



Extract from the report to the
Public Accounts Committee on
the investment in the PhD education

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I. Introduction and conclusion

1. This report is about the investment in the PhD education in order to double the intake of PhD students and establish PhD schools.

2. The Danish parliament (the Folketing) has appropriated an additional amount of approximately DKK 4.8 billion for an increase of the intake of PhD students in the period 2005 to 2012. The objective of this investment is to increase the national research capacity and thereby provide the basis for continued growth and welfare in Denmark. The investment in the PhD education is part of the strategy to reach the national target for education set by the Folketing according to which public investment in research should make up minimum 1 per cent of the Danish GDP. In 2007, the Folketing decided that PhD training should take place at PhD schools rather than at the former graduate schools. The decision was among other factors based on an international evaluation from 2006. The objective of this decision was to improve the quality of the PhD education and the completion rate.

3. Considering the size of the investment and its educational implications, which include implementation of extensive organisational changes at the universities, Rigsrevisionen has decided to evaluate progress made with respect to the implementation of the investment.

The new large classes of PhD students have not yet graduated but are expected to do so in a couple of years and it is therefore not possible at this point to measure the effect of the increased intake of PhD students and the establishment of the PhD schools. Still, the report will provide insight into whether the PhD investment is on track and thereby contribute to qualify the basis upon which the Folketing is going to make its decision concerning continued investment in the PhD education. The report will also point to areas that deserve focus from the Ministry of Science, Technology and Innovation (the Ministry of Science) and the universities in the years to come.

4. The objective of the study is to assess the progress of the implementation of the PhD investment both in relation to the increased intake of PhD students and in relation to the changed framework for the PhD education. The study answers the following three questions:

- Have the universities and the Ministry of Science implemented the PhD investment?
- Are the PhD schools focused on improving the quality of the PhD education and the completion rate?
- Has the Ministry of Science prepared and followed up on the investment in the PhD education?

The study encompasses the Ministry of Science and the eight Danish universities and covers the period from 2004, when the decision to increase the intake of PhD students was taken, to the beginning of 2011.

PhD

Generally a 3-year postgraduate academic degree qualifying students to undertake research, development and teaching assignments at an international level.

Up to 2004, the annual intake of PhD students was approximately 1,200. The objective of the PhD investment was to increase the intake to 2,400 by 2010.

The number of PhD degrees awarded has increased from 883 in 2004 to 1,219 in 2009.

A **PhD school** is an organisational unit whose head has the overall responsibility for the PhD training within a specific delimited and coherent discipline.

MAIN CONCLUSION

The PhD investment includes establishment of PhD schools and a doubling of the intake of PhD students.

The universities have established PhD schools and streamlined the PhD education and thereby taken an important step in direction of improving the quality of the education and the completion rate. In the opinion of Rigsrevisionen it is essential that the universities continuously endeavour to ensure that the PhD students complete their education, and recommends that the Ministry of Science in the years ahead follow up on the effect of the PhD schools on the completion rates.

The universities have doubled the intake of PhD students in the period 2003 to 2010 in compliance with the decision made by the Folketing. The majority of the PhD students have been enrolled at the prioritized faculties of natural science, health science and technical science, respectively. The Ministry of Science has supported the universities in their efforts to achieve the targets set for the intake.

On account of the increased intake, the number of international students enrolled at the faculty of natural sciences and technical sciences, respectively, is very large and increasing. Almost every third PhD student enrolled at these university faculties is from a foreign country. The recruitment of international PhD students makes it possible for the universities to attract the best research talent which again puts the business community in a better position to recruit the best researchers. However, an increasing number of the international students leave Denmark after their graduation, and as a consequence Denmark is at risk of providing highly educated researchers to other countries and becoming a net exporter of PhDs. As a result hereof, the doubling of the PhD student intake may not to the extent required contribute to growth and welfare in Denmark.

In 2012 the Folketing will decide how to continue the investment in the PhD education. Considering the size of the investment and its educational implications, Rigsrevisionen is of the opinion that the Ministry of Science should provide the Folketing with a sound basis for this decision. The ministry should, for instance, collect more information on the extent to which and within which areas the private business sector is recruiting PhDs, as this sector is expected to employ the majority of the new PhD graduates. The ministry should also look into the effect of the increased number of PhD graduates from the universities on Danish economy, and assess the development in PhD immigration and migration. The ministry has stated that this knowledge will be obtained.

The main conclusion is based on the following findings:

Implementation of the PhD investment

The universities have achieved the targets set for the intake of PhD students and the establishment of PhD schools. As a result of the establishment of the PhD schools, the distribution of responsibilities is now clearer and the consistency of the PhD programmes has improved.

The Ministry of Science should in cooperation with the universities provide adequate and comparable data on the PhD education. Without such data, the universities and the ministry will not be able to follow up on progress made among the students in respect to completing the PhD education.

The PhD intake

- The universities have increased the intake of PhD students from 1,445 in 2005 to 2,592 in 2010 in compliance with the overall target. They have also increased the intake of PhD students at the faculties of natural science, health science and technical science. Eighty-five per cent of the total growth recorded in the period 2006 to 2010 has been generated in these faculties.
- The Ministry of Science has, through dialogue and by following up on the development contracts, supported the universities in their efforts to achieve the intake targets. The ministry has also discussed the issues relating to recruitment of PhD students with the universities.

Establishment of sustainable PhD schