included all publications from the time the students were admitted to a PhD programme and up to today (December 2017) based on data from the Norwegian Register of Doctoral Degrees. What is essential is not whether international co-authors were present at any of the publications that make up the PhD thesis itself, but whether the PhD students have been engaged in international co-publishing at some point after they embarked on their PhD.

International co-publishing may not be the optimal choice of indicator given the short duration of the research schools and the fact that it takes time to publish. Another objection towards such an indicator is the validity of the indicator: does it capture the relevant aspects of internationalization? A more relevant indicator could have been more process related indicators such as participation and/or presentation at papers at international conferences. However, there is no national verifiable database covering this⁹, and most likely few of the schools themselves

⁸ For the period 2008-2010 we only have data from the four broad universities in Norway at the time (the universities in Oslo, Bergen, Tromsø and the Norwegian University of Science and Technology (NTNU)), while all higher education institutions are included in the period 2011-2017. Although the data material is smaller for the first few years, it is important to note that publications that are affiliated with the research schools most likely does not appear before 2009 and onwards, so we do not consider this a problem.

⁹ The higher education institutions may document this in the national publication database CRISTin, but unlike the reporting of scientific publications, the academic staff at the institutions do not have equally strong incentives for devoting time to reporting of other activities, as there is no financial

have complete information about it, not to mention the impossibility of collecting such information for all other PhD students in Norway.

1.3.3 Effect on national collaboration (WP3)

In WP3 we study whether the research schools have contributed to strengthening cooperation nationally and have included more of the smaller national research communities into a research network. The methods are similar to those in WP2; we base our analysis on the survey and compare the research schools to the rejected applicants.

We do not follow a clearly defined indicator of national collaboration, rather we focus on some important factors, cf. how we measure activities of internationalization above. We include factors such as (the RCN's focus on) getting smaller institutions more involved in collaboration with the leading national environments and the work to standardize PhD programmes at the schools' member institutions.

Both WP2 and WP3 evolve around the survey responses. Again, we would like to emphasize that this survey has a limited number of respondents. Therefore, the analysis and conclusions we draw from these sections will be more qualitative than when analysing completion rates and time in WP1.

1.3.4 Organization of the research schools (WP4)

The last work package deals with the question: is the national research school scheme designed in an appropriate way to achieve the objectives behind the scheme? When it comes to output factors such as completion rates, time-to-degree and international co-authorship we want to emphasize that it is somewhat early to draw strong conclusions. This is partly because only five research schools have completed their funding period, and partly because it may take some time before increased collaboration and internationalization manifest in measurable output, such as international co-authorship. We nevertheless use these outcome variables to study whether organizational features of the schools (such as size, division of responsibility, scientific disciplines of the schools, etc.) are associated with positive outcomes in such indicators.

All in all, the methods and data sources used here are based on a mixture of 1) a large national sample where we study statistical differences with great certainty (study of completion degree and completion time), and 2) a small sample of units, where the comparison group (the rejected host institutions) may not be directly

rewarding of e.g. conference contributions. While the definition of 'scientific publications' follow strict national guidelines, and are being verified by the CRISTin secretariat, it is not always so clear from the self-reported conference contributions to differ between e.g. what is the presentation of a peer-reviewed paper at a conference and what is a more informal speech at a meeting.

comparable to the research schools, since it only covers the ‘leading’ actors behind the applications. The analysis of national and international cooperation, and of the organization of the research schools, are thus subject to more qualitative assessments. It is also important to keep in mind that the quantitative analyses do not include the newest research schools and that many students at the older schools are still in the process of completing their PhDs. The completion degree and completion time at the research schools may therefore change over the next years, because our results are primarily based on students enrolled in the years 2008-2013.

1.4 Outline of the report

The outline of the report follows by large the work packages, as they respond intuitively to the main research questions from RCN’s terms of reference. In Chapter 2 we give an overview of the research schools and their main organizational features. In Chapter 3 we study the research schools’ contribution to national cooperation (WP2) and in Chapter 4 their contribution to international cooperation/internationalization (WP3). These two chapters are about process outcomes at the schools, which may be considered outcome variables in themselves but also as intermediary steps towards increased programme effectiveness by increased completion rates (Chapter 5.1) and reduced completion time (Chapter 5.2) which make up WP1, presented in Chapter 5.

In Chapter 6 we sum up of some of the main impressions from the survey that are not specifically related to the topics in the work packages (WP1 – WP3). In Chapter 6.1: what is the added value of the national research school scheme according to the schools? In Chapter 6.2: what are the limitations of the scheme according to the schools? In Chapter 6.3: is the duration and grant size of the scheme sufficient to meet the goals? And finally, in Chapter 6.4: what will happen to the schools when the funding from the RCN is terminated?

In Chapter 7, we turn to the organizing of the research schools. First, in Chapter 7.1 we study how different organizational features of the schools are associated with differences in outcomes of completion rate/time and with internationalization and increased national cooperation. We then provide a brief Nordic comparison in Chapter 7.2 where the Danish and Swedish work on research schools are compared to the Norwegian scheme. In Chapter 8 we sum up of the impressions from chapters 2-7 and answer to what degree the national research school scheme has contributed to higher completion rates, lower completion time, and increased national and international cooperation. At the end of the report we offer the RCN our recommendations for further development of the research school scheme.

2 The research schools

The rationale for applying RCN for funding to establish a research school appears to be self-initiated by the research environments rather than a result of any external or internal pressure. Our survey among both established schools and rejected applicants clearly demonstrate a bottom-up approach, i.e., the schools are not established due to any formal or informal encouragement from the RCN or other public instances nor from pressure from the faculty administration. It is clear, that the applying institutions are most of all motivated by a desire to bring the national competences together, thus strengthening the national collaboration and to contribute to increasing the academic strength of the smaller national institutions (Figure 2.1). Internationalization is only to a moderate extent mentioned as a motivation for establishing the schools among the 18 research schools and the 23 rejected schools that answered our survey.

In addition to these ‘general’ motivations, many schools have their own ‘unique’ set of motivations for applying/participating in research schools. The main distinction is between those schools whose ambition has been to establish a new (cross-disciplinary) PhD education involving different academic disciplines from different environments, and those who wanted to strengthen the existing PhD education within current established academic fields by increasing the ‘critical mass’ of existing environments. Environments who wanted to ‘unite the national competences’ often argue that it is needed, because the environments are small and fragmented, and a national umbrella to work under would help improve the quality of the PhD education.

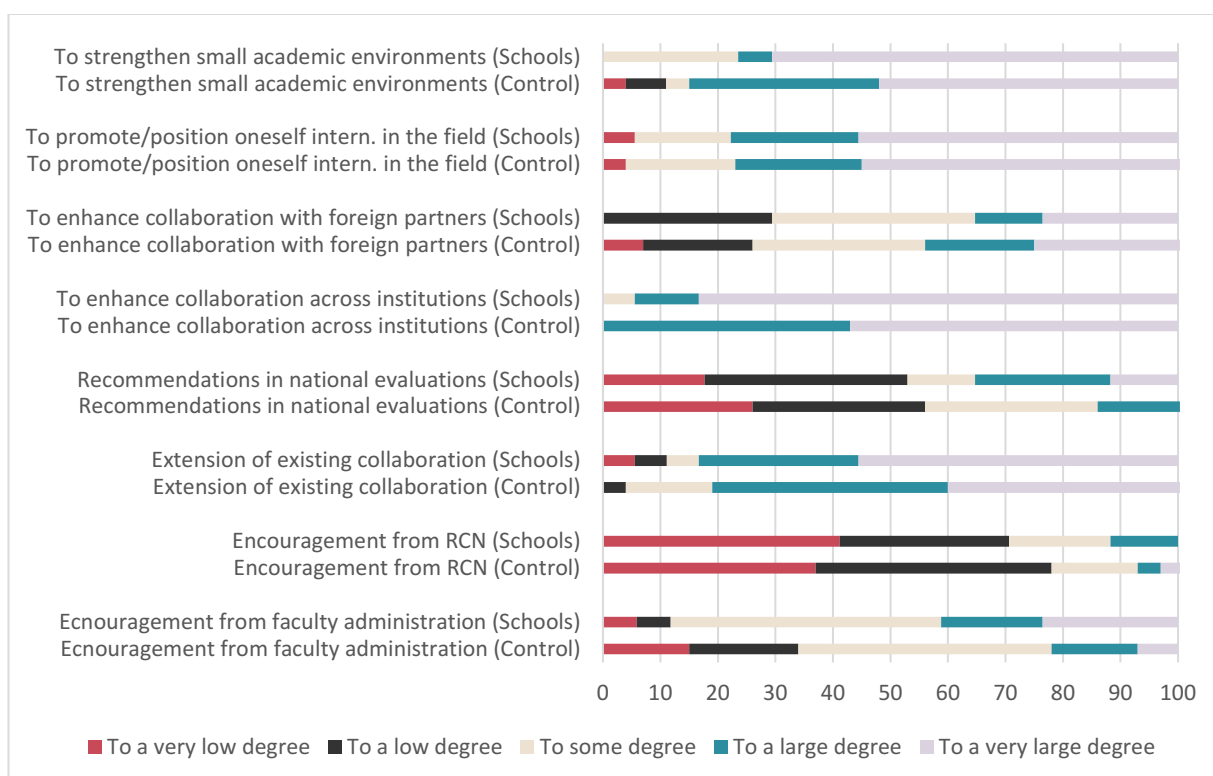


Figure 2.1 To what extent did the following factors influence the decision to apply RCN for research school funding (per cent)?

2.1 Size of the schools

The schools vary considerably in their size and composition, ranging from 4 – 13 formal partners, and a student population of 26 - 50 to more than 200 PhD students affiliated to the school at any given time (Figure 2.2). 44 per cent of the schools report that their student numbers usually are in the range 76 – 150 and two schools report that they have more than 200 students enrolled. In addition to students that are formally admitted to the schools, many schools have affiliated students who attend seminars, courses etc.

The schools are non-comparable by organizational characteristics, having chosen very different ways to organize their activities and how the partners are put together. In Table 2.1 we summarise some of the key organizational features of the schools. The schools are stratified by (three) main fields of science. There are no distinct differences in the number of partners between the three fields, but schools in Social Sciences & Humanities on average have fewer PhD students.

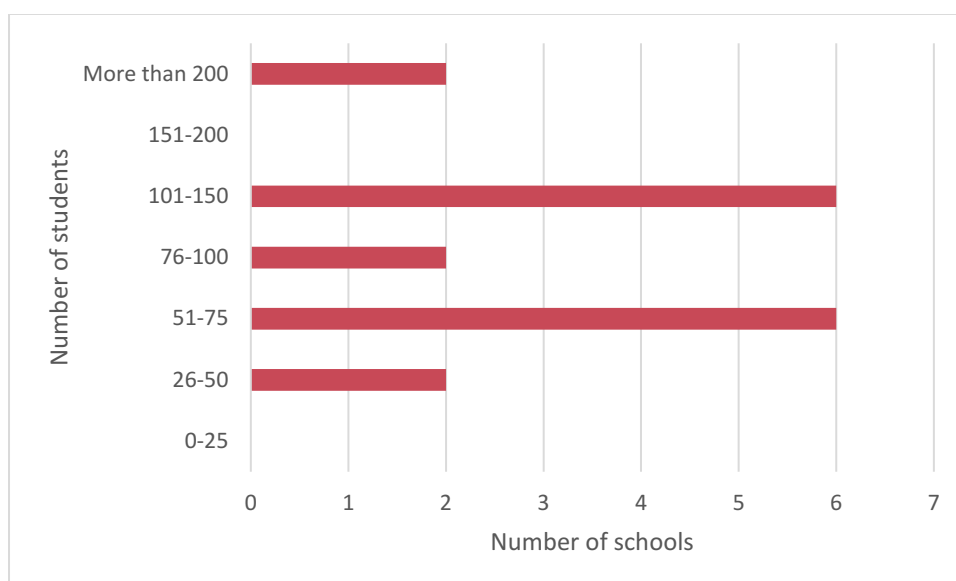


Figure 2.2 Numbers of enrolled PhD students at any given time

In the medical/health related schools there are no foreign students (i.e., students from foreign partner institutions) enrolled in the research school. On average, schools in Natural Sciences & Technology have about 20 foreign students enrolled, but the differences between the schools within this field is very large. The medical/health schools are generally more directed towards national collaboration, with few international (formal or informal) partner institutions. On the other hand, they stand out with a much higher presence of post docs affiliated to the schools compared to other scientific disciplines.

Table 2.1 Mean values (minimum and maximum) for schools within three broad academic fields

	Medicine (n=6)	Natural Sciences & Technology (n=6)	Social Sciences & Humanities (n=6)
Partners (total)	7.2 (4 – 9)	8 (6 – 13)	7.7 (3 – 13)
PhD students attached to the school (at any given time)	101-150 (51-75 – 200+)	51-100 (26-50 – 101-150)	51-75 (26-50 – 200+)
PhD students affiliated with foreign partner institutions (at any given time)	0 (0 – 0)	21 (0 – 70)	11 (0 – 35)
PostDocs affiliated with the school (at any given time)	20 (0 – 50)	8 (0 – 30)	2 (0 – 10)
Administrative additional resources converted into man-year per year	0.7 (0.2 – 1.5)	0.2 (0.0 – 0.5)	0.4 (0.1 – 1.0)

Among the 18 research schools studied here, 15 recruited students under a separate application scheme. In two schools, the students were automatically signed in to the schools if they were already admitted to the PhD programme at one of the schools' participating institutions. At one school, the candidates are not formally

taken up at the research school, but apply for participation at the research school's activities.

We asked the schools about the students' sense of belonging to the schools, i.e. whether they saw themselves as PhD students at the schools, or whether they more saw themselves as PhD students at their respective institutions. The response was rather mixed: six schools reported that the students to a very low or low degree saw themselves as students at the research schools, seven schools reported that the students to some degree saw themselves as students at the school, while five schools reported that the students most of all identified themselves with the research school they attended, rather than the institutions they came from. The schools themselves do not act as 'degree-conferring' institutions. 72 per cent of the schools report that only single subjects (courses etc.) are taken by the PhD students at the research school. Only four schools (22 per cent) answer that most of the PhD students' courses are taken at the research school.

Most research schools have students with their background from different academic fields. Within each school, the students also represent different institutions and different sectors (higher education sector, research institutes, university hospitals). Nevertheless, 11 of 18 schools report that the students are not split up in groups. One of the schools provided an interesting rationale for this, saying that they considered it important not to 'reduce' the multidisciplinary of the student group. Three schools report that the students are thematically split into groups, two of which comments that this principle is up to the students to follow, i.e. they may change groups if they want.

2.2 The board/advisory organs

The composition of the board can give interesting information about the running of the research school. The size of the board tended to vary with the number of partner institutions. In six of the 18 schools that responded to the survey, the academic leader of the school was also the chairman of the board. This is against the recommendations from the first mid-term evaluation. The mid-term evaluation argued that division of power, hence separation between the functions of chair of the board and school director (CEO), is in line with best organisational practices. Furthermore, the evaluation argued that it should be a separation not only by person, but also by institution, to make other partners responsible for the school.

Following recommendations in the last mid-term evaluation of the research schools, all schools now have (or had, for those who no longer exist) PhD students as members of the board. All boards are also comprised of representatives from

the schools' host institutions and from the partner institutions, and it appears that it is usual that all partner institutions are represented in the board.¹⁰

The number of schools where the board also includes a representative from e.g. the business community or other external actors is very low. The schools with a medical/health profile are generally characterized by more members from the host institution, and a larger number of PhD students (most likely from the same institution) (Table 2.2). In general, there are no differences across academic fields in how often the board meets; the norm is that the board meets 2-3 times per year. Three schools reported that the board met four times each year, and three schools reported that the board met once a year. In addition to the board, half of the schools report that they also have an advisory body (e.g. a scientific advisory board or a scientific committee).

Table 2.2 Composition of the boards (percentage) and board size

Board members	Medical/health	Natural Sciences & Technology	Social Sciences & Humanities
PhD students	28.8 %	20.4 %	18.0 %
Foreign partners	0.0 %	0.0 %	6.6 %
Norwegian partners	48.0 %	61.1 %	62.3 %
Host institution	20.5 %	14.8 %	11.5 %
Other	2.7 %	3.8 %	1.6 %
Board size	Medical/health	Natural Sciences & Technology	Social Sciences & Humanities
Mean	12.2	10.2	10.2
Minimum	6	8	5
Maximum	17	12	15

2.3 The partner institutions

The general impression from the schools, as reported by the academic leader of the school, is that the partner institutions fulfil their commitments. 83 per cent of the academic leaders meant that the partner institutions to a large or very large degree do so. No one reported that the partners did not or only to a small degree fulfilled their commitments, but three schools reported that their partners only fulfilled their commitments 'to some degree'. These three schools come from each of the three main scientific domains in Table 2.2. Only one of the schools reported that the partner institutions pay a fee for their participation in the school.

The extent and content of any written agreements between the partner institutions differ largely between the schools. A common feature is that they often seem to contain intentions rather than clear-cut requirements. Some of the respondents

¹⁰ Table 2.2 indicates a difference in representation by foreign partners. This is due to the fact that most institutions do not have a foreign partner institution.

claim that the distribution of responsibilities and the specific requirements should have been made clearer from the outset, as the agreements more focus on shared goals rather than precise clarifications of who does what and how. In this respect, the research school have little formal grounds to require anything from their partner institutions.

Only three out of eighteen schools reported that foreign institutions were formal partner institutions, but a total of 12 schools reported that they had international collaboration partners that were not formally affiliated with the school. Some schools have as much as 10 to 15 such partners. Two thirds of the schools with international partners of some kind stated these were in fact active partners.

2.4 Activities at the schools

The research schools are engaged in a very long list of different activities (Table 2.3), and it is hard to use the activity information that we received from the survey to create 'profiles' of the schools or to compare them in cross-tables etc.

Table 2.3 Comparison of budget profiles across three types of schools

Budget spent on activities (per cent)	Medicine/ Health	Natural Sciences & Technology	Social Sciences & Humanities
Support for participation at international conferences for Norwegian/international PhD students	8	11	0
Support for participation in courses at the research school for Norwegian/International PhD students	19	32	22
Support for stays abroad	7	4	11
Support for stays at one of the partner institutions	0	1	1
Fees for external international lecturers/lecturers	6	7	14
Fees for internal international lecturers	0	1	3
Fees to Norwegian lecturers/lecturers outside the research school	2	1	2
National conferences/workshops	28	12	14
Administration	26	26	30
Other	4	4	3

We therefore use their budget profiles as some sort of proxy for what kind of activities that takes place at the schools. The research schools were asked to fill out a matrix where they stated how much (in per cent) of their budget that was spent on a selection of activities (for an average/'typical' year)¹¹.

Administrative costs typically constitute 25-30 per cent of the total budget. This may seem high, but there are perfectly understandable reasons for these high

¹¹ One of the schools has been left out in Table 2.3 because the school reported that 78 per cent of its budget was spent on 'Other' activities. For this particular school, most of the budget is spent on funding of their own researchers, since this school has to acquire their own researchers for teaching duties at the research school.

shares, such as development costs to create new PhD courses, board work, funding of coordinators etc.

The medical/health oriented schools stand out with a much higher share of budget spent on national conferences/workshops than at other schools, which coincides with earlier findings about their weaker international orientation. Schools from Natural Sciences & Technology are the only ones where support for participation in courses at the research school for PhD students is the highest single budget post. No schools in Social Sciences & Humanities reported that any of the budget was used for supporting their students to attend international conferences. Six of eighteen research schools have a structured offer for career guidance, with all claiming that this is a result of the research school.

3 National cooperation

A goal with the establishment of national research schools was to increase national cooperation between small research environments. Cooperation is important as many research environments in Norway are small and fragmented which may make it harder to create an internationally competitive research environment. The institutions' own doctoral programmes are the fundament in the national research schools, but the research schools are responsible for guaranteeing that teaching and supervision is at a high level. Furthermore, the research schools shall encourage participation in international and Nordic research networks.

It is obvious that the institutions within the research schools cooperate on the doctoral education and a more interesting question is thus whether this cooperation also has led to other types of cooperation such as research cooperation, co-publishing and mobility among students and staff. To be able to argue that the research school grant enabled the research environments to achieve something that they would not have been able to do without the funding, such activity should be much larger in the research schools than in the comparison group. It is important to note that the basis of the discussions in this section is based on two surveys with a limited number of respondents. The analysis is thus more of a qualitative nature than a quantitative one.

3.1 Research education

The advisory committee behind the development of the national research school scheme recommended that the research schools should have the responsibility for the academic development of the doctoral students that were admitted to the research school. The research schools are responsible for providing a course portfolio that at minimum adhere to the requirements in the Doctoral Degree Regulations. The national research schools have the possibility to coordinate the organization and content of the educational component of the doctoral degree. The autonomy of the universities is a potential obstacle in this process as each degree awarding institution has the right to structure their degree independent of the structure at comparable institutions. We asked the research schools whether they

had taken any steps to make the doctoral programme more uniform across the partner institutions. A majority of the respondents (53 per cent) answered that they did not consider it as a goal that the doctoral programme should be uniform. Only one school had taken means to make the doctoral education more uniform, while three responded that the doctoral programme was uniform prior to the establishment of the research school. The last four schools reported that there are still large differences between the structure of the doctoral programmes at the partner institutions.

In research education in general, the quality control of the educational component is less developed than for the dissertation, as the dissertation is validated through evaluation by external (and foreign) committee members. The size and the requirements for the educational component vary across fields and institutions, both in the scope of the knowledge that is communicated and examined and in the evaluation of each doctoral candidate's knowledge level. The scope of the compulsory part of the courses also differs across institutions. Hence, the doctoral students' possibility to attend courses at the research schools differs across disciplines and institutions.

Some universities might hesitate to approve courses that are taken at other institutions. The mid-term evaluation of the first five research schools reported that in some instances the number of ECTS-points credited to a student for a course taken at the research school varied with the institutional belonging of the student. The evaluation committee concluded that the research schools should have a formal agreement between the partners that harmonized the use of ECTS points and that ensures that the points assigned to a specific course are accepted by all the partner institutions. Only 12 out of 18 respondents in our survey answered that they had such an agreement in place. One school responded that they were going to establish it, one responded that they would not establish it and two responded that an agreement was partly established. The final two reported that they did not have a formal agreement, but that they had not experienced any problems with individual approval.¹²

In addition to getting the completed courses approved, there might be an obstacle to be allowed to attend the courses as well. It is not always easy to get information about courses across institutions as the courses are only announced in the catalogue of the institutions that host them. Furthermore, if doctoral students want to take courses at other institutions they need to apply to become a 'guest student'. If this deadline is passed before the student receives information about

¹² This is by the experience of the academic leader of the research school and it is possible that individual students have experienced problems without the knowledge of the academic leader.

the course the student cannot attend. There is thus a potential problem with coordination and cooperation across institutions on the educational component of the doctoral degree.

Ten of the eighteen schools that filled out the survey, stated that there were no activities at the research school that were mandatory. In the eight schools who reported mandatory activities, these mandatory activities varied from what we may describe as peripheral activities (e.g. attend the general assembly or attending the 'national PhD days') to more core activities such as participation in 1-3 seminars per year or a three-day course in academic work.

Because the survey went out to the academic leaders of the research schools and we have not conducted a separate survey for the students at the research schools, we do not have information about how the doctoral students evaluate the educational component of the research schools, nor any of the other components. However, a survey about the doctoral students working conditions (Reymert, Nesje & Thune, 2017), finds that students that self-report to be affiliated with a research school are somewhat more content with the educational component than other students. Note, however, that 'research school' is not a protected title and there are other units that call themselves research schools than the ones we evaluate and thus we cannot conclude directly that it is the research schools within this scheme that make students more content. Furthermore, we note that the report did not find any significant differences in the evaluation of other domains, such as supervision.

3.2 Supervision

The development of good models for supervision and emphasis on the role of the supervisor was an essential element in the design of the national research school scheme. Well-functioning supervision is important for high-quality research education. According to the guidelines developed by The Norwegian Association of Higher Education Institutions (UHR)¹³, each doctoral candidate should have one main supervisor and one or more formal co-supervisors. This was also listed in the background documents before the establishment of the national research school scheme. Having more than one supervisor reduces the doctoral candidates' dependency on one person and it increases the amount of supervision.

On average about 80 per cent of the students at the research schools have at least two supervisors. However, there is large variation; one of the research schools report that only 30 per cent of their students have more than one supervi-

¹³ www.uhr.no/documents/240315_Veiledende_retningslinjer_for_graden_philosophiae_doktor_ph_d_.pdf

supervisor, while five schools report that all their students have more than one supervisor. The results from the control group (e.g. the rejected schools) are quite similar, the average is 89 per cent, while the lowest observation is 50 per cent. The results are comparable to the results from a recent study of doctoral students' working conditions (Reymert, Nesje & Thune, 2017), where only 8 per cent of the students report that they only have one formal supervisor. The results indicate that both research schools and control schools to a large degree have implemented the two-supervisor system.

The research schools have a unique possibility to encourage national, cross-institutional collaboration and knowledge exchange by appointing a co-supervisor from one of the partner institutions in the research school. Only about two out of ten of the students (as reported by the research schools) that have more than one supervisor have a supervisor at one of the other institutions in the research school.

The control schools were asked a similar question where they were asked about the extent to which it was common for their doctoral students to have a supervisor at one of the potential partner institutions. Prior to the evaluation we had operated with the hypothesis that it would be more common that the doctoral students had a second supervisor at the intended host institution, rather than at a partner institution, as the intended host institution tends to be the leading environment in the field. We therefore split the survey question in two. The results from the survey is shown in Figure 3.1 and show that almost all respondents answered that it was only to some degree (or less) common to have a second supervisor at an institution within the intended research school network (i.e. another institution than the one that the PhD student came from).

The results indicate that cross-institutional supervision is not common neither at control schools nor at research schools. The exception was one research school which reported that 70 percent of their doctoral candidates have a supervisor at one of the partner institutions.

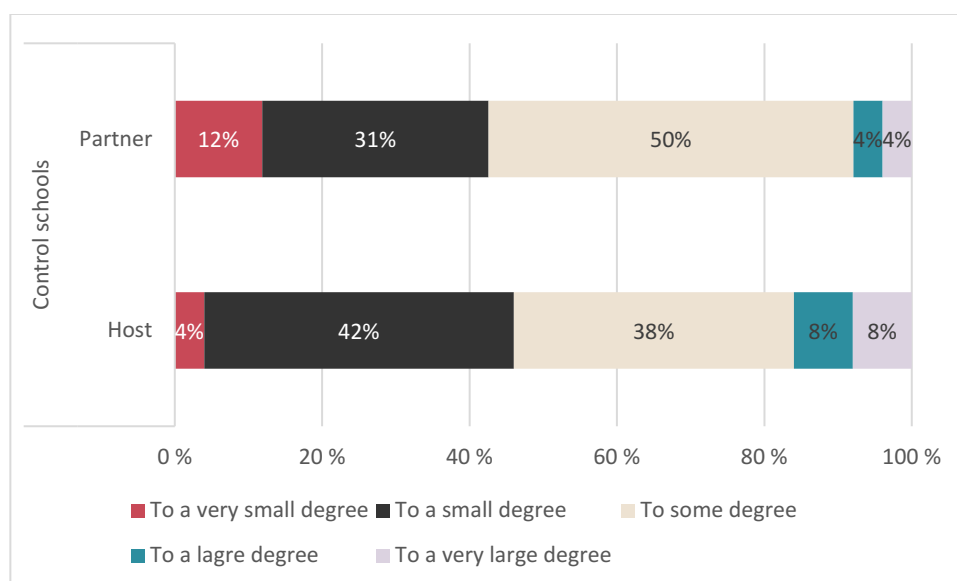


Figure 3.1 To what degree is it common that students at the control schools have a supervisor at the potential partner/host institution of the research school?

The national research schools are encouraged to put emphasis on the role of the supervisor, and development of good models for supervision should be a fundamental element in the research schools. The mid-term evaluation of the first five research schools found that supervisors were less than optimally involved in the schools. In our survey 80 per cent of the research schools reported to have had or was planning to have separate activities for supervisors (with a large majority stating that they had already had it). Examples of such activities are yearly supervisor seminars, courses or workshops or activities at the annual research school conferences that are specially directed towards supervisors. The focus on the supervisor activities is the supervisors' role, how to improve supervision, for example how to supervise interdisciplinary work, and how to build a research group. The research schools thus seem to encourage the supervisors to be actively involved in the schools. One of the research schools reported that they got increased attendance when they started to offer the supervisor seminars locally. To be able to offer activities locally multiple research schools collaborate on supervisor seminars. Based on their own assessments, this seems to work very well.

To study the supervisors' involvement, we also asked the research schools to specify the degree to which supervisors were active in the activities at the schools. We expected that much of the research schools' activities are placed at the host institution which could generate a difference between the activity level of supervisors at host institutions and other institutions. We therefore asked the question for supervisors at the host institution and the partner institutions separately. However, we did not find any differences in the activity level; the supervisors at

the host institutions and the partner institutions were equally active in the research schools' activities. About 60 per cent of the respondents answer that the supervisors to a large or very large degree are active in the research schools' activities (Figure 3.2). This potentially indicates that the supervisors are more involved in the research schools now than at the first mid-term evaluation. However, there is still quite a room for improvement. The higher activity level of the supervisors suggests that the research schools have put emphasis on activity of the supervisors. Involvement of the permanent staff, and not only the doctoral students, is potentially a key factor for sustaining the cooperation between the research environments also after the funding from the RCN ends.

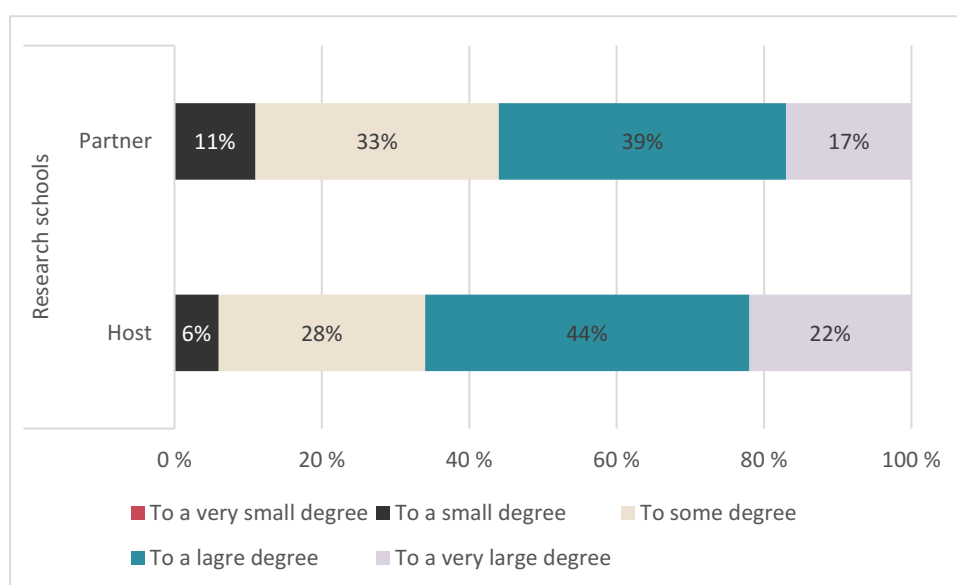


Figure 3.2 To what extent are the supervisors from the partner/host institutions involved in the research school's activities?

3.3 Researcher mobility

The guidelines for the research schools stated that the research schools should use the best researchers in the field for teaching as well as supervision. This requires mobility among students and staff between the institutions in the research schools. It can be a challenge to create close networks when the members of the research school are not physically present at the same institution. Our survey address how the researchers from the partner institutions contributed to courses, workshops and other academic activities at other institutions inside the research school. 12 out of 18 (67 per cent) schools answered that researchers from the partner institutions to a large or a very large extent contributed to this (while just one school reported the opposite, i.e., to a low degree).

Furthermore, these respondents answered that this activity level was much higher than prior to the establishment of the research school, with 72 per cent stating that it was considerably higher now than it used to be. By comparison, 9 out of 26 (35 per cent) of the respondents in the 'control schools' reported that their researchers contributed to a large or a very large extent to academic activity at any of the potential partner institutions. Thus, it seems that the research school grant has increased mobility among academic staff in the research environments.

3.4 Division of responsibilities

The evaluation committee of the first five research schools recommended that each partner should take responsibility for certain courses to ensure involvement of all parties and division of responsibilities. This model is expected to increase the probability that the initiatives undertaken by the research schools are continued after the funding from the Norwegian Research Council ends. The evaluation committee recommended that the 2015 call encouraged this model, but we do not find any evidence in the call that the RCN followed up on this recommendation.¹⁴

The responses from the survey show that the research schools can be divided into three categories based on their model for division of responsibility. *The first category* is the top-down category where the leader group of the research schools has the main responsibility for the organization of activities and decides which institution should organize the events. This is illustrated by one of the schools: "The main responsibility is being taken by the host institution. The partners are responsible for activities located at their institutions".

The second category is the bottom-up category where courses and other activities are initiated by the institutions in the research schools and the initiating institution takes responsibility for organizing the events. This is well illustrated in some of the schools' responses in the survey, e.g.: "There is no fixed division of responsibilities. The various partners have arranged (courses, seminars etc.) following their own interests". *The third category* includes cases where the responsibility is divided so that the institutions are given specific activities to organize, or the responsibilities for activities rotate between the institutions.

The different models for responsibility for the activities reflect differences in how many of the activities that have been held at the partner institutions. While five research schools reported that 50 per cent or more of the activities were held at the host institution, ten research schools reported that less than 30 per cent of the activities were held at the host institutions. At its most, one school reported

¹⁴www.forskningsradet.no/no/Utlysning/FORSKER-SKOLER/1254005647018/p1173268235938?visAktive=true&progId=1254005627520

that 75 per cent of all activities took place at the host institution. On average, 30 per cent of the activities take place at the host institution.

Based on these results, it might seem that the organization of the research school could have implications for the degree of national cooperation and possibly also for whether the institutions within the research school will continue their co-operation after the funding from the RCN has ended. Among the four schools who stated that the school would not be continued after the funding from the RCN stopped, three were characterized as within the third category 'division of responsibility', and one as 'top-down'. This means that all schools with a bottom-up design claims that the school will continue after the funding stops.

3.5 Networking and mobility

National networking between doctoral students at different institutions is important as many of the institutions in Norway are small and there can be only a few doctoral students at each institution that work on related topics. In section 3.3 we found that there seemed to be larger mobility between senior researchers in the research schools compared to 'rejected schools', in that senior researchers at the research schools were more likely to contribute to academic activity such as courses, workshops and seminars at the partner institutions.

We asked the research schools to describe the work that they did to create shared platforms for the doctoral students at the research school. The research schools described that the main activities of the research schools, i.e. courses, summer/winter schools, seminars and conferences to a very large extent function as meeting arenas for doctoral students. They ensured to design these events with emphasis on discussion and cooperation between the PhD students. The conferences and courses reinforce each other in terms of networking and are considered important for socialization into the scientific community. The conferences have more room for transfer of silent knowledge, which typically is not discussed at the courses. Some of the research schools also mention that they extensively use social media and web-pages as a 'meeting arena'. The advantage with social media platforms is that the students can use the network also after they have graduated.

Many of the research schools have separate conferences directed either only towards PhD students, or including post doctors and supervisors, and these seem to be popular. One of the research schools also mentioned that the doctoral students was obliged to participate on at least two symposiums that the research school hosted during their doctoral degree. They were required to present their own work here at least once and to act as opponent on another PhD student's presentation at least twice. Another research school said that they had divided the doctoral students into separate groups based on their field of work and that each

group met once per semester where they presented and discussed their doctoral work.

To study the extent to which there was mobility between the institutions in the research schools, we first asked the research schools about the extent to which PhD students presented their work at the other Norwegian partner institutions. Ten out of 18 research schools said that this was common to a large or very large degree. Five of the schools, however, reported that this was not common.

When asked whether it was common that the doctoral candidates had a visit of more than a week's duration at one of the other institutions in the research school network, only one school said that this was common to a large degree (Figure 3.3). More specifically, for this school it was common that doctoral students from the partner institutions visited the host institution, and not the other way around. We do not have comparable answers from the control group of rejected schools as we did not expect the potential research schools to have any knowledge about the level of presentation of their potential doctoral students at what would have been partner institutions. However, the results from the research schools indicate that it is common for the students at the research schools to present at other Norwegian institutions, but that it is not common to have research stays at the other institutions (irrespective of whether one is at a research school).

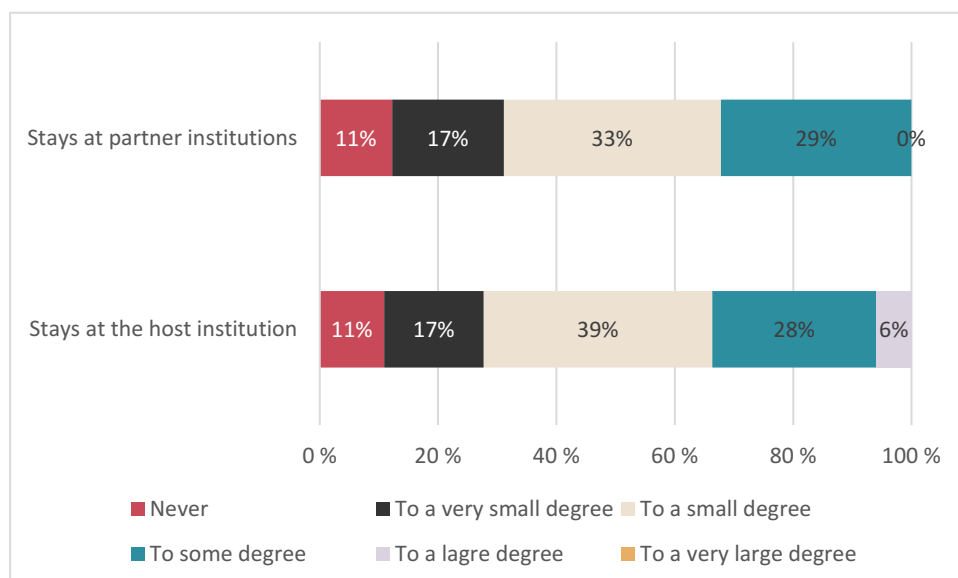


Figure 3.3 To what extent is it common that your doctoral students have a stay at the host institution or one of the partner institutions?

3.6 Research collaboration

We were interested in whether participation in research schools increased the collaboration between researchers at the research schools. 7 out of 18 respondents answered that it was common to a large/very large degree that doctoral students *within* an institution co-authored papers or cooperated on projects (Figure 3.4). Only 3 out of 18 schools said that it was common with such cooperation for doctoral students *across* institutions (the majority – ten schools – reported that this happened seldom; two schools even reported ‘never’). The control schools were asked similar questions, they were asked whether it was common that doctoral students at the potential host institution had co-authors at one of the other institutions that would have been part of the potential research school. Only 5 out of 26 respondents (19 per cent) answered that this was common to a large/very large degree.

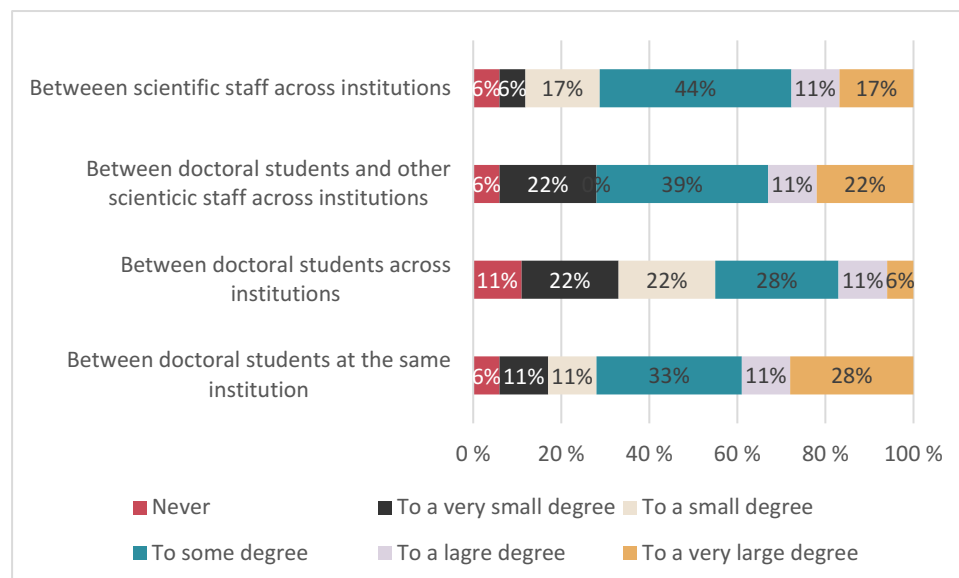


Figure 3.4 To what extent is it common to co-author papers/engage in joint research projects in the research school network?

It was a bit more common with cooperation between doctoral students and senior researchers across research school institutions, where 6 out of 18 schools said that such cooperation was common to a large or very large degree. Again, some schools report very little such activity: four schools stated that such cooperation took place to a very low degree, and one school stated that it never occurred.

Cooperation was not common across senior researchers either, only 5 out of 18 schools report that it was common to a large/very large degree that senior researchers cooperated across institutions (joint research projects/co-authorship). For this question, as for most questions related to national cooperation, the schools' answers roughly follow a 30-40-30 distribution: 4 schools report

low/very low cooperation, 8 schools report some cooperation and 5 schools report much/very much cooperation

The schools that reported national research cooperation, also stated that the cooperation to a large degree was a result of the research school. It was the opinion of four of the 18 schools that the current research cooperation between the partner institutions was a result of the research school.

4 Internationalization

The call for application to become a national research school required concrete plans for quality enhancing internationalization measures. This includes exchange of doctoral students between Norwegian and foreign institutions, international collaboration, international network and international co-authorship. Contact and cooperation with relevant Nordic and European networks was a suggested criterion for establishment of national research schools.

In this section, we will define indicators of internationalization and discuss the extent to which the research schools have led to more internationalization. By comparing the international activity at the research schools to the activity in the comparison group (see section 1.3.2) we may study whether the research schools have actually increased the level of internationalization or whether the grant is merely funding activities that would otherwise be funded by the institutions and thus crowding out the institutions' own contribution to internationalization.

The indicators of internationalization discussed in this section are: international mobility, international collaboration, international activity and international co-authorship. The first three subsections are based on responses from the survey, while the fourth is based on a bibliometric analysis. We want to emphasize that the low number of research schools and applicants for research schools gives a low number of respondents to the survey. The results from comparing the research schools and control schools are thus only indicators, and not robust tests, of whether the research schools have had an effect.

We first look at the schools' general views on the additionality with regards to internationalization, i.e. how the scheme has contributed to or could contribute to internationalization that otherwise would not have been possible. It was a broad agreement in our survey that financing international lecturers for doctoral courses, workshops and conferences was an important contribution of the research schools. Combined with grants for courses and conferences abroad, the research schools give students access to courses held by leading academics in their fields. Furthermore, the activities held in Norway have been open to international PhD students, creating arenas where Norwegian PhD students can meet international peers.

Some research schools mention that it allows more possibility for stays abroad as it is easier to plan for such stays when the research school can guarantee funding, than when the PhD students have to apply for external funding. Furthermore, some research schools think that the scheme has opened up for cooperation with international partners on exchange of doctoral students. Thus, the schools state that the scheme has contributed to increased mobility.

4.1 International mobility

In the mid-term evaluations many of the research schools reported that a significant part of the funding for the research schools had been used to fund grants for PhD candidates for visiting international universities and labs. It is thus interesting to study whether doctoral students at research schools are more likely to have a stay abroad than doctoral students outside the research schools. We asked both the research schools and the control schools about the approximate share of students that have had a research stay abroad. We divided the research stays into shorter stays (more than a week, but less than three months) and longer stays (more than three months).

From Table 4.1 we can see that there is no difference between the propensity to have stays abroad for students at the research schools compared to the control schools (as reported by the academic leader). Students at the control schools are at least as likely to have stays abroad as students at the research schools. The results are interesting as most of the research schools report that the research schools have to a (very) large degree contributed to a more conscious plan for research stays abroad. It is a paradox that while many schools claim they have contributed to such a plan, they also address problems in actually going through with the plan, illustrated by the following response: “Many of our PhD students could have stayed abroad for longer periods, but much pressure on completing the PhD within three years has limited this”.

Table 4.1 Percentage of students that have had a stay abroad

	Less than three months		More than three months	
	Research schools	Control schools	Research schools	Control schools
Median	45	50	20	10
Average	40	47	18	23
N	12	25	11	25
Not responded	6	2	7	2

Based on the schools disciplinary/scientific affiliation, there is a clear general divide between the schools’ propensity to have their students on stays abroad. We see that the research schools operating in Medicine/Health Sciences have much lower presence of stays abroad compared to the schools in Technology and Natural Sciences.

The evaluation of the PhD education in Norway (Thune et al., 2012) showed that participation on international conferences and workshops was much more common than longer stays abroad. To study this element, both the research schools and the control schools were asked to estimate the percentage of PhD students that participate in academic activities abroad such as conferences, courses and workshops. Almost all doctoral students at both the research schools and the control schools participate in academic activity abroad. However, there seems to be a difference between the research schools and the control schools in how often the students attend academic activities abroad. As Figure 4.1 shows, while the typical student in the control group participate in academic activities abroad once a year, the typical student in the research schools participate two to three times a year.

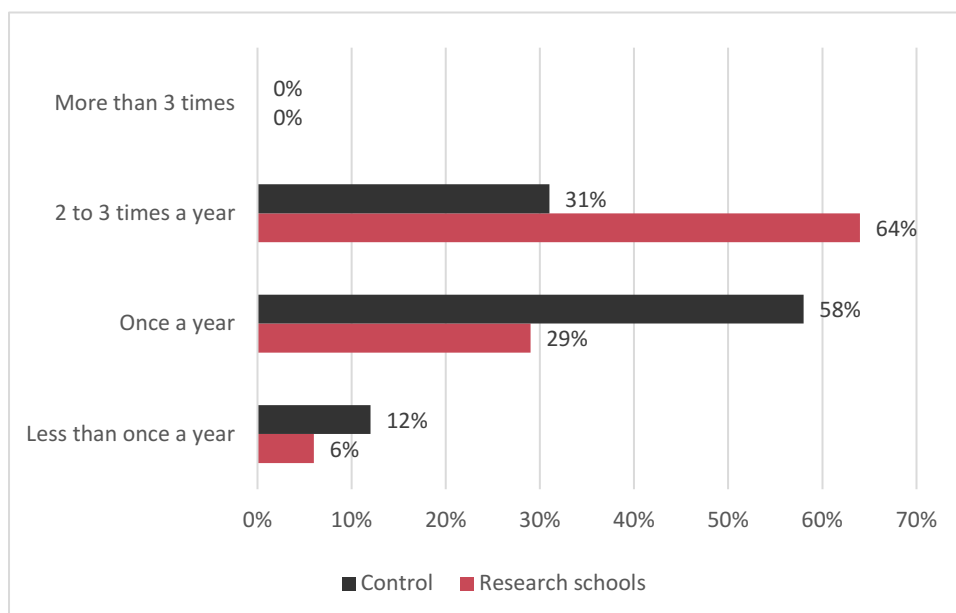


Figure 4.1 How often does a typical PhD student participate in academic activity abroad?

The research schools were also asked whether they considered the research school to have contributed to international mobility into the research school, that is whether the research school had increased the propensity of foreign doctoral students and foreign researchers to visit the research school. As Figure 4.2 shows, the research schools do not believe that being a research school have contributed significantly to international mobility into the institutions in the research schools. Less than one in four of the research schools believe that the research school has to a large/very large degree contributed to make foreign researchers have a stay at the school, while less than one in seven thinks that it has increased the propensity of foreign doctoral students to have a stay at the research school.

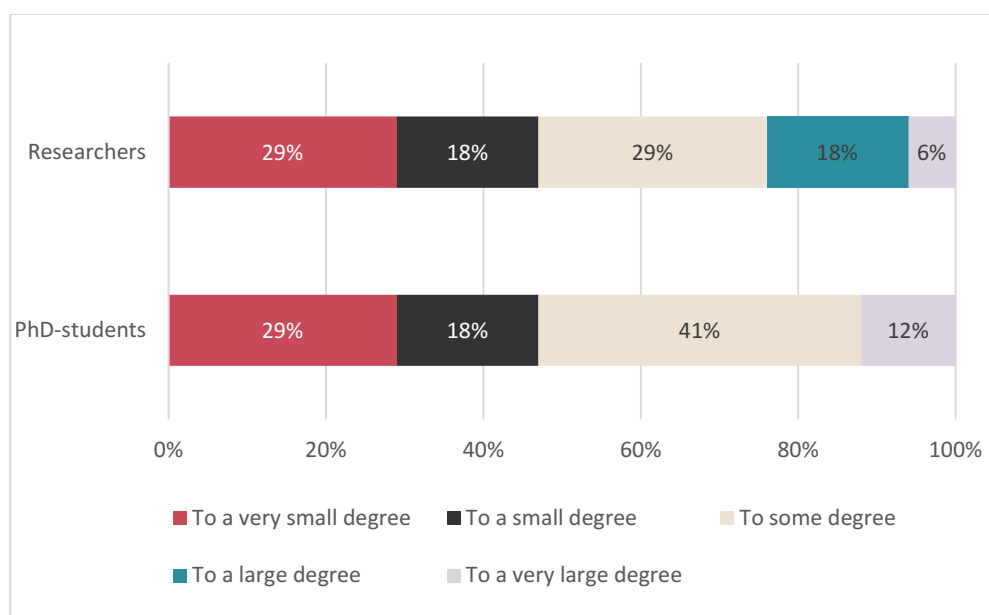


Figure 4.2 To which extent has the research school contributed to make foreign researchers and PhD students have a stay of more than a week at the research schools?

The research schools were also asked an open question about whether and how they facilitate research stays abroad. 11 of the 17 research schools report to provide financial support for research stays abroad. Furthermore, one school reported that they only give financial support to take courses abroad. However, the control schools also to a large degree give financial support; 18 out of 21 respondents report that they give financial support for stays abroad, although one reported that the grant is too low to be a meaningful contribution. Based on this it seems as the control schools are equally likely to offer financial support for stays abroad as the research schools. The students at the control schools tended to get their funding from the faculty and some schools had separate grants for stays abroad dedicated to doctoral students.

The fact that students at the control schools also had access to financial and administrative support to go abroad could be one contributing factor to why we fail to find that the research schools have increased the propensity to study abroad. Another possibility is that stays abroad is not only constrained by the possibilities given to the students, but also the students' willingness to go abroad. One of the research schools commented that despite them having agreements with foreign institutions, travel grants and encouraging students to go abroad, only *one* student went abroad.

Many of the research schools argue that the research schools increase the PhD students' network, through for example international lecturers and participation of international students in courses, which in turn could make it easier to make the necessary connections for a stay abroad. Some of the research schools also had

agreements with foreign universities which simplified the process for the students. However, the control schools also reported to have international collaboration partners which facilitates stays abroad and thus it is not clear whether the research schools increased the international network.

4.2 International collaboration, participation and contribution

Only three of the national research schools that responded to our survey reported to have international partners in their research schools. It is thus not particularly common that the research school itself is international through representation of formal partners at the school.

While it is not common to have foreign institutions as partners in the research schools, two thirds of the research schools reported to have international collaboration partners that were not formally part of the school. Three of these twelve schools reported to have one such international partner, while six of the schools reported to have more than eight such partners. Some schools also documented other forms of international 'partnerships', such as one school who reported that even though they did not have formal international collaboration partners, they had a significant international network, which was for example demonstrated by the ability to host at least ten courses each year with international lecturers.

International cooperation can be strengthened through courses which can give new contacts between the lecturers and individual doctoral candidates. To study to which extent the national research schools have contributed to increased use of international lecturers we asked both the research schools and the control schools about the share of the courses that had international course leaders. While the research schools reported that about half of their courses had international course leaders, the control schools reported that less than a third of their courses had international course leaders. This indicates that the research schools have a larger share of international lecturers as course leaders than the control schools.

Furthermore, the survey indicates that foreign researchers are more often invited as guest lecturers in the research schools than in the control schools (Figure 4.3). About 9 out of 10 research schools report that foreign researchers were to a large/very large degree invited to be guest lecturers or speakers in workshops, courses, seminar etc.

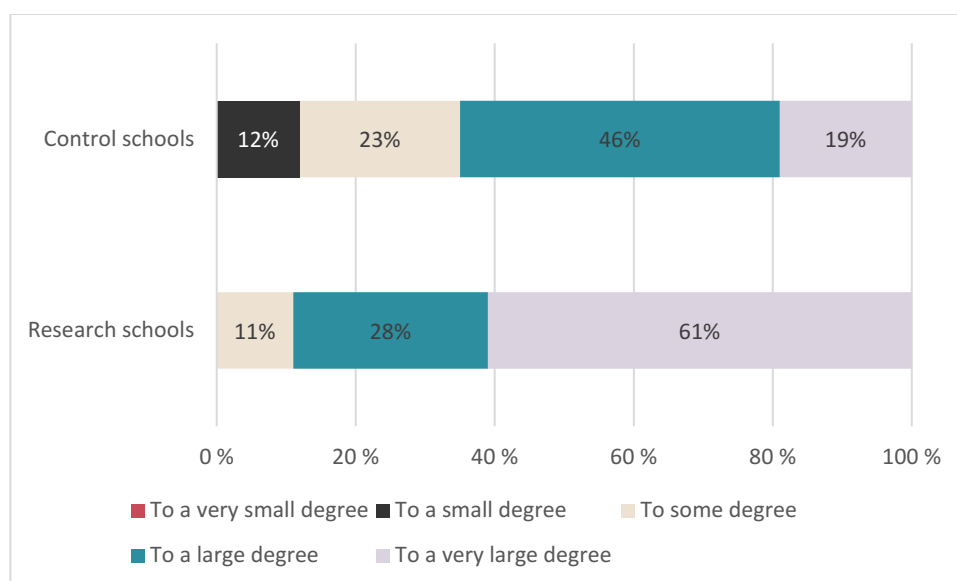


Figure 4.3 To which extent are foreign guest lecturers/speakers invited to workshops/courses/seminars etc.?

The research schools thus seem more likely to have international participation from senior researchers in seminars, courses and workshops. However, just as important for networking is the possibility to network with other doctoral students. To study this aspect, we asked both the control schools and the research schools about the extent to which there was international participation of PhD students at courses/workshops/seminars etc. As Figure 4.4 shows, while the majority of control schools report that there was international participation in these activities to a large/very large degree at their institution, the majority of the research schools report that there was only international participation to some degree. The research schools thus do not seem to have led to increased international participation, that is, there is no indication that foreign PhD students were more likely to attend courses at the research schools than at the control schools.

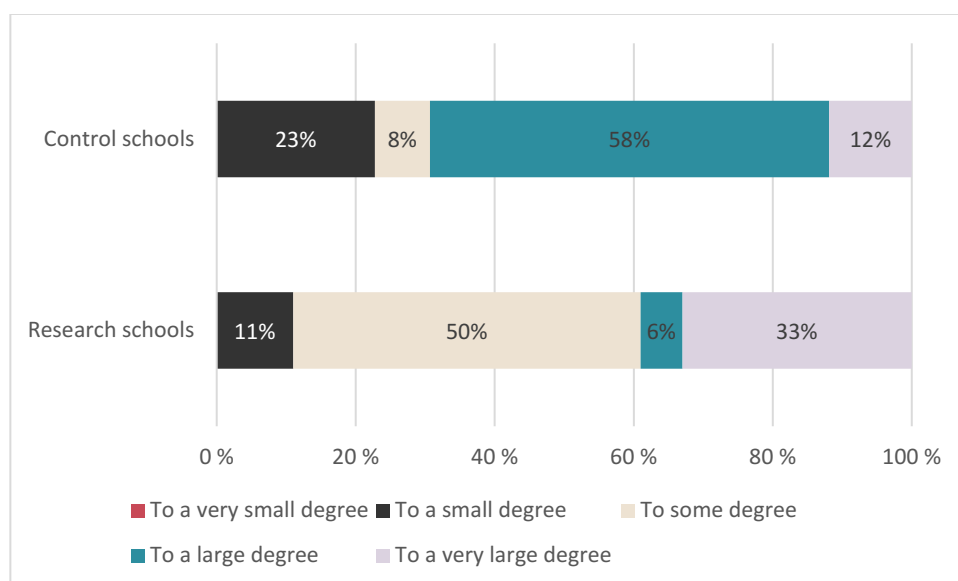


Figure 4.4 To which extent do you have international participation of PhD students at courses/workshops/seminars etc.?

Another vein of internationalization is through supervision as the doctoral students may have international supervisors. Most students in the research schools have more than one supervisor, and it is thus possible that at least one of the supervisors is from an institution outside Norway. Because some of the partners in the national research schools themselves are non-Norwegian we separated between supervisors at the foreign partner institutions and supervisors at other foreign institutions.

Only 11 respondents answered this question. It is possible that those that did not answer felt that the question was irrelevant to them, which means that the answer should have been zero, but it is also possible that the person who answered the survey did not feel that he/she had the necessary information to answer this question. Among those that answered the question, the typical situation was that about one in five students had a supervisor at a foreign institution other than the foreign institution in the research school, while about one in seven had a supervisor at a foreign partner institution (that was not formally part of the school). Given that we can add the two shares, about one in three PhD students (at the research schools that responded to this question) has a foreign supervisor. The control schools were not asked about the shares of students that had a foreign supervisor, but simply whether it was common that doctoral students at their school had a supervisor at a foreign institution. Only two respondents answered that this was common to a large or very large extent. It therefore seems as the research schools have contributed to more use of international supervisors.

4.3 Overall impressions on international work

Finally, we asked the research schools to describe in which areas of the internationalization work that the research school had succeeded the most. Many emphasize the development and maintenance of international networks as a very important factor and that the senior researchers had expanded their international networks. Surprisingly, however, two of the schools reported that they did not consider development of international networks as a goal for the research school. Most of the research schools argued, though, that the students' international network increased through international lecturers in courses, support for taking courses abroad and contact with international doctoral students. Many argued that the increased international networks have resulted in international co-authorship. We will study this claim in section 4.4.

We also asked the research schools what they think could have been done better with their internationalization work. Many were happy with their work and did not have any plans for improvement. The potential improvements that were mentioned was to create a list of international courses and seminars that the research school recommended to the students, to formalize agreements for exchange of doctoral students, to connect more research environments to the research school and to coordinate the course portfolio and activities more with international partners.

We also asked the control schools how *they* think that getting a national research school would have influenced the internationalization work at their institution. The control schools said that getting a research school grant would have increased the possibility to get international partners through positioning of Norwegian research environment and increased exposure. Furthermore, they think that a research school would have increased the possibility to invite international lecturers and financial support for research stays abroad for doctoral students. They think it could have increased the coordination and development of courses which would have made the courses more attractive to doctoral students outside Norway. Several of the rejected applicants highlight that a relative large part of their budgets would have been dedicated to stays abroad for their students ("so that they could establish an international network at an early stage of their careers"), and that this was emphasized in their applications. There were some complaints that the level of international stays for PhD students is now much lower, than what it would have been, had the application been granted funding.

4.4 International co-authorship

One hypothesis on how to stimulate international co-authorship is that the more internationally oriented an institution is, such as using international lecturers or supervisors or facilitating stays abroad, the higher is the probability that a PhD student will cooperate with foreign researchers. In this section, we use a bibliometric analysis to study whether the research schools have increased the level of international co-authorship among their PhD students, compared to a national sample containing all other PhD students in Norway in the same time-period. Only research schools from the calls in 2008 and 2012 are included.

Name lists of PhD students from the RCN (provided by the research schools) were matched with names in the Norwegian national publication database CRIS-tin. The matching was done based on name and year of birth. Names from the lists that matched with several persons in the database were excluded. Some names that could not be matched are arguably missing because of misspellings of names, but also in many cases because the persons have no publications.

Table 4.2 PhD students at research schools identified in the publication database

Research school	N (total)	N (data-base)	% match in data-base
Structural Biology	164	117	71 %
Research School of Computer and Information Security	89	61	69 %
National Research School in Population-based Epidemiology	134	84	63 %
International Research School in Applied Ecology	76	45	59 %
Norwegian Graduate Researcher School in Linguistics and Philology	89	25	28 %
Medical Imaging	330	266	81 %
Norwegian Research School in General Practice	61	39	64 %
Norwegian PhD Network on Nanotechnology for Microsystems	208	149	72 %
Educational Research	115	98	85 %
Business Economics and Administration	141	93	66 %
Norwegian PhD School of Pharmacy	159	103	65 %
Norwegian PhD School of Heart Research	166	104	63 %
Norwegian Research School of Neuroscience	233	139	60 %
Research School on Peace and Conflict	36	24	67 %
Climate Dynamics	106	87	82 %
Total	2107	1434	68 %
Other PhD students	21353	12946	61 %

68 per cent of all Norwegian PhD students affiliated with a research school was identified in the database with one or more scientific publications (Table 4.2). The national share for other students was 61 per cent. For obvious reasons, PhD students from the earlier schools (e.g. Climate Dynamics) have a higher percentage of students in the publication database, as these students have had longer time to get their work published, and thereby being included in the database.

In Table 4.3, we see that since starting their PhD training, 35.6 per cent of the PhD students affiliated with a national research school have published with international co-authors. Among all other PhD students, the share of international collaboration was 30.2 per cent. This means that the share of PhD students with international co-authors is 18 per cent higher among PhD students at the research schools.

Table 4.3 Mean percentage international co-authorship

Type of PhD student	N	%
Research Schools	1,434	35.6
Other	12,946	30.2
Total	14,380	30.7

The numbers in Table 4.3, do not take into account that there may be differences in how the two groups are composed. International co-authorship (and co-authorship in general) is much more widespread in the ‘harder’ sciences compared to e.g. Social Sciences and Humanities. Table 4.4 demonstrates strong differences in degrees of international co-authorship between the research schools. 9 out of 15 research schools have higher shares of international co-authorship than the 12,946 PhD students that were not affiliated with a research school. This is, however, largely determined by differences in composition of the students in the research school and the national sample. In Table 4.4 we therefore report field-adjusted differences in percentages of international co-authorship, where each student at each school is compared to the national percentage of international co-authorship within his/her scientific field. The column ‘% Field adjusted’ is thus each school’s average difference in percentages compared to all students at the national level within the same fields.

Table 4.4 Percentage international co-authorship across research schools

Research school	%	% Field adjusted	N
Structural Biology	46,2	+ 3.6 %	117
Research School of Computer and Information Security	24,2	-1.0 %	61
National Research School in Population-based Epidemiology	30,5	-3.0 %	84
International Research School in Applied Ecology	53,6	+7.6 %	45
Norwegian Graduate Researcher School in Linguistics and Philology	11,4	-2.2 %	25
Medical Imaging	38,0	+1.3 %	266
Norwegian Research School in General Practice	26,5	-4.5 %	39
Norwegian PhD Network on Nanotechnology for Microsystems	36,8	-2.8 %	149
Educational Research	10,5	-3.9 %	98
Business Economics and Administration	21,4	+ 0.6 %	93
Norwegian PhD School of Pharmacy	34,5	-5.5 %	103
Norwegian PhD School of Heart Research	39,9	+3.6 %	104
Norwegian Research School of Neuroscience	45,8	+9.5 %	139
Research School on Peace and Conflict	15,5	+1.2 %	24
Climate Dynamics	54,9	+11.2 %	87
Other	30,2		12946
Total	30,7	+1.4 %	14380

When we study the field adjusted percentages of international co-authorship, we find that the schools vary from being 5.5 percentage points below the national mean within the same fields, to being 11.2 percentage points above the national mean (median value is 0.6 percentage points). Eight research schools have a higher share of international co-authorship compared to the student population within their field(s), while seven schools have lower shares. In total, when controlling for field composition, the difference in international co-authorship between the research schools and the national sample is barely present, it is only 1.4 percentage points higher for the research schools.

The four schools with the lowest shares of international co-authorship are from Social Sciences and Humanities, which is expected. Similarly, it is not surprising that among the medical/health related schools, the research school in general practice medicine has the lowest share (also below the national average).

Table 4.5 International co-authorship across scientific disciplines (percentages)

Scientific field	Research schools	N	Other PhD students	N	Difference
Agriculture, Fisheries, Forestry	64,2	12	40,8	398	+ 23.4 %
Biology	48,8	39	51,3	335	- 2.5 %
Biomedicine and Molecular Biosciences	45,5	257	43,1	1233	+ 2.4 %
Business Studies and Economics	19,7	47	21,3	283	-1.6 %
Chemistry	45,4	54	38,8	328	+ 6.6 %
Clinical Medicine	37,6	344	35,3	2626	+ 2.3 %
Computer and Information Science	23,4	64	24,7	421	-1.4 %
Engineering	24,3	78	25,4	1253	-1.0 %
Geosciences	54,9	93	44,5	659	+ 10.4 %
Health Sciences	33,3	81	30,3	1182	+ 3.0 %
Humanities	1,4	23	7,4	889	-6.0 %
Materials Science	47,3	27	30,4	225	+ 16.9 %
Mathematics and Statistics	32,4	7	28,0	203	+ 4.4 %
Not classified	70,0	15	48,8	92	+ 21.2 %
Physics	35,1	112	47,1	574	-12.0 %
Psychology	22,2	36	27,3	378	-5.1 %
Social Sciences	12,3	145	13,0	1867	-0.7 %

The field adjustment takes into account that this difference is natural given the disciplines. The field-adjustment does not lead to any substantial changes in the pattern at school level, i.e., the highest shares of international co-authorship are found at schools within fields that already had much international co-authorship, that is, mostly in schools from Natural Sciences and to some degree also Medicine.

Ideally, we would have liked to compare students that graduated from the institutions in the research school networks prior to the establishment of the research school to other students to control for the potential difference in the composition of the students in the research school to the other students. That is, to get an estimate of differences in international publication both before and after the establishment of the research school. However, there are obviously no readily

available list of names of the students that was in the research school network prior to the establishment of the research school.

In Table 4.5 we group the PhD students by scientific fields, using the Web of Science based classification scheme developed by the Swedish Research Council. For persons that do not have any publications in Web of Science, we have classified them based on their publications in CRISTin, using the scientific discipline classification scheme developed by the Norwegian Association of Higher Education Institutions (UHR), thereafter converting it to the Swedish classification scheme. Table 4.5 confirms our assumptions: International co-authorship is most seldom in Humanities, Social Sciences and Business Administration – both at the research schools and for all other PhD students.

In most fields, there are only very small differences in international collaborations between research school students and other PhD students. The two fields where the research schools stand out with much higher shares of international co-publications are in Agriculture, Fisheries & Forestry (+23.4 percentage points) and Materials Science (+16.9 percentage points). What these two fields have in common, is that the number of PhD students publishing in these fields at the research schools is very low, and these 'positive' findings should therefore not be given much weight. The fields with the relatively lowest international co-authorship shares at the research schools are Humanities (-6.0 percentage points) and Physics (-12.0 percentage points). The latter is interesting as Physics is one of the largest fields in our sample. In the other five 'large' fields, the research schools have slightly higher shares in Biomedicine & Molecular Biosciences and Clinical Medicine, and slightly lower shares in Engineering, Health Sciences and Social Sciences.

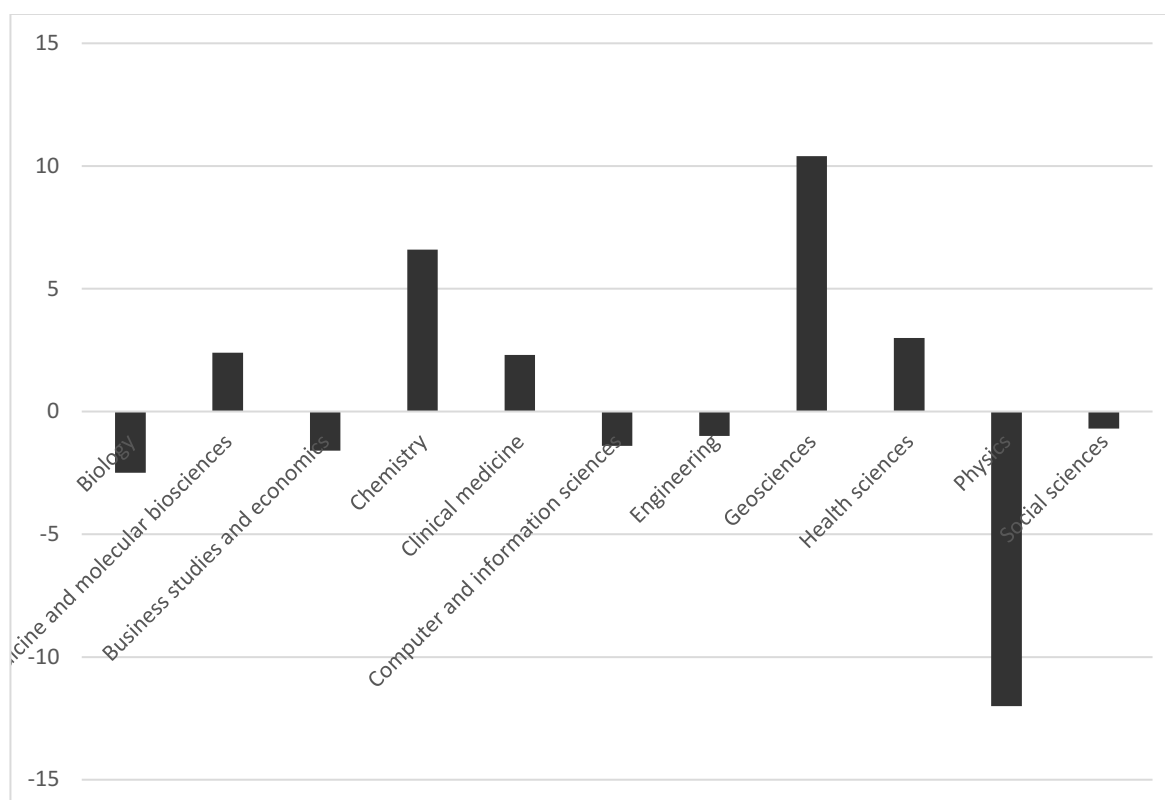


Figure 4.5 Differences in international co-authorship across scientific disciplines (percentages) between research school students and other PhD students

It is thus not clear whether the research schools have contributed to increased international co-publications. The overall statistics indicates that students within research schools have a higher share of international co-authors than students outside research schools. However, when the results are broken down to field level and we focus on fields above a certain size (minimum 35 PhD students at the research schools in the field), we find that the only two fields where there is a truly higher share of international co-authors at the research schools are in Chemistry and Geosciences. For one field, Physics, the research school students actually have less international co-authors than their comparison group (Figure 4.5). In all other fields, the differences are modest (in the range +/- three percentage points). Taking the student population at the schools into account, our results indicate that about half of the schools have higher shares of international co-authorship than what is expected, while the other half has lower, consistent with pure random noise. In sum, there is no real difference between the research schools' PhD students and other PhD students in international co-publishing.

5 Programme effectiveness

Having looked at the research schools' work on national cooperation and internationalization work, we now address the two main outcome variables of the evaluation: have the research schools contributed to improved completion rate and reduced completion time among PhD students? A general description on data and methods are presented in Chapter 1.3.1.

5.1 Effects on completion rate

The total number of students registered as affiliated to a researcher school (from the 2008 and 2012 calls) is 1,220, which is higher than the number of unique individuals (1,169), because some students have been affiliated with more than one school during their PhD period. 50 persons were affiliated with two research schools, while one person was affiliated with three schools. In our analyses, we only included persons who by December 2017 had been enrolled at a research school for five years or more back in time. In the same period, there were 9,487 PhD students in Norway that were not affiliated with any of the research schools. Thus, in our sample there are in total 10,656 persons.

Table 5.1 shows the number of doctoral students that completed within five years after start. Due to field differences in completion rates, we also report the field-normalized completion rates for the research schools. This indicator has been calculated as follow: each student is compared to the national completion rate within his/her given field. At a school with both students from Medicine and Psychology, the percentage of medical students that have completed their PhDs are compared to the percentage of medical students that have completed nationally. The same applies for the psychology students. The research schools' field-normalized completion rates are thus the sum of all their students' deviations from the national numbers within their respective fields. The column 'Difference in field-normalized completion rates' expresses in percentage points how much higher (or lower) the research schools' completion rates are compared to all other students within the same field(s) at the national level.

Table 5.1 Completion rates at research schools five years after start (includes students enrolled for at least 5 years prior to December 2017)

Research school	Completed within 5 years after start (N)	Total (N)	Share completed within 5 years after start	Difference in field-normalized completion rates
Structural Biology	62	109	57 %	+ 10.0 %
Research School of Computer and Information Security	22	40	55 %	+ 5.8 %
International Research School in Applied Ecology	15	41	37 %	- 10.4 %
Medical Imaging	100	219	46 %	+ 3.4 %
Norwegian Research School in General Practice	6	25	24 %	- 16.3 %
Norwegian PhD Network on Nanotechnology for Microsystems	61	116	53 %	+ 3.4 %
Educational Research	20	100	20 %	- 5.7 %
Business Economics and Administration	51	113	45 %	+ 10.7 %
Norwegian PhD School of Pharmacy	45	90	50 %	+ 3.5 %
Norwegian PhD School of Heart Research	31	84	37 %	- 3.5 %
Norwegian Research School of Neuroscience	22	92	24 %	- 16.4 %
Research School on Peace and Conflict	10	26	38 %	+ 10.1 %
Climate Dynamics	56	81	69 %	+ 21.6 %
Total Research Schools	502	1220	41.1 %	+ 0.4 %
Total Other Students	3883	9487	40.9 %	

The main result is that the completion rate at the research schools is practically identical to the completion rate for all other PhD students in Norway: 41.1 vs. 40.9 per cent¹⁵.

The completion rate within five years after start varies from 20 to 69 per cent at the research schools. It is important to note that the departure points for the schools differ. The low completion rate at for example NAFALM is not unexpected, nor should it be considered especially low. Many of the students are doing their PhD work part-time in conjunction to their daily clinical work. It is important to note that many (but far from everyone) of the students that did not complete their PhDs within the five-year period, will most likely do so, or have done so, at some later point. A longer time window would have increased the completion rates. Nevertheless, some PhD students may have deliberately terminated their PhD work, while others may be considered true 'drop-outs', i.e. persons who tried but for different reasons never succeeded in finalizing their PhD work.

¹⁵ Two Schools (EPINOR and LingPhil) have been excluded from Table 5.1 as the number of PhD students that could be properly matched (name lists versus register data) and that had spent five years at the school was too low.

When we use the field-normalized completion rate, the rates at the research schools are in the range -16.4 to +21.6 percentage points (compared to the national completion rate within the same field(s)). The median value is +3.4 per cent. In total, the students at the research schools have a 0.4 percentage points higher completion rate compared to all other students. The school in Climate Dynamics display a substantially higher completion rate compared to other schools. The field comparison allows us to see that for some of the schools with a low completion rate, such as the school in educational research, the completion rate is not a result of the school being ineffective, rather it is in line with what is usual within this field. Actually, Table 5.1 shows that for the school on peace and conflict, although it has a seemingly low completion rate, the completion rate among this school's students is ten percentage points higher than for other PhD students operating in the same fields.

Table 5.2 Comparing completion rates among PhD students in research schools and other PhD students within 5 years after start*

	Research schools			Other PhD students			
Scientific discipline	Compl.	Total	% Compl.	Compl.	Total	% Compl.	Diff. (percentage points)
Pharmacy	4	7	57.1	5	8	62.5	-5.4
Health Sciences	12	46	26.1	77	221	34.8	-8.8
Medicine	121	333	36.3	1009	2436	41.4	-5.1
Psychology	8	32	25.0	116	266	43.6	-18.6
Natural Sciences	228	412	55.3	1118	2333	47.9	+7.4
Social Sciences	12	40	30.0	233	898	25.9	+4.1
Technology	38	88	43.2	713	1345	53.0	-9.8
Educational Sciences	17	84	20.2	59	264	22.3	-2.1
Economics and Business Administration	36	77	46.8	73	251	29.1	+17.7

**In the 'total numbers' the following fields are also included: Architecture, Library Science, Arts, Music, Theology, Other, No Education. We do not show numbers for these fields in tables and figures, since none of the candidates at the research schools have graduated within these fields.*

In Table 5.2 we compare the two groups of PhD students (those affiliated and those not affiliated to national research schools) based on their educational background (which by large correspond to the scientific field that their PhD work is relevant to). The fields Humanities, Law, Dentistry and Veterinary Sciences are left out, due to either too few persons within these fields at the research schools (the latter three), or in the case of Humanities: too few students that have had the possibility to be affiliated for five years or more at the schools, which is the time frame of this analysis.

Only in three of the disciplines, the research school students outperform the other students. The research school students perform better compared to the other students within Economics and Business Administration (18 percentage points higher). Furthermore, in two of the largest disciplines – Natural Sciences and Social Sciences – the research schools have some seven and four percentage points higher completion rates, respectively. The fields where the research schools have moderately lower completion rates are Health Sciences and Medicine, while the completion rate is substantially lower in Psychology; visualized in Figure 5.1.

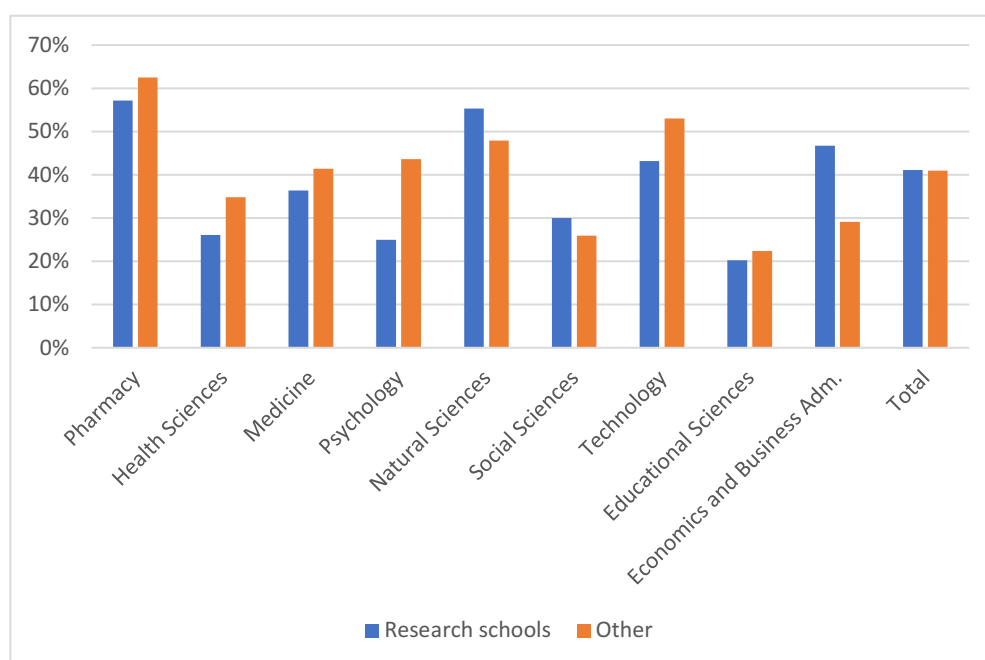


Figure 5.1 Comparison of completion rates among PhD students in research schools (n=1,119) and other PhD students (n=8,022) within 5 years after start

5.2 Effects on completion time

When studying completion time, the sample simply involves all persons that have defended their doctoral thesis, i.e. completed their PhDs.¹⁶

Table 5.3 Duration of the doctoral period up to the time of dissertation (completed PhDs)

Research School	Average number of days	Average number of months	Average number of years	Field-normalized difference in years	Number of persons
Structural Biology	1 648	54.2	4.5	+0.10	82
Research School of Computer and Information Security	1 550	50.9	4.2	-0.15	27
National Research School in Population-based Epidemiology	1 944	63.9	5.3	+0.83	3
International Research School in Applied Ecology	1 565	51.5	4.3	-0.11	19
Medical Imaging	1 584	52.1	4.3	-0.16	123
Norwegian Research School in General Practice	1 743	57.3	4.8	+0.32	9
Norwegian PhD Network on Nanotechnology for Microsystems	1 663	54.7	4.6	+0.15	84
Educational Research	1 968	64.7	5.4	+0.42	45
Business Economics and Administration	1 743	57.3	4.8	+0.05	80
Norwegian PhD School of Pharmacy	1 674	55.0	4.6	+0.18	58
Norwegian PhD School of Heart Research	1 592	52.3	4.4	-0.09	44
Norwegian Research School of Neuroscience	1 718	56.5	4.7	+0.14	28
Research School on Peace and Conflict	1 784	58.6	4.9	-0.15	18
Climate Dynamics	1 601	52.6	4.4	-0.03	69
Total research schools	1 667	54.8	4.6	+0.04	689
Total other PhD students	1 676	54.8	4.6		5671

The average completion time for PhD students at the research schools and other PhD students in unadjusted numbers differs by no more than nine days – 1,667 and 1,676 (Table 5.3). Using the more traditional average number of years (or number of months), the numbers are identical. Completion time may, however, depend on scientific field. We have therefore field-normalized the PhD students' completion time. The calculation of this indicator is as follows: each students' number of years is compared to the national average number of years for students within the same field. The field-normalized indicator for each school is thus the sum of the difference between the research school students' actual completion time and the field adjusted (national) mean.

¹⁶ The research school LingPhil has been left out the analysis, due to the low number of students that we were able to match with data in the Doctoral Degrees Register.

The research schools are evenly distributed across the national mean. Two schools display an average number of years identical to the national mean (4.6), while six schools perform better (range 4.2 – 4.5 years) and six schools perform worse (4.7 – 5.4). When studying the field-normalized differences in number of years, there are still six schools with better completion time than for these schools' relevant student population outside the research school. The differences, however, are very small. At the most, three schools' completion time is some 54-58 days lower than for other students within the same fields. The median value is -0.05/-0.10 (that is about 0.1 years longer spent on the PhD). Comparing the initial difference of ten days to the field-normalized difference of 0.04 years, demonstrates that a ten-day superiority at the research schools have been transformed to a 14.6-day inferiority.

When comparing the completion time across scientific disciplines (based on the students' educational background), we find that the PhD students at the research schools have higher completion time in four fields (0.1 to 0.5 months) and lower completion time in five fields (0.1 to 0.2 months) (Table 5.4). For this analysis, all fields with less than five persons at the research schools have been removed.

Table 5.4 Duration from start to completion among PhD students that have finalized their PhD

	Mean duration: Number of days		Mean duration: Number of months		Mean duration: Number of years		N	
	RS	Other	RS	Other	RS	Other	RS	Other
Pharmacy	1824.3	1674.1	60.0	55.0	5.0	4.6	7	7
Health Sciences	1438.4	1491.4	47.3	49.0	3.9	4.1	13	101
Medicine	1615.0	1656.8	53.1	54.5	4.4	4.5	158	1543
Psychology	1697.4	1744.4	55.8	57.4	4.7	4.8	14	188
Natural Sciences	1629.6	1623.6	53.6	53.4	4.5	4.4	294	1473
Social Sciences	1787.3	1845.5	58.8	60.7	4.9	5.1	21	429
Technology	1691.0	1610.5	55.6	52.9	4.6	4.4	55	903
Educational Sciences	1994.2	1816.5	65.6	59.7	5.5	5.0	39	113
Economics and Business Adm.	1730.8	1767.6	56.9	58.1	4.7	4.8	55	119
Total	1667.8	1676.9	54.8	55.1	4.6	4.6	664	5671

While some schools, and PhD students within some scientific fields, perform better/worse than the overall national average, the general conclusion is that there is no difference between the results obtained at the research schools with institutions outside the research school scheme. Although one may claim that the composition of students at the research schools may be skewed in other ways than

what we have captured by our field-standardization (e.g. different gender balance, age balance etc.), we believe the results clearly affirm that the national research school scheme has not contributed to higher completion rate or reduced completion time.

6 Overall impressions

For this evaluation, and permeated in the rationale behind the establishing of the national research school scheme, the Research Council of Norway had a range of objectives that the scheme would hopefully influence. In this section we look at whether the research schools think that the national research school scheme have contributed to achieving these goals, and at their overall impressions of the scheme.

One of RCN's goals of the scheme was increased efficiency, that is increased rate of completion and reduced time to completion. However, when we asked the schools whether they thought the establishment of the research school had contributed to achieve these goals (Figure 6.1), only a few of the research schools believed that this to a large/very large degree had happen, which coincides well with the findings in Chapter 5. A few more believed that the scheme had increased the rate of completion than that it had reduced the time-to-degree. In addition to efficiency, the research school scheme was believed to have increased the attractiveness of the research education through increased quality and increased recruitment. 14 out of 18 research schools thought that the research school scheme had increased the quality of the research education, while only 4 out of 18 though that it had increased recruitment (including, in both cases, those who replied to a large or to a very large extent).

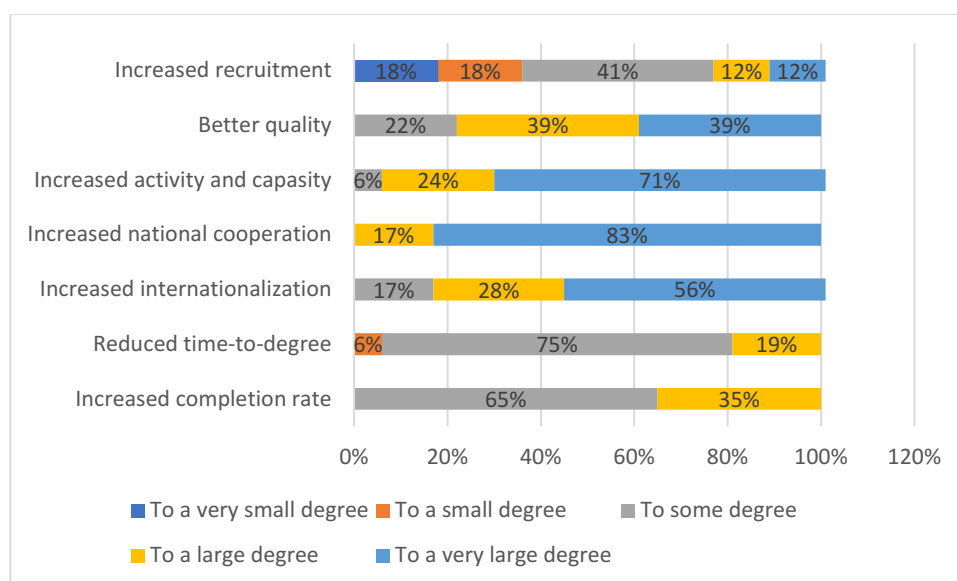


Figure 6.1 Research schools' perceptions on achievement of objectives

Another goal behind the set-up of the research school scheme was increased internationalization. 15 out of 18 research schools report that they to a large/very large degree believe that the research school has contributed to internationalization. We studied internationalization in Chapter 4, and found in many of the domains that we measured that there was no difference in the level of international activity of the research schools and the control schools. However, there was an increase in the number of foreign lecturers and seminar speakers. Furthermore, the PhD students at the research schools participated more often in academic activity abroad. Thus, we can assume that it is these two factors that the research schools think about when they say that they have experienced increased internationalization.

Increased national cooperation between small and fragmented research environments was a very important motivation behind the establishment of national research schools. 15 out of 18 research schools report that they think that the establishment of the research schools have contributed to this to a *very large degree*. In sections 3.4 – 3.5 we studied different aspects of national cooperation and found that the research schools seem to have increased cooperation between senior researchers across institutions. Specifically, senior researchers were more likely to contribute to academic activity at the partner institutions than if the research school had not been established. When asked whether the research school had contributed to increased activity and capacity in the research environment almost all research schools answered that this has happened to a large or very large degree. In short, they point to national cooperation as the largest success factor of the research school.

The control schools were asked a similar question (Figure 6.2); about whether they think that the establishment of a research school would have contributed to increased recruitment, better quality, increased national cooperation, reduced time-to-degree and increased completion rate. On all factors other than national cooperation the control schools were more optimistic about the prospects of a research school than the research schools were themselves. We can assume that the research schools were also optimistic about the prospects when they established the schools, but may have found it hard to deliver on many of the factors that they were measured on.

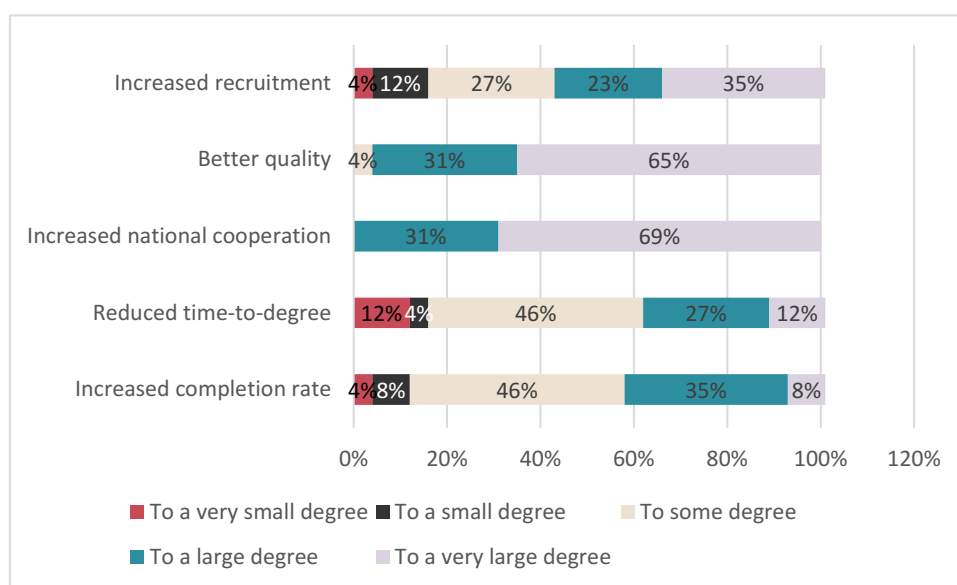


Figure 6.2 Control schools' perceptions on potential achievement of objectives

6.1 Additionality of the research school scheme

The research schools were asked about what they thought was the added value of the research school. In the research schools' own opinions, one of the main contributions of the research school was increased cooperation between research environments. They answer that the creation of the research school had contributed to a better and more coordinated PhD education, more international lectures and a stronger course portfolio. In addition, one of the respondents said that the creation of a research school allowed a comparison of the topics taught at the institutions within the research school which made it possible to compare the level of the courses as well as to identify topics that were not adequately covered.

The increased invitation of international top researchers for doctoral courses and seminars is moreover said to inspire the senior staff of the research schools. Furthermore, the research schools emphasize that the scheme has contributed to building networks and larger cooperation across the sector (especially among PhD

students). One of the research schools says that the research environments now “talk together, know each other and write applications together, something that did not occur before the research school”.

Some of the research schools are in topics that have currently small scientific communities in Norway and the research schools argue that these branches would not have been able to develop if they had not received the research school grant. These research schools argue that the creation of a research school made it possible to include the majority of these research environments in a research network. Furthermore, they say that the research school grant has lifted the research environment in Norway and made it more visible internationally and created cooperation also across borders. Some of the research schools have been cross-disciplinary. These research schools emphasize that the cooperation between doctoral students from different disciplines have been an important contribution of the research school.

When we ask the schools about the added value of a national research school, just one school emphasized the scheme as a tool to streamline the education, or gave any verdicts on it as a tool to make the PhD students more effective, thus increase the ‘production’ of doctoral dissertations. The overall impression is that the scheme makes funding available that enable the schools to increase the range of activities which may increase networking, research collaboration and increased quality seen from the student perspective through mechanisms such as methodological reflection. As such, most of the scheme’s activities are considered supplements to the current PhD programmes.

6.2 Self-reported limitations of the research school scheme

The schools were overall very satisfied with the research school scheme, but we also asked for potential limitations or weaknesses of the scheme. One of the topics that was frequently mentioned was the continuation of the research school after the funding ends. Research schools that are still active, fear the end of the funding and that the network will “collapse back to zero”. One of the schools that had finished their period said that they failed to continue the cooperation in a formal manner. They tried to continue the research school with a decreased budget, but they did not succeed. How the research schools should ensure that the national cooperation continues after the grant period is thus still an open question. We explore this further in section 6.4.

One of the goals of the research school scheme is to create cooperation across institutions within the same discipline or on the same subject. This means that within a given geographical area/city there can be multiple institutions that belong to different research schools. The research schools comment that the fact that

the scheme does not encourage cooperation across research schools is a limitation as the research schools duplicate offers in generic skills and offers for supervisors. Cooperation across research schools would make it possible to offer some activities locally, which for some research schools has proved to be important to get supervisors to participate. Moreover, research schools can create synergies by sharing experiences with each other.

Some research schools are defined by disciplines while some are thematic. The disciplinary research schools say that it is a challenge that many of their courses are also suitable for people from other disciplines, but that the other disciplines refrain from attending. Hence, it is a challenge for these types of research schools to breach the disciplinary barriers and promote more cross-disciplinary thinking.

The research school scheme allows the institutions to decide their own structure to a very large degree. The research schools say that this is both an advantage and a disadvantage. It may potentially create unclear structures between the research schools and the institutions' doctoral programme as the content of the doctoral programme is determined by the individual institutions. Furthermore, for some schools it is a challenge that while the parties in the research schools typically are departments, the doctoral programme belongs to the faculty. Some research schools argued that since the faculty was not involved in the research school (the research schools are typically connected to departments), it was harder for the institution to make use of the experiences that were made within the research school. Despite such objections, most schools described their relationship with the local institutions as well-functioning.

The control group was also asked questions about what they thought were the challenges in the research school. Some feared that the research school scheme created elite thinking, that the research environments that received the research school grant was considered as better than the research environments that did not achieve research school status. Furthermore, some respondents felt that there had become an in-group and out-group thinking as their environment was not included in the research school activities. However, here there are likely to be differences across the research schools. One of the research schools wrote that they had a clear policy to involve all doctoral students that fit into the research school independent of their institutional belonging. However, they emphasized that this is costly and that the choice came at the cost of internationalization.

Potential applicants for the research school scheme that rely on external funding commented that it is hard for them to promise a certain number of doctoral students for the research school, which can make it harder for them to apply. Likewise, it is commented that small fields have a harder time to generate a good application than larger fields. One of the applicants commented that their application

was built on local initiatives that were built over time, but since the network was small and vulnerable the cooperation ceased after the application was rejected.

Another issue on which the respondents hold different opinions, both among the research schools and the rejected applicants, is whether the research schools should focus on disciplines or be cross-disciplinary. Some think that there is too little emphasis on the development of strong disciplines, while others think that the scheme has a too narrow definition which made it hard for environments that wanted to focus on something other than thematic areas or disciplines, such as a focus on common models or method.

6.3 Duration and grant size

The research schools are funded for eight years. The eight-year period was chosen as the experience from other Nordic countries was that four to five years was too short as it gave too much uncertainty to the schools who received funding. Building a well-functioning research education environment takes time and resources, and the Research Council of Norway thought that more long-term financing, more specifically eight years, would be better. That the funding expires does not mean that the networks must shut down. However, the RCN has been clear that in any future calls new research schools will be prioritized. The continuation of the activities of the research school thus needs to be with institutional funding or other grants.

We asked the research schools about whether they found the duration of the programme to be long enough and whether the funding was sufficient to reach most of the goals of the research school scheme. More specifically, we referenced to the research questions of this evaluation where we asked them to what extent the research school had contributed to improve completion rate, completion time, internationalization, national cooperation, increased recruitment, better quality in the education and increased capacity and activity. The results are displayed in Figures 6.3 and 6.4.

Nine out of 18 research schools find the duration sufficient to meet most of the goals, while five research schools say that eight years is sufficient to some extent. Only two schools think that they would need more time. Two schools could not answer directly to this, but the first stated that the school may collapse back to zero if no further funding is granted, while the second school commented that for their special case it is not sufficient as their doctoral students are part time practitioners and part time doctoral students which extends the expected duration of the doctoral programme to six years.

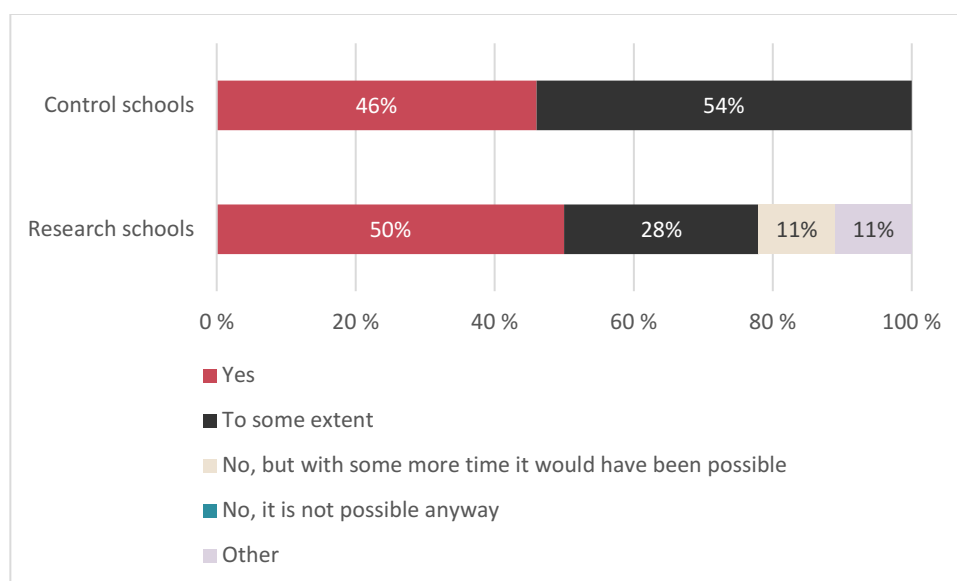


Figure 6.3 Is the *duration* of eight years long enough to meet most of the goals of the research school scheme?

The time needed for the schools may also depend on whether the research school network was already established at the time the grant was given. One of the schools suggests that under certain circumstances it could be beneficiary with an introductory period were the network is allowed to be built before the full funding starts. Likewise, it could also be beneficiary to have a phase out period after eight years to make the transfer of the responsibility for the activities to the institutions easier.

When asked whether the funding was sufficient to meet ‘most of the goals’ of the national research schools, two thirds of the research schools answered yes, only one answered no and the others answered that it was enough to some extent. Thus, our survey results indicate that the majority of the leaders of the research schools believes that the funding and the duration of the research school scheme is sufficient to meet the goals. Some of the research schools actually claimed that it could have been a better solution to give less money to each research school which would force the research school to focus the activity and give more schools opportunity to get funding. However, there is no general agreement about this as some of the other schools think the funding period is too short and the funding is too low. There seems, however, to be a general trend that many of the research school leaders are worried about how the research school should continue their work after the funding ends.

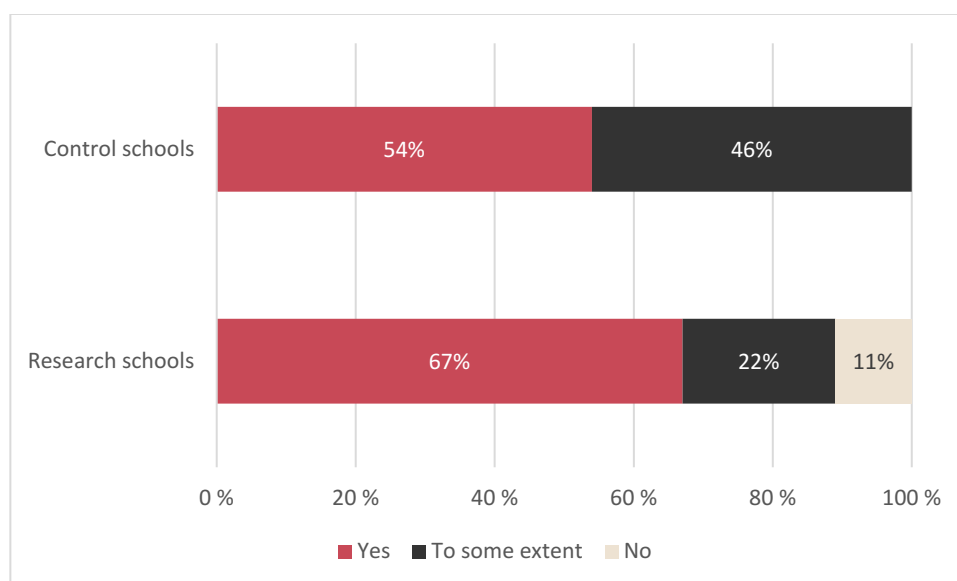


Figure 6.4 Is the *size of the funding* sufficient to meet most of the goals of the national research school scheme?

6.4 Continuation of the research schools

We asked all the research schools if their schools would be continued after the financing from the Research Council of Norway came to an end. 75 percent of the schools said that they would continue the research school. We then asked the discontinued schools what had happened to the research school after the funding had ended, and the research schools that were still active was asked about their plans for when the grant ended and which activities they thought would continue.

The research schools from the first call has ended their funding period from the RCN. One of these schools has made plans for how to continue the research school with reduced activity with focus on offering a (reduced) course portfolio. The leader of the research school says that it was strong support from the institutions initially, but that at the present it is uncertain whether it will go through due to other processes that diverted the attention. Two of the other discontinued research schools answered that some of the research schools' activities are continued in new research schools. Neither of these new research schools are funded by the national research school scheme, but they are both funded by other grants from the Norwegian Research Council. The fourth discontinued school says that they applied for a new research school and got rejected and they will no longer be able to offer joint courses. Thus, based on the discontinued schools, the strategy for continuation of the research schools' activities seems to have been to obtain a new grant, and if that failed the schools failed to continue their activities.

The research schools from the second call are a bit more than midway in their grant period. When asked about their plans for continuation of the research

schools' activities some of them say that they have no plans yet, but that they are planning to work on it. Many of the research schools say that they plan to apply for further external funding through the Research Council of Norway and other sources such as Erasmus+ Strategic Partners and NordForsk. The research schools emphasize that most of the activities are not sustainable without external funding. Some activities such as the main courses can be continued with financing from the institutions, but the schools will not be able to open up the courses for external participations as they do today. Some of the research schools also think that they can keep their annual conference. Activities such as the summer/spring/winter schools are not considered sustainable, or they will require participation fee which will give much fewer participants. The research schools also think that mobility grants, development of new courses and invitation of international lecturers will be significantly reduced.

The research schools from the third call have just started their grant period and thus cannot be expected to have made plans for the continuation yet as they are still forming the school. However, they were also clear that the research schools depend on external funding also after the grant has ended otherwise the activity level would be drastically reduced. The schools hope that their researcher network will be robust and serve as a platform for cooperation also after the funding has ended.

Generally, there seems to be consensus that the majority of the research schools' activities are not viable after the grant period has ended, but that the established doctoral courses can be continued with funding from the member institutions. Most research schools rely on new funding from the Research Council of Norway for the continuation of the research schools' activities. Only one of the schools says that they have plans for funding from the industry. This seems like a viable plan as they had support from the industry also prior to funding from the RCN.

7 The organizing of the schools – different outcomes?

The research school scheme allows the research schools a lot of autonomy in deciding the size, structure and student population of the research school. Thus, as described in chapters 2-4, the research schools differ on many aspects. For example, the research schools conduct their activities differently and they differ in their national and international orientation. In this section we study whether the variation in organizational features can explain differences across research schools in their success in terms of fulfilling the goals of the scheme. Understanding the link between organizational features and success is important when planning and developing new research schools. Based on our analyses, is there a recommendable model for structuring national research schools? Answering this question (Chapter 7.1), is the final task of the evaluation: to consider various aspects that may explain the research schools' achievement of objectives. In Chapter 7.2 we give a brief overview of the organization of the research school scheme itself in Sweden and Denmark, compared to Norway, i.e. a Nordic comparison.

7.1 Organizational characteristics of Norwegian research schools

In the terms of reference for this evaluation, the RCN included several suggestions of organizational features that could be useful to study¹⁷. Based on these suggestions we have developed a more overall approach including twelve institutional characteristics of the schools which are scrutinized in this chapter (see Box 7.2).

The purpose of this analysis is to see whether different scores in the institutional indicators are associated with different scores in outcome indicators, measuring the schools' achievement of objectives. These are: 1) Completion rate, 2)

¹⁷ Scientific and administrative leadership; Cooperation between the partner institutions; Number of members (size of the research school, i.e. number of partner institutions and/or number of PhD students affiliated with the school); Procedures for recruiting PhD candidates; Work on internationalization; Involvement of supervisors and other scientific personnel at the participating institutions).

Completion time, 3) Increased national cooperation, 4) Increased international co-operation, and 5) Improved quality of the PhD education, as outlined in Box 7.1.

Box 7.1 Outcome indicators

Percentage of PhD students that complete within five years (completion rate)

The completion statistics show a variance from 20 to 69 per cent (see section 5.1). The schools' shares are field-standardized based on their students' surplus or deficit compared to the national field-standardized share. That means that a school's completion rate of e.g. 30 per cent comes out as higher/better than another schools' share at 60 per cent if the national values for the same student population is for example 25 and 65 per cent, respectively. The nationally standardized completion rate differences are in the range -16.4 to +21.6 percentage points. Median is +3.4 percentage points. We separate between schools with high and low completion rates:

- High completion rate (range: +5.8 to +21.6 percentage points higher than the national average, n=4)
- Low completion rate (range: -16.4 -to +3.5 percentage points higher than the national average, n=12)

Average years on time-to-degree (completion time)

The statistics show a variance from 4.2 to 5.2 years at the schools, see section 5.2. The schools' values for time-to-degree are field-standardized based on their students' surplus or deficit compared to the national field-standardized average number of years. This means that if a school's completion time is 4.8 years, it will be considered better than another school's completion time of 4.7 years if the national values for the same student populations are for example 4.9 and 4.6 years. The field-adjusted differences vary between the schools from -0.16 years (i.e. 0.16 years less spent on the degree) to +0.83 years (i.e. almost a full year longer spent on the degree). The median value is +0.075 years (that is, almost a month more time spent on the degree). In classifying the schools, we differ between schools above and below a difference of 0.09 years:

- Shorter completion time (0.09 to 0.016 years less spent on the degree, n=5)
- Little difference, or longer completion time (0.83 more years to 0.03 years less, n=8)

Increase in international co-authorship

The PhD students' shares of publications with international co-authors have been compared to the shares for other PhD students within the same discipline. Each school's value for this indicator is thus the mean surplus or deficit compared the national field-standardized share. The lower and higher standardized percentages of international co-authorship at the research schools are in the range -5.5 to +11.2 percentage points (median is +0.6 percentage points). We have grouped the schools into two categories:

- Substantial increase: +3.6 to +11.2 percentage points (n=4)
- No increase (substantial) or a decrease: -5.5 to +0.076 percentage points (n=12)

Increase in national cooperation

The schools were asked to what extent the resources they got from the research school scheme had contributed to increased activity and capacity in the collaborative environments, including more courses and better access to research networks and guidance (see Figure 6.1). The answers 'to some degree' (n=1) and 'to a large degree' (n=4) have been collapsed into 'Increased cooperation'. The value 'to a very large degree' is here labelled 'Very high increase in cooperation' (n=11).

- Increased cooperation (n=5)
- Very high increase in cooperation (n=11)

Increase in international activities

The schools were asked to what extent the resources they got from the research school scheme had contributed to increased internationalization (see Figure 6.1). The categories 'to some degree' (n=2) and 'to a large degree' (n=5) have been collapsed into the category 'Increased cooperation', while the category 'to a very high extent' (n=10) has been labelled 'Very high increase in cooperation'.

- Increased cooperation (n=7)
- Very high increase in cooperation (n=10)

Improved quality of the PhD education

The schools were asked to what extent they believed the research school scheme had led to improved quality of the PhD education (see Figure 6.1). The responses were:

- To some degree (n=3)
- To a large degree (n=7)
- To a very large degree (n=7)

This analysis is based on a very simple cross-tabulation of indicator values where the very low number of observation units puts strong limitations on the generalizability of the findings. We are partitioning an already small sample into even smaller parts. The opportunity to unveil differences between indicator values is also partly hampered by the lack of variance in the schools' reporting or scores on the quantitative indicators. Therefore, we cannot make clear-cut predictions about

what kind of organizational features that will promote positive outcomes, but rather make a qualitative assessment of whether there are any differences in outcome indicators across institutional characteristics. The organizational characteristics of the schools that are studied are presented in Box 7.2.

Box 7.2 Organizational characteristics

Indicators for academic orientation (1-2)

Type of research schools: Thematically or discipline oriented (1): Based on the schools' self-reported descriptions of why they applied for funding to establish a school, we may separate between two different types: 1) Those who wanted to create a national school because the existing PhD-awarding environments were too small. These schools are typically oriented towards one specific academic field and desired national coordination and synergies. Mostly, they recruit students from one academic discipline (e.g. pharmacists), but sometimes from two or three that have shared domain (e.g. medical doctors and psychologists for neuroscience). The other type of school, is 2) the multidisciplinary school where there were no existing similar training courses available prior to the establishment of the research school. The schools recruit students from many different field. These schools are thematically, not disciplinary based.

Scientific profile of the school (2): The schools are divided in three groups based on their scientific field: Medicine (n=4), Natural Sciences (n=7) or within Social Sciences & Humanities (n=6).

Indicators for the relationship between the partner institutions, and for the size of the schools (3-6)

Organization of responsibility (3): Based on the schools' self-reported descriptions on how the activities at the schools are organized, we have classified them in three groups. 1) Top-down schools: the leader group of the research school has the main responsibility for the organization of activities. 2) Division of responsibility: each institution within the research school has the responsibility for given activities or the responsibility of given activities rotate among the institutions. 3) Bottom-up schools: Courses and other activities are initiated by the institutions in the research schools and the initiating institution has the responsibility for the activity.

Size of the school - Number of partners at the schools (4): The size of the schools varies from three to 13 partner institutions. Here we distinguish between small schools (3-7 partners) and large schools (8-13 partners).

Standardization of the PhD programmes (5): We asked the schools whether work had been done to unify/standardize the doctoral programmes at the partner institutions. The schools who responded that 'Yes, they were not unified, but they are now' (n=1) and 'No, they have always been unified' (n=3) have been collapsed into 'Unified'. The schools who responded 'No, and there are still major differences' (n=4) or 'No, and it is no goal that they should be unified' (n=8) have been collapsed into 'Not unified'.

Number of PhD students at the school (6): Schools with 26-50 students at any given time (n=1), 51-75 students (n=6) and 76-100 students (n=2) have been collapsed into 'less than 100 students', and the categories 101-150 students (n=6) and 200 or more students (n=2) have been collapsed into 'more than 100 students'. The two size indicators (number of partners and number of PhD students) are only moderately associated. Ten out of 18 schools have high (or low) values on both indicators.

Student related indicators (7-11)

The research school's dominance in the education (7): We asked the schools how much of the students' doctoral training that was provided by the research schools (surprisingly, one school responded 'none'). We distinguish between those schools where most of the activities take place at the school (main contributors) and those where only certain elements take place at the school (secondary contributors). We use two categories: 'Most subjects are taken at the research school' (n=4) and 'Only individual subjects are taken at the research school' (n=13).

Recruitment of PhD students (8): The schools have different procedures for recruiting their students. Broadly speaking, there are two types of enrolment procedures: Automatically if they are admitted to a specific doctoral program at the partner institution (n=2) or by application (n=16).

Sense of belonging (9): This indicator is a proxy of 'identity'. We asked the schools about to what extent their PhD students regard themselves as fellows at the research school, as opposed to their respective institutions. The responses 'to a very large' and 'to a large degree' are collapsed into 'High identity' (n=5) and the other responses (to some degree, to a low degree, to a very low degree) have been collapsed into 'Low identity' (n=13).

Percentage of activities arranged at the host institution (10): This indicator looks at how 'centralized' the activities at the schools are. We asked the schools how much of the teaching that was provided by the host institution (in percentage) compared to how much was provided by the partner institutions. The responses varied from 0 to 75 per cent. We distinguish between schools where less than 50 per cent takes place at the host institution (n=12, range: 0–40 per cent) and more than 50 per cent (n=5, range 50-75 per cent).

Mandatory activities at the school (11): The schools were asked whether there were any activities at the schools that were mandatory for the PhD students. We do not distinguish between what types of activities these are, simply whether there are mandatory activities (n=8) or not (n=10).

Indicators for internationalization (12-13)

Foreign partners involved in the school (12): Although many schools have agreements with, are involved in networks with or associated to foreign institutions on some way, only three schools reported to have foreign formal partners at the school. 15 schools reported not to have foreign partners.

Foreign PhD students at the school (13): The number of foreign PhD students at the schools (that is: students that are formally affiliated to a foreign university) varies from 4 to 70 among the schools with international students. Here, we distinguish between schools with no international students (n=8) and those who had such students (n=7). Three schools did not respond to this question and are excluded (we do not know if their blank fields mean zero).

In Table 7.1, the cells are empty if there are no differences in outcomes relating to organizational features. In case of differences, the name of the best/highest scoring category is inserted in the cell. Note that this is based on 'subjective' assessments of the raw scores, which again are based on a very low number of observation units. The main purpose here is not to document 'significant' differences (which is not possible) but rather to see if any interesting patterns emerge. *Grey colour* indicates that there is a small difference in favour of the indicator category listed in the cell. *Green colour* means that there is a substantial difference between the listed category and the categories not listed.

Table 7.1 Organizational features with best values on outcome indicators

Outcome indicators (Box 7.1) Organisational characteristics (Box 7.2)	Completion rate	Completion time	International co-author- ship	Increased international cooperation	Increased national cooperation	Improved quality
Type of school (1) Scientific profile of school (2)	Thematically Natural Sc./SSH	Thematically Medicine	Medicine	Thematically Natural Sc./SSH	Medicine/SSH	SSH
Organization of responsibility (3) Size of the school (4) Standardization of the PhD programmes (5)		Division	Bottom-up	Bottom- up/Division Large	Division	
Number of PhD students at the school (6)	No	Yes				
	<100		>100	< 100		< 100
The research school's domi- nance in the education (7) Recruitment of PhD students (8) Sense of belonging (9) Percentage of activities arranged at the host institution (10) Mandatory activities (11)	Individual subjects Low			Most subjects High	Application High	Most subjects High
	No	No	>50 % No	> 50 % Yes	< 50 % Yes	
Foreign partners involved in the school (12) Foreign PhD students at the school (13)	No	Yes		Yes Yes	No No	No

The first two indicators (1-2) deal with the academic orientation of the school. Some schools are thematically oriented, which often means that their courses are completely new, not duplicating any existing work. The discipline oriented schools have a very different approach, often harmonizing existing educations, trying to create synergies from the use and further development of existing courses and personnel. Even though some schools are multidisciplinary, we saw in Chapter 2, that it is possible to classify the schools by three main academic domains (Medicine/Health, Natural Sciences and Social Sciences & Humanities (SSH)). For both these types of indicators there are no a priori hypotheses that can be made. That is, it can be argued that for example a thematically oriented school may perform both better or worse than a discipline oriented school. Arguments in favour of better performance may be: a more tailor-made education offer to the PhD students being more in line with their academic needs and interests, thus also potentially stimulating their motivation. Arguments against better performance may be: lack of direction and efficiency compared to discipline oriented schools, i.e. the disci-

pline oriented schools are standing on the shoulders of previous experience, making it easier to streamline the education across institutions, adopt and improve already established courses, using personnel with long standing experience from teaching and supervising within the field.

Scientific field

The two indicators for the research schools' academic profile, clearly display differences according to their classification, but in general it is not possible to say that one type of school is generally better than the other. No medical schools have higher *completion rates* compared to the national means for the student population at these schools, while in Natural Sciences (2/5) and SSH (2/3) there are mixed results. In the latter two fields, the schools do not have very strong results in general, but they perform relatively better compared to the medical oriented schools.

When we study *completion time*, the situation is reversed. The PhD students at the national research schools operating in medical fields have shorter time-to-degree than students at the other types of schools. Two out of four medical schools have 'high values' relative to the national means, which is better than in Natural Sciences (2/5) and SSH (1/4).

Natural Sciences and Medicine are from the outset more international fields than SSH, but the self-perceived degree of increased internationalization is almost equally strong in SSH as it is in Natural Sciences. Some of the SSH schools have a very international outlook; which is very different from the medical schools, that are very domestically oriented (in terms of partners, students and international mobility). One school even stated in the survey that "the school did not aim to increase its cooperation with international institutions". This may help explain why medical schools score high on self-reported increase in *national* cooperation: all five medical schools report that there has been a very high increase in national cooperation. The schools from Natural Sciences are less convinced that there has been an expansion of national networks in their fields originating from the research schools (which could be seen as the flip side of their increased international outlook). Despite these findings, it is among the PhD students at the medical schools where we find the highest shares of international co-authorship relative to the national mean within the relevant fields. While Natural Sciences and SSH both reported a high increase in international cooperation, this is not visible in their scientific publications as most of these schools have shares below the national average in these fields.

In terms of improving the quality of the PhD education, it is the SSH schools that report the highest values, where four schools respond that the quality has been

increased 'to a very high degree' and two schools 'to a large degree'. In the other fields, the responses are more skewed towards 'large' or to 'some degree'.

Type of school

Studying whether the schools have a thematically or discipline related design, points towards better performance in the thematically oriented schools, whose completion rates and completion time are the best in our sample. There are relatively higher completion rates in thematic schools (60 per cent of the schools have high completion rates) compared to discipline schools (14 per cent), the completion time is also relatively shorter in the thematic schools: 50 per cent versus 14 per cent respectively with shorter completion time than other PhD students in the field. The thematic schools also report much higher increase in internationalization (67 per cent report 'very high increase in cooperation' on internationalization compared to 44 per cent), while no difference is found regarding national cooperation.

Relationship between the partners

The two indicators for the relationship between the partners involved in the schools (3-4), show completely different results. First, variations in school size (that is, the number of partners involved) are not associated with any of our indicators except increased international cooperation. Looking at how the schools organized their activities, we find more systematic results according to type of organizing, although there are no a priori reasons to why e.g. schools characterized by a division of responsibility should have higher completion rates, which is what we observe. What is clear from the results in Table 7.1, however, it is that schools with a top-down approach do not outperform the other types of schools on any of the indicators, which implies that such a centralized model does not seem to work in the context of our outcome indicators. It is the schools characterized by a division of responsibility that works best with respect to both improved completion time and with national and international cooperation.

Finally, we expected that work to unify (or standardize) the doctoral program across the institutions at the research school would be beneficial for the students, thus leading to improved completion rate and time, also possibly to improved cooperation among the Norwegian institutions. The latter was not the case in our analysis (5). As expected, we find that standardized PhD programmes are associated with lower time-to-degree, but at the same time those schools that have not unified their PhD tracks have higher completion rates.

Number of students

Looking at the number of students that are affiliated with the school at any given time (6), the evidence is not convincing. The smaller schools (i.e. less than one hundred students) have slightly better completion rates, and report a stronger improvement of the quality of the PhD education, with 9 out of ten schools reporting that the quality has been improved 'to a large' or 'to a very large degree', while the larger schools' answers are evenly distributed across a very large/large/some degree response. Larger schools, however, have had higher shares of international co-authorship.

Education/student perspectives

The next five indicators (7-11) represent the student perspective, that is how integrated the students are at the schools, and how important the schools are in their research training. For all outcome variables, the overall picture is that it is hard to understand the distribution of responses. The fact that schools without mandatory activities (11) have better completion rates and time is not intuitive, as the push-factor of the training thus seems missing. We would have expected schools with more mandatory activities to be better equipped at pushing their students through the education. On the other hand, if the mandatory activities are not specifically related to paper-writing, a relevant topic for the PhD student, etc., then the mandatory activities may not be especially relevant and may have a negative influence on the PhD students' work with their dissertations.

Schools with mandatory activities report, on the other hand, higher increases in both national and international cooperation, which could potentially be explained by more involvement from the partner institutions in hosting these activities, or by 'forcing' the students to attend activities at other institutions than their own. This coincides with the finding that the sense of increased national cooperation is higher in those schools where less than 50 per cent of the activities takes place at the host institution (10). Hence, a 'geographic' distribution of activities towards the periphery seems good for increased national cooperation. Such a concentration/centrality-periphery indicator works the other way both in terms of internationalization and completion time. The interpretation of this would be that schools with a strong/central host is better equipped at developing international ties, and seem better at pushing their students through the educational component at a faster pace. Such centralization of activities is nonetheless not associated with key variables such as completion rate and completion time.

Another aspect of 'dominance' is the role that PhD activities play in the PhD students' educational component (7). At some schools, most subjects are taken at the school – while at other only individual subjects are taken. One would expect

that a high share of courses taken at the school would lead to a more efficient education, i.e. a one-stop education location would be preferable to balancing courses and other activities between two or more different 'schools' (different partner institutions of the research school and the faculty/institute where the PhD student is formally enrolled). This is, however, not the case. Research schools where the students only take individual subjects have higher completion rate than at research schools where most subjects are taken. The main objection to these results, is of course, the very low number of respondents that we base our analysis on, since most schools report that the students only take individual subjects at the research school. There is only one indicator where the results seem non-delusive: for the self-reported improvement of the quality of the PhD education, where all schools where most subjects are taken at the school are positive (to a very large degree/large degree), whilst schools where only individual subjects are taken all show mixed results; a 30-30-30 distribution of 'to a very large/large/some degree'.

The degree to which the research schools are able to create a strong 'community' may be important in shaping the motivation and effectiveness of their students. The first indicator related to this is the recruitment procedures of the research school (8). The mid-term evaluation of the 2012 schools revealed that some students had no idea whether or not they were affiliated with a research school. This confusion originates foremost from the fact that some research schools automatically enrol students that are admitted to a particular PhD program at the partner institutions, while other schools have separate application procedures so that the students need to actively apply. Some of the research schools resemble more 'course providers' than 'schools' and many students participate at one (or more) courses without having a conscious understanding of actually attending a research school.

In the cases with automatic admission, there are lesser reasons to expect a strong sense of belonging among the students. For this indicator we are not able to detect any differences between the two recruitment types, except an increased international cooperation in schools recruiting students by applications. The research schools' self-reported impressions of their students' sense of belonging (9) to the school (a marker of identity), is more in line with the expected results, as a strong sense of belonging is clearly more associated with self-reported high values of both national and international collaboration, and with improved quality of the PhD education. Sense of belonging, however, is negatively associated with completion rate (note, that there are only two schools with high identity among the 2008 and 2012 schools, both with low completion rate).

Internationalization

Two indicators measure factors relevant to internationalization: whether there are foreign partners involved in the school (12) and whether there are foreign PhD students affiliated with the school (13). It is not surprising that schools with foreign partners are less inclined to report an increase/expansion in national cooperation than what schools with no foreign partners do (12). The self-reported increase in *internationalization*, works only to some extent as expected: schools with international students report a much higher increase in internationalization: 5 out of 7 schools report 'very high increase in cooperation' on internationalization, while this number is 3 out of 8 for schools with no foreign students). Related to this, schools without international students report higher increase in national cooperation. For schools with foreign partners and foreign students we *do not*, however, find higher shares of international co-authorship based on what we could expect given the academic background of the students. It is also difficult to interpret the negative association between involvement of foreign partners and low completion rates, and the positive association between foreign students and better completion time.

Implications

Looking closer into the material and the success cases, it is hard to generalise the findings. The research school which overall displays the highest scores on all indicators that we have studied, cannot be used as a recipe for success: it is a thematically oriented school within the Natural Sciences, with a bottom-up approach, with no mandatory activities (the students take only individual courses at the school), its students feel a low sense of belonging to the school, more than 50 per cent of the activities take place at the host institution, etc. In fact, when we study the schools with high/good values on the outcome indicators, it is difficult to spot any systematic trends at all. Two main reasons for this are, first (as previously mentioned) the very low number of observation units that makes it difficult to identify generalizable findings, and two: in most outcome indicators the highly different organization of the schools leads to inconclusive findings where e.g. the schools that are successful on an outcome indicator in many instances have completely different values on the organizational indicators (such as both presence and absence of international partners being associated with high completion rates).

We are, based on this, therefore unable to offer any conclusive evidence of how different organizing of the schools may be important for different achievement of the research school scheme's objectives. In Chapter 8 we will, however, look into

other dimensions of potential success at the schools that have not been adequately covered by the indicators discussed in this section.

7.2 The Nordic perspective

Sweden and Denmark have a longer tradition with research schools than Norway: the first research schools in Denmark were established in 1996 while the first research schools in Sweden were established in 2001. In this section we first present the scheme in these two countries and then we will compare the schemes to the Norwegian scheme.

It is important to keep in mind that the development of research schools has come on top of other structural changes in the different countries. Furthermore, even though the other Scandinavian countries are similar to Norway in many respects, the research education in the three countries are organized and financed differently and the research schools have thus played different roles. A comparison of the schemes can, however, give further insights into which factors influence the success of a research school.

7.2.1 Research schools in Sweden

In 2001 the Swedish Government decided to fund 16 national research schools. Unlike the Norwegian national research schools, the Swedish schools were established with a top-down approach. Ten large universities and specialized university institutions were given permanent funding for establishing and hosting national research schools. Each host institution was allocated some partner institutions, and the goal was that the national research school would increase the research competence at the partner institutions and improve the research education within interdisciplinary topics where the research environments themselves were too small to carry a well-functioning research education.

The partner schools included university colleges without their own doctoral program. The motivation was that inclusion into the research school could improve the opportunity for students at university colleges without their own research education to be accepted to a doctoral program. The first six years of the host institutions' funding for the research school required collaboration with the selected partner institutions. Within these six years the research schools also needed to meet a graduation target. After six years, the host institution could use the funding as they wished given that it funded research education.

The evaluation of the Swedish research schools finds that the research schools have the potential to develop research education if they are given optimal conditions for resource allocation and cooperation (Swedish National Agency for Higher

Education, 2008). The evaluation committee concluded, however, that the incentives for the host institutions have been too weak to really strive to develop the system of research schools given the resource allocation and the chosen partner schools. This was particularly true for research schools where the host institution had a strong research environment within the field and where the partner institutions had little to add.

As in Norway, there was large variance in the structure of the administration of the research schools. Some research schools acted mainly as a simple communication organ for distribution of research and research education resources, while others took on the full responsibility for the doctoral students and the research education process. Most research schools were organized so that the students had to apply directly for PhD fellowships at the research schools, but some also allowed associate members with external funding.

The evaluation committee argued that the research schools could have seized the opportunity to develop the system for supervision and to larger extent develop an explicit supervisor policy. Even though each PhD student in the research school should have at least one secondary supervisor, the evaluation committee found that supervision still mostly occur individually between student and *one* supervisor. Still, many of the doctoral students have emphasized the opportunity to contact other supervisors at the research school if necessary as particularly valuable, and contact with other supervisors who are connected to the research school has occurred through supervisor seminars, workshops and conferences where the entire research school meets.

The doctoral students report that the dedicated financing of the research school has enabled good course programmes, well-functioning supervision and a valuable network of doctoral candidates and researchers. The Swedish research schools also gave each doctoral student what they refer to as financial 'backpacks'. That is, an economic grant that the doctoral students have at their disposal to use for activities such as travelling and course participation. This grant is a valuable prerequisite for being able to take advantage of the activities that the national research school offers.

The Swedish research schools, like the Norwegian, contributed to enhance and improve the course component of the research education. That has happened through better and more systematic supply of courses suited for the doctoral candidates' specialization. There is, however, large variation in the scope, depth and participation in the courses offered at different institutions. The evaluation committee found multiple instances where the national research schools had taken initiative to create a shared structure of courses and core curriculum within the field.

7.2.2 Research schools in Denmark

The first research schools in Denmark were established by the Danish National Research Foundation. These two schools were the basis when the Danish Research Training Council (FUR) launched their research school scheme with the establishment of 11 big national schools in 2000. In the years that came the FUR supported over 70 multi-institutional and institutional research schools and the concept has been used within all fields in Denmark. Most of the research schools in Denmark are based on the network model, and many of these schools are loosely organized and quite difficult to separate from the ordinary PhD education.

Three main objectives were defined for the research school scheme in Denmark: establish research schools within the Social Sciences and Humanities to strengthen small environments; research schools across institutions and disciplines; and research schools where sectoral research and the business communities are included.

Today there exists about 140 research schools in Denmark. A large part of these schools has a clear and formal structure with boards and regulations, but the concrete structure varies between research schools. About half of the research schools involve more than one institution, while the other half includes multiple units within the same institution.

The Danish research schools were evaluated in 2005. The conclusion was that in the years to come (which has already passed) the schools wanted to focus on planning courses, develop cooperation and educating supervisors. These elements are considered central to the research schools quality control.

About 90 per cent of the research schools in Denmark follow the 5+3 structure of the PhD which is equivalent to a five-year master degree (or bachelor + master) and then a three-year PhD degree. However, the students at the research schools tend to finish about *6 months after* the estimated time to degree.

PhD Schools in Denmark

The research school scheme in Denmark came in addition to the development of *PhD schools* which have also contributed to increasing the quality of the PhD education in Denmark. Although these schools are not part of the research school scheme, we believe that there are lessons to be learned from the PhD schools also in a study of research school schemes.

In 2004 it was decided to enhance Danish research efforts in part by strengthening the PhD education. The main component of the increased investments in the PhD education was to gradually increase the intake of PhD students, with a goal of doubling the number of candidates from 2003 to 2010.

At the same time, the PhD education in Denmark underwent relatively comprehensive structural changes. A new university law from 2007 led to the establishment of PhD schools. The PhD schools were to have the formal, overarching responsibility for a defined and coherent academic field, and should consist of a PhD school leader and a PhD school panel (Rigsrevisionen, 2011). The objective behind the establishment of PhD schools was two-fold: increase the quality and completion rates, and ensure that the system would tolerate the increase of the student body.

In 2017 there was a total of 49 PhD schools in Denmark¹⁸. These schools organize research activities within a field at the universities and are accountable for the academic part of the PhD education. This means that every PhD student in Denmark is part of a PhD school. Although the law opens up for inter-university PhD schools, none were organized like this in 2011, and to our knowledge none are today either. The aim with the PhD schools was to clearly define who were accountable for the PhD education (Rigsrevisionen, 2011). Previously, this had been more informally organized; different actors from different universities could be responsible for parts of the PhD education.

There has not been conducted a comprehensive evaluation of Danish PhD schools. However, existing indicators suggest that the establishment of PhD schools have led to positive outcomes. For instance, PhD plans (a plan for the PhD period developed by the student in cooperation with the supervisor) is now more common than before (Rigsrevisionen, 2011). Drop-out analysis of PhD candidates conducted in 2007 showed that among those that finished the degree, a significantly larger part had individual PhD plans compared to those that dropped out (Epinion Capacent, 2007). Thus, PhD plans were regarded as an important tool in order to reduce dropout. In addition to this, lack of administration of the PhD period, poor supervision and lack of attachment to a research community were identified as areas that contributed to drop out. Measures have been taken by the PhD schools to improve on all these areas, albeit to a varying degree (Rigsrevisionen, 2011). In 2017, the Ministry of Higher Education and Science published a report on the quality of the PhD education, based on a survey among PhD students and their supervisors (Ministry of Higher Education and Science, 2017). It showed that 87 per cent of the students were very or somewhat satisfied with the Danish PhD education. Among the supervisors, 24 per cent believed that the students' academic level was higher now than ten years ago, while 46 per cent felt that it was the same. Whether these results can be directly attributed to the organization of PhD schools is, however, impossible to say.

¹⁸ Ministry of Higher Education and Science. (2018, February 17th). Ph.d.-skoler. Retrieved March 9th from <https://ufm.dk/uddannelse/videregaende-uddannelse/universiteter/ph-d-uddannelse/ph-d-skoler>.

7.2.3 Research schools in Norway compared to Sweden and Denmark

As in Norway the establishment of the research school scheme in Denmark was partly a result of an evaluation of the research education that concluded that measures should be taken to increase the quality of the research education. The evaluation suggested that committed cooperation between institutions and faculties in form of networks or centres, could contribute to ensuring that the PhD students had access to internationally acknowledged environments. The report also emphasized the research education's contribution to the development of society and that the education should not take place in small and isolated academic institutions.

The national research schools in Norway, Sweden and Denmark are all typically structured by the network model. In Norway it is encouraged that all relevant environments within the given research education both universities, research institutions and the public and private sector are involved. In practice, however, the Norwegian research schools tend to include only universities and university colleges (only to a minor degree research institutes). In Denmark, about one third of the research schools get support from private firms and research institutes, being largest in the Natural Sciences, while the private funding is largest in the technical sciences. The Norwegian research schools can thus potentially learn from Denmark where they seem to have been more successful in including also private firms and the research sector.

The financing from the industry is a major difference between the Norwegian and Danish research schools. However, Sweden also stands out with a different type of financing. While the funding for the research schools in Denmark and Norway are temporary, the funding in the Swedish system is permanent for the host institution. Still, in the first five years the funding is conditional on cooperation with the other institutions in the research school network. The leadership of the Swedish research schools indicated that after the compulsory period for sharing the funding with the partner institutions, the school would reallocate the funding to research education at their own institution. Thus, despite the permanent funding, the research collaboration seemed for many not to be viable after the given time-period. Also in Denmark, it is reported that the further existence of the school depends on further funding from the Danish Agency for Higher Education.

The research schools are organized differently across countries. Sweden used a top-down approach where the host institution had limited opportunity to define the topics or choose the collaboration partners in the research school. This a major difference from the Norwegian and Danish structure. In Norway applications for the research schools followed a bottom-up approach and research environments at different institutions voluntarily came together to write the application.

All three countries have problems with unclear structure and division of responsibilities between the partners in the research school. In Norway, the administrative responsibility for the research school has typically been divided between the research school leader who is responsible for the scientific content of the research school and an administrative coordinator. This seems to have worked well. Furthermore, most of the schools report good collaboration with the host institution. In Denmark several institutions said that there is a need for a clearer division of responsibility between the research schools and the institutions both administratively and scientifically. In Norway, however, the need for improvement is more on the division of responsibilities between the institutions within the research school.

All three countries seem to lack involvement of the PhD students in the running of the schools. In Norway, it is now required that the PhD students are represented on the school's board. However, there is still room for involving the PhD students more in the running of the school.

In Norway the schools differ in their criteria for admittance to the school and in the degree to which the students are considered as a 'research school student'. The report from Denmark also finds that some of the schools considered the lack of clear criteria for intake to the schools a problem.

The research schools in all three Scandinavian countries share the challenge of involving and raising the quality of the supervisors. The Norwegian research school may learn from the Swedish research schools where the PhD student is assigned a secondary supervisor from one of the other institutions in the research school. However, the Swedish evaluation found that there was room for more improvement on the involvement of this second supervisor.

8 Conclusions and recommendations

In Chapter 8.1 we present the main findings addressing the four research questions (see box below) of this evaluation. Certain aspects of the research school scheme and of the research schools' activities are not visible in our analysis, and related validity problems are discussed in Chapter 8.2. In Chapter 8.3 we offer our recommendations to the RCN on how to improve the national research school scheme.

8.1 Main findings from the evaluation

The national research schools were established based on suspicions that the strong increase in PhD students may have led to reduced completion rates and a higher average age at the time of completion (cf. NOU 2008:3). The research schools should “set a standard for other environments on how to drive PhD students through their research training with good results within estimated time to degree”. In NIFU's evaluation of the Norwegian PhD education in 2012, it is argued that there has been little evidence to show “what research schools really do and how they support PhD education” (Thune et al., 2012, p. 42), even though the implementation of the research schools was met with great expectations. The “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” (ibid).

In this part of the report we use the insights from the other chapters to discuss whether the national research school scheme has contributed to improved results on completion rate and completion time, and to increased national and international cooperation. We emphasize again that the purpose of this evaluation is not to evaluate 22 unique research schools, but rather to investigate to what extent the national scheme has contributed to increase the quality of the Norwegian researcher education by meeting the objectives below. In the current evaluation, we were specifically asked to respond to the following four questions:

- Is the **completion rate** (i.e. absence of drop-out) higher among PhD students affiliated with national research schools, compared to PhD students that have not been affiliated with any research school?
- Is the **completion time** (i.e. time-to-degree of completed PhDs) lower among PhD students at national research schools, compared to PhD students that have not been affiliated with any research schools?
- To what extent have the national research schools contributed to **internationalization**, by for example travel grants, support to stays abroad, international course instructors, supervisors, etc.?
- Have the research schools contributed to strengthening **national cooperation** within scientific fields, professions and thematic areas; including more (small) national institutions, and in what ways?

8.1.1 Effects on completion rate

Our analysis has not documented any improvements in completion rates following the introduction of the national research school scheme. Based on findings from the research schools that started up in 2008 and in 2012 (restricted to students that were enrolled during the first few years of the schools established in 2012), we have found that the completion rate for PhD students at the research schools are practically identical to the completion rates for all other PhD students in Norway. After field-normalization of the completion rates, that is, we are comparing each research school student with the results for PhD students nationally within similar fields, the completion rate at the research schools in total is just 0.4 percentage points higher.

This difference to the national sample of students vary from -16.4 to +21.6 percentage points at the research schools. In other words, some schools have higher completion rates than the national average in the field but arguably this is the case for many degree awarding units outside of the research school scheme too. In sum, schools with good and less good results on completion rates converge towards zero, i.e. there is no overall difference compared with other PhD students.

The research school students perform better than other PhD students in three fields. Foremost in Economics and Business Administration, but also in Social Sciences and Humanities and Natural Sciences. Studying completion rates in relation to organizational characteristics of the research school, we find that the ability to get the students to complete their PhDs is higher in thematically oriented schools compared to discipline oriented schools.

8.1.2 Effects on completion time

The PhD students at the research schools that have completed their PhDs have spent a remarkably identical time on their work compared to other PhD students. No more than nine days separate the two groups: 1,667 versus 1,676 days. Converted to months, the result is identical in the two groups. After adjustment for scientific field, there are six schools whose completion time is lower than for other PhD students in Norway within the same fields. Still, six schools have longer completion time, and the overall performance of the research schools is negative: on average the research school students spend 14.6 days more on their PhDs. Students from thematically oriented schools generally perform better than students from the discipline oriented schools on completion time.

The results clearly confirm that the national research school scheme has not (yet) contributed to higher completion rate or reduced completion time. It should be noted that these analyses are based on results from the schools established in 2008 and 2012; the latest schools from 2015 have not been part of the analyses.

8.1.3 Effects on internationalization

Studying whether the national research schools have succeeded in increasing their internationalization is a more difficult task. Unlike completion rate and time, we cannot rely upon *one* (or more) unambiguous indicators.

One first reflection on the schools' work on internationalization, is that many schools simply do not see this as an objective of the school. The arguments are either that the schools are simply more oriented towards unification of *national* resources and environments within the discipline, or that the purpose of the school is to enhance the *quality* of the PhD training.

Among the schools that do consider international work as an important element, there is a broad agreement that financing international lecturers for doctoral courses, workshops and conferences has been an important contribution of the research schools. Combined with grants for courses and conferences abroad, the research schools have given their students access to courses held by leading academics in their field. Furthermore, the activities held in Norway have been open to international PhD students creating arenas where Norwegian PhD students can meet international peers.

However, the opening-up has not necessarily resulted in a very large mobility across countries. We find no difference between students at the research schools and at other PhD awarding institutions in Norway regarding their propensity to have stays abroad. Despite much funding available, and the institutions encouraging their students, the willingness (or ability) to conduct longer stays abroad is simply not very strong among the students.

The PhD students at the research schools have, however, become more frequent users of short-term activities abroad, i.e. conferences, seminars. It is not a matter of more students attending, but that those who do – are doing so more frequently.

The mobility of foreign researchers and students into Norwegian partner institutions in research schools have not been high. But foreign personnel do come to the research schools more frequently on temporary basis. It also seems as the research schools have contributed to more use of international supervisors compared to what is the case at institutions whose applications for research school grants were rejected.

While the research schools reported that about half of their courses had international course leaders, the control schools in our survey (i.e. environments that applied for research school grants, but whose applications got rejected) report that less than a third of their courses had international course leaders. This indicates that the research schools have a larger share of international lecturers as course leaders compared to the control schools. But participation from foreign PhD students at the same activities, were in fact (reported) to be higher in the control schools. With a few noticeable exceptions, there is no indication that foreign PhD students are more likely to attend courses at the research schools in general than at the control schools.

Many emphasize the development and maintenance of international networks as a very important factor at the research schools and that the senior researchers have expanded their international networks. In our data there is no evidence that this increase in international collaboration involves the PhD students equally much. In the PhD students' publication activities, we find no evidence that PhD students at the research schools have more international co-authors, neither during their PhD period or in their publications after completing the PhD, than what we find among other PhD students.

In sum, the teaching activities and supervision at the research schools have more international contributions than at the control schools. It is important to keep in mind that 'control schools' in this context means the host institutions of these rejected schools, who are arguably more internationally oriented than the other rejected partner institutions.

The general observation is still that given the available resources at the research schools, the degree of internationalization is not particularly high compared to the other PhD institutions in Norway (albeit, some of the schools are highly international), and there is clearly an unexploited potential given the funding and the international contacts that many of the schools have made.

8.1.4 Effects on national cooperation

In line with the mid-term evaluation of the research schools conducted in 2015, we find that the partner institutions at most of the research schools have not taken steps to make their doctoral education more uniform, and about one third of the schools have still not harmonized the use of ECTS points for courses offered by the research school. From the students' perspectives, there is a potential problem with lack of coordination and cooperation across institutions on the educational component of the doctoral degree.

The increased national cooperation is missing in some of the PhD students' core activities during their PhD period. Cross-institutional supervision at the Norwegian partner institutions is just as seldom at the research schools as it is for other PhD students (and PhD students still do not work on joint publications across institutions).

Among supervisors and researchers from the partner institutions, there has however, been an increase in contribution to courses, workshops and other academic activities at other institutions inside the research school. This activity level is much higher than prior to the establishment of the research school, and as expected much higher than at institutions that are not part of a research school. It seems that the research school grant has increased mobility among academic staff in the research environments (although it is still not common to have research stays at the other institutions). Few schools reported that participating in a research school had led to increased research cooperation across institutions. It appears that the national cooperation is mainly related to teaching activities.

For obvious reasons, two or more Norwegian institutions involved in a joint research school, will lead to some kinds of collaboration. It appears that the cooperation is not so much about research and student co-authorship, but about teaching activities and short-term 'performance' of visiting personnel at other partner institutions. The increase in national cooperation has been the strongest in the schools within medical-oriented fields, whose schools are discipline oriented, and where the focus has been largely national and on using resources and capacities to streamline the catalogue of teaching activities – unlike the thematically oriented schools who have fewer national partners to work with, are more international oriented, and where the increase in internationalization is clearly higher.

8.2 Different focus of different research schools

The overall assessments of the national research schemes' achievements as assessed in Chapter 8.1 were somewhat discouraging on behalf of the scheme. It is, however, very important to note that there are some fundamental issues that have

not been taken into account in our study so far. There are also methodological issues that may counterbalance our findings to a certain degree. In the next sections we will discuss some of these.

When the research schools were mid-term evaluated in 2015, the panel's overall assessment of each school seemed to be very positive; they were "well-functioning". Furthermore, Thune et al. (2012) found in a study of the earliest research schools (in addition to research schools at the time that are not part of the scheme), that the research schools provide the PhD candidates with access to academic networks, a good social environment and courses of high quality, and also that the research schools promoted internationalization. In Thune et al.'s study (2012), the respondents did not seem to think, however, that the schools promoted efficiency or relevance. This contradiction between networking and good teaching on the one side, and no sign of efficiency on the other, is also highly evident in our own analysis.

Understanding this contradiction is key in understanding the schools' failure in improving completion rate and time. The starting point of such an analysis is to define what a 'research school' is, because the Norwegian research school model is not a 'physical school', but rather a network of schools. This way of organizing the schools, gives rise to some methodological reflections. Thune et al. (2012) experienced in their survey of the PhD students that the institutions had great difficulties in giving information about the number of PhD students associated/participating in each school, and many units did not provide any data despite listing links to a research school. The data reported on participation was thus assumed to be limited. It was argued that these difficulties were based on most of these schools having voluntary participation arrangements, and many would not have a fixed number of participants for such schemes, making it difficult for them to calculate PhD candidate numbers in some cases. We believe that our statistical analysis may be subject to some of the same difficulties. When it is not clearly defined what it takes to be a research school student, who are to be counted, making reliable analysis of the schools' impact on their students is obviously difficult. Our results in analysing these outcomes (completion rate, completion time and international co-authorship) depended on the name lists that we were provided by the research schools. In a few schools, the number of PhD students was so low, that they could not be included in the analysis. The accuracy of the name lists in those schools that were included, has been taken at face value.

8.2.1 The multifaceted tasks and purposes of a research school

According to Thune et al. (2012) it is a persistent problem that the term 'research school' is not particularly well defined and is being used in several different ways.

Upon the introduction of the national research school scheme, the Norwegian Association of Higher Education Institutions (UHR) intentionally avoided to make any precise definition, so that the institutions would be allowed to define their own concepts, based on their needs and competences. Thune et al. (2012, p. 44) claim 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 would otherwise not be offered, and by providing a positive learning environment for the PhD candidates who participate in them”. This ‘supplement’ role seems to take place through teaching and network activities.

A large portion of the respondents in our survey highlighted networks and social interactions as two of the most important results of their schools. Network in this respect may serve different actors in different ways. Some examples are: 1) creating networks through establishing of a national course-portfolio that the students can choose from, 2) national forums for presentation and feedback, 3) joint research projects across institutions, and 4) social arenas for PhD students. The mid-term evaluation from 2015 found that a majority of the PhD students believed that the research school with which they were affiliated was important in creating contacts and networking with other PhD students. In one school, the panel even believed that the school itself was just as much a meeting place for “scientists at different stages of their careers as it is a PhD school”, which would not be taken negatively by the school, because this assessment was consistent with the school’s objectives.

It was striking how many schools in our survey that expressed their surprise about how much weight that was given to internationalization issues. Some schools stated that this element had not been communicated by the RCN as a primary task of a research school, others stated that they did not consider it especially relevant/important. Other claimed that since they were already highly internationalized (and had always considered this a key element), getting a research school grant did not lead them to aim for a further increase in their international efforts, as they were already on a high level. However, many of the schools give credit to the scheme for their increased international activities, and many of the rejected schools were saddened by how the international activities that were planned in a potential research school never came to life. The evaluation panel in the mid-term evaluation lifted the international dimension as one of the schools’ greatest added value. Findings from our survey aimed at the research schools and the ‘rejected schools’ do not necessarily support this.

Compared to NIFU's evaluation of the Norwegian PhD education (Thune et al., 2012), this report only covers some of the dimensions that the PhD education system in Norway deals with (Table 8.1).

Table 8.1 Evaluation criteria in NIFU's evaluation of the PhD education system in Norway (taken from Thune et al., 2012, Table 1.1).

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.

The networking dimension discussed above does not manifest itself so much in the four goal dimensions we have looked at: completion rate, completion time, increased international and national cooperation, as 'networking' as a concept may have a more informal function, which may not necessarily lead to 'hard outcomes' such as joint publications or research projects, formal agreements on supervision or teaching across institutions, etc. The indicators we have used when measuring the goal dimensions may not cover many of the informal aspects of networking and other activities. One school commented in our survey that the school had no formal international collaboration partners, but still considered itself highly internationally oriented, with high international presence at the school's activities.

One of the most obvious indicators that (ideally) ought to have been part of an evaluation of the research school scheme is the *Quality of the output*, which we address in the next section, and the students' perspectives on their training, covered by three dimensions in Table 8.1: Quality of the research/training process, Relevance of competences acquired for successful PhD training, and Relevance of qualifications for post-PhD work (which we discuss in section 8.3.3).

8.2.2 Quality of the PhD education

In our survey, one of the research schools stated what we believe is a rather typical opinion on the research school scheme, namely that «improved completion rate and completion time was not part of the overall aim for the first set of research schools. The main goal was to improve the quality of the education». Several respondents in our survey support a shared impression of the scheme adding to higher quality in the teaching, a lifting of the supervisors' competences, and that increased cooperation with leading foreign and national partners may improve the academic level. These, and many other quality related dimensions are not specifically dealt with in the methodological design of our evaluation.

Our impression is that the contribution of the research schools is not so much to speed up the pace of the educational period, nor to create mechanisms to ensure that fewer students drop out. The scheme is simply not designed as a tool to increase the efficiency of the PhD training. Rather, it seems to be aimed at increased quality, which does not necessary have a causal link to efficiency. Our impression from our survey and from the mid-term evaluation, is that the activities that take place at the schools are of high quality. The scope of courses, seminars and network opportunities can arguably be considered quality enhancing tools.

More than anything else, our evaluation design (given the terms of reference) has not dealt with the perhaps most important quality dimension, which is the quality of the PhD students' scientific work. According to Thune et al. (2012, p.53):

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.

It is beyond the scope of this evaluation, and we do not have data to test whether the national research school scheme has increased the *scientific quality* of the doctoral dissertations, but this is a question that the RCN should consider investigating, because it is arguably the most important contribution of the research school scheme. In practice, such a question could be addressed in at least three different ways: 1) through a survey to PhD students and supervisors, 2) by a qualitative analysis of the evaluation committees' assessments¹⁹, and 3) by a bibliometric approach comparing publications by the PhD students (studying the citation rates/relevant bibliometric indicators of the papers).

¹⁹ Thune et al.'s (2012) review of the literature on this topic suggest that the examiners' written reports use similar notions, such as literary presentation, innovative work and international standards. There is a considerable agreement about the criteria which constitutes a good thesis.

8.2.3 The students' perspectives

The voice of the PhD students has not been heard in this evaluation. As stated many times before in this report, we have not evaluated the research schools themselves, but rather the scheme under which they operate. The perspectives of the students could, however, have given valuable information on aspects of the quality of the research school. They have, after all, first-hand knowledge with their education. Nevertheless, the research questions in focus for this evaluation did not specifically connect with the students' opinions, and a survey among PhD students was therefore not conducted. Former reports, however, have considered different aspects of student satisfaction, and are worthwhile mentioning here.

In 2017, NIFU conducted a study on Norwegian doctoral candidates and their evaluation of different aspects of the PhD education related to research training, working conditions and career expectations (Reymert, Nesje & Thune, 2017). The study was based on a survey sent to all doctoral candidates (n=8,300, response rate was 48 per cent) who were admitted to a PhD program at a Norwegian higher education institution in the autumn of 2016. Among the respondents, 28 per cent reported that they were part of a research school.

The PhD students that were affiliated with a research school were significantly more satisfied with the training compared to the other candidates. The differences, however, were small: There were no differences between the groups in the share reporting to be very satisfied with the research training, which was 18 per cent²⁰.

The candidates also received questions about their evaluation of supervision, work environment and follow-up, and there were no differences between the two groups on these questions. The candidates that attended research schools did however, not surprisingly, report significantly higher levels of both academic and social integration. Being both academically and socially integrated is likely to affect the motivation and support for work, which at least in theory could prove to be important conditions in order to enhance completion rates.

These findings from 2017 are encouraging, because another NIFU survey from 2009, found far less positive opinions among students affiliated with a research school (Thune & Olsen, 2009). We do not know how many of the students in *this* survey that were affiliated with any of the 2008 schools studied here (the first schools that were established under the scheme), but most likely most of them were not (but affiliated with a research school outside the scheme). In the 2009 study, those at the research schools were *not* substantially more satisfied with the

²⁰ Among the research school students 44 per cent reported to be somewhat satisfied, 19 per cent reported to be neither satisfied or dissatisfied, 14 per cent reported to be somewhat dissatisfied and 4 per cent reported to be very dissatisfied. Among the other candidates, 41 per cent reported to be somewhat satisfied, 21 per cent reported to be neither satisfied or dissatisfied, 12 per cent reported to be somewhat dissatisfied and 6 per cent reported to be very dissatisfied.

courses they received, their integration in academic environments or their working situation. Hence, it seems reasonable to claim that research school students are now generally more satisfied with their schools than ten years back in time.

8.3 Recommendations to the RCN

We recommend that the RCN consider a more differentiated funding of the schools (8.3.1) and organizing of the scheme (8.3.2), making special efforts at increasing national and international mobility (8.3.3), in conjunction with the school's design (thematically or discipline oriented schools), and to make sure that specific efforts towards increased completion rate and completion time become part of the contract between the RCN and the research schools (8.3.4).

8.3.1 Evaluate whether the resources and funding made available to the schools are expedient

Our survey came up with an unusual conclusion regarding the size of the funding for the schools – and the duration under which it is given. The respondents simply believe that the level of funding is high enough. One respondent even argued that the size of the funding was probably too high. However, when it comes to the structure of the funding there are more challenges.

The financing the research schools receive from the RCN are temporary, and although existing research schools are allowed to apply when there are calls for new grants, the previous calls have emphasized that new applicants will be given priority. Many of the countries that have established research schools report that this periodical financing creates uncertainty for many of the environments that have used resources to build up research schools. Evaluations from multiple countries, among them, Netherlands, Germany and Finland have asked for the opportunity for more long-term financing when the schools are established. The eight-year period that the RCN chose was intended to reflect this desire for more long-term financing. However, it is an open question whether the funding is sufficiently long term.

Based on self-reports from the existing research schools it seems as the existing scheme is not able to create schools that are viable after the funding ends. To continue with the activity, the schools rely on acquiring new external funding. Some of the discontinued schools have managed to do this, but this new funding is also temporary. A challenge with the research schools is that many of the activities are course and conference based which is resource demanding. The institutions are not able or willing to fund these activities themselves and if the students would have to pay participation fees many argue that the participation would be very

low. It may be hard for the institutions to take over financial responsibility for the schools if they go from full funding to no funding in one year. One suggested model is that rather than dividing the funding for the scheme equally across an eight-year period, the scheme can use a model which phases the external funding in and out. Many schools reported in the mid-term evaluation that they were unable to use up the funding the first year as it took some time to establish the schools. Thus, the schools could have had lower funding in the first year, and so prolonging the funding period. We believe that a transition period with divided funding between the research schools and the institution that will take over full responsibility of the school's activity, may enhance the survival of the school's activities after the funding from the RCN stops. One possibility is that the funding for the transition period is conditional on good results after eight years.

Longer funding periods may be linked with clearer and stricter delimitations of activities that the grant can be used for, e.g. that the grant is used for development and maintenance of the research school and joint activities for the research school's members. An option is that after a few years, the ordinary running of the research schools is taken care of by the institutions over their own budgets while the grant is purely used for quality enhancing measures.

While we understand the RCN's rationale for having time-constraints on the research schools' funding possibilities and the RCN's long-term plan for building up a larger number of research schools to the level in other European countries, it appears that the aim that the institutions take over the funding responsibility of the schools after eight years is not fulfilled. The question then becomes, what are the consequences for the 'quality' of the schools? Many of the schools argue that when a school is established one has to start from scratch – and that there is little organizational learning between the ongoing schools themselves, and between the current schools and the discontinued schools. One of our starting hypothesis in this evaluation was that there would be a correlation between the positive outcomes and the year that the school was established, i.e. the schools that started up in 2012 would perform better than the schools that started up in 2008 (and the schools from 2015 performing even better). The rationale behind this was that the earlier schools were first of its kind and did not have any predecessors to copy. At the same time, it could be expected that the RCN would have adjusted the funding requirements based on impressions from the first schools, so that the 2012 schools would have a better starting-point. However, the start-up year was neither positively nor negatively associated with any of the outcome indicators, with one exception: self-perceived increase in quality of the PhD education where the 2008 schools in fact reported more positive than the later schools (and the 2015 schools

report more positive than the 2012 schools)²¹²². Hence, the schools do not seem to have become better over time due to learning from previous schools. The implication of this is that when a school have spent eight years on establishing routines and practices to become a 'good' school, it is most often shut down. Another school will be established, starting from scratch, and will now go through the same procedures over an eight-year course. This is unfortunate as it does not lead to an expansion of good schools nationally, but rather to a situation where Norway will always have a relatively low number of research schools and a substantial proportion of these will be in the process of establishing themselves.

8.3.2 Consider a differentiated research school scheme

We acknowledge that many of the discipline-oriented schools have created many courses and other activities that do not duplicate any existing activities at the participating institutions, but in general, the thematically oriented schools do to a much higher extent create new activities from scratch. The latter schools are established with a different purpose and different aims than the discipline oriented schools. A simplified 'model' of a least-common-denominator (where most schools would probably disagree that *they* would fit into any of the categories) based on the results and data in our evaluation, reveal different profiles and different needs in the two types.

The discipline schools typically bring all (or most) national actors within the discipline together; it is a 'national unification' of competences. This means utilizing existing personnel, competences and available courses and teaching material. It is a cost-effective model for cooperation. Within such a model, the RCN wants the larger institutions to bring the smaller institutions on the periphery into the national core network. The smaller environments are to be taught by the main actors within the discipline. The student population is big.

The thematic schools are typically developed by one (or at least very few) actors in Norway, as they are oriented towards a niche area, where there simply does not exist many stakeholders in Norway. Therefore, the schools have a much more international outlook. Where the discipline schools unify all national actors, the thematic schools engage in cooperation with international actors. The training components of the schools are developed from scratch, as they seldom (or never) duplicate any existing courses in Norway. The establishment costs of such schools

²¹ Note that the schools that were established in 2015 are not part of the quantitative analysis of completion rate, completion time and international co-authorship, so that we do not know if these schools have performed better/worse than the 2008/2012 schools.

²² In the 2008 schools, three schools reported that the quality had improved to a very large degree, and one school that it had improved to a large degree. In 2015, there is a 50-50 distribution of answers, while the 2012 schools are less positive: 2 schools report 'to a very large degree', 4 schools report 'to a large degree' and 4 schools report 'to some degree'.

are simply much higher than for disciplinary schools, and we must assume that it takes longer time for thematic schools to work well on full capacity.

The distinction between discipline and thematic schools were also highlighted in a Danish evaluation, which recommended a further classification of Danish research schools, recommending that at least three different types were introduced (Forskningsstyrelsen, 2005, p.18): 1) highly ambitious, clearly institutionally defined units who meets a long list of pre-defined quality criteria, 2) program collaborations, that more or less concentrate on providing courses only, 3) a mixture of the two. The purpose of introducing these three categories was not that all schools should adjust themselves to fit into one of these categories, but to give the Danish authorities the possibility to finance (and we might add: evaluate) the different schools based on their different needs and purposes.

For schools who are primarily focusing on unifying the existing national course providers related to a specific discipline, there are no a priori reasons to expect more international cooperation or higher completion rate. It can be argued, though, that a streamlining of the teaching could lead to lower time-to-degree and to more national cooperation. A school whose work is related to a thematic area where no current provider of courses exists, and who is working with international partners in creating such a teaching platform, may be expected to show positive results on internationalization, but not on national cooperation. On the research front, there is not so much expectations that establishing discipline related schools will lead to increased research cooperation, as this should ideally be fully possible to conduct already within national boundaries. Contrary, for thematic schools, the long-term funding and the presence of international partners, may be the critical opener to international research cooperation that would otherwise not be possible. Such cooperation would possibly also benefit from a stronger inclusion of research institutes from outside the higher education sector. These institutes are highly specialized, often with relevant competences in the research schools' activities, but have on some occasions been excluded from participation in the research schools, since they do not bring in their own PhD students.

It is fully possible to imagine a split-up of the research school scheme into 'national PhD teaching networks' and 'national research schools'. The former would concentrate on utilizing national synergies for good teaching, bringing the smaller institutions into the fold, and making all partners involved accountable and involved in the planning and running of the PhD education – to a stronger degree than what they are today. The latter would focus on connecting the few Norwegian environments (and students) within the thematic area to international actors operating within the same theme, thereby also spurring research cooperation. Such a split-up, would undoubtedly also mean a differentiation on funding allocation – probably also the length of the funding – as it must be expected that it would be

easier (and less costly) for the partners of a 'national PhD teaching network' to take over the expenses of running the network compared to expenses of running a research oriented international research school.

8.3.3 Special efforts made at increasing national and international mobility

Under the national research school scheme, there has been a positive mobility of both students and senior researchers for short-term activities. Mobility regarding longer stays abroad or at other institutions seem absent. This is not due to lack of funding; in the case of PhD students it appears to be due to low willingness or ability to do so among the students; for the senior researchers it is probably due to the fact that no particular need has been identified to do so. We believe that in further calls by the RCN there should be stricter demands on mobility. Related to our recommendations above, these requirements should differ between different types of schools/networks (and must also be considered in relation to the student mass, for example the older student population in general practice medicine who often work part-time during their PhD period). For PhD students at schools with a foreign partner represented in the school, we believe that in order to promote international relations (and since one or more relevant contacts have already been established abroad), the Norwegian institutions – at least in the thematic schools – should be able to send a much higher share of their students on long-term stays abroad. Also: use of a second supervisor from the international partners should be much more frequent than it is today, given internationalization being one of the aims of the scheme.

For the national discipline schools, the partner institutions should be encouraged to have some kind of ‘guest visits’ arrangements to enhance a certain national mobility for the PhD students. This should not be a general requirement, but may be highly relevant for PhD students from smaller research environments. This is not unique or radical. The RCN’s Industrial PhD scheme demands that the PhD students (who are employed at a private company) spend half of the time at the academic supervisors’ institution (a higher education institution), in order for them to feel part of an academic environment, and in order to truly establish a contact between industry and academia.

National cooperation would also be more effectively developed if the schools to a larger degree than today were able to provide the students with supervisors from two institutions that are part of the school, which is seldom today. Most students have two supervisors from the institution they come from – not from another institution within the research school.

The overall point is that what RCN requires from the research schools, i.e. how they should work on increasing national and/or international cooperation, should be dependent on what type of school it is. To what extent it is reasonable to expect of the schools that they increase their national or international cooperation differs greatly between the schools. Any formal or informal agreement between the RCN and the schools should be individually designed with this in mind.

8.3.4 Direct efforts towards increased completion rate and completion time

The Norwegian research schools are mainly characterized by two features: teaching activities and (short-term) mobility of senior researchers. Very few schools report specific efforts to increase the effectiveness of the PhD education. If the RCN wants the scheme to improve the results on completion rate and completion time, the calls for grants simply needs to emphasize the importance of concrete, measurable efforts that will be specifically aimed towards these outcomes. It is beyond the scope of this evaluation to come up with criteria for such efforts. We may nevertheless briefly introduce two. *First*, good supervision is imperative in leading the students towards their completed degrees. A close and good relationship between the supervisor and the students is arguably an important tool in enabling students to avoid dropping out. We believe that more efforts in the calls, and in the schools, should be made on further qualifying of supervisors, for the participating partners in a school to make systems where the students should have two supervisors representing two different institutions at the school, and that the supervisors should commit to make formal plans (cf. the Danish individual plans) with the PhD student on how to improve progress and completion.

Second, the loose organizing today, with the very large amount of teaching activities, seminars etc., of which many are open to anyone, does not add a very strong sense of belonging to the schools. At some schools today, many of the students do not consider their research school as important in order for them to complete their PhDs. They are simply attending a few courses (some students do not even know that they are part of a school). If this is the case, it is hard for the schools to have added value on completion rate and time. We believe the schools should provide the students a clearer identity as being members of a research school. The schools have, to our understanding not emphasized their role as instruments to improve completion rate and time. Most informants at the schools believe the added value of the school is to improve the quality of the PhD education. However, good teachers, interesting foreign lecturers, discussions, seminars, etc. are all factors that may provide the students with higher academic skills. It may potentially lead to doctoral degrees of higher quality. But it does not automatically lead to higher efficiency of the candidate's doctoral training.

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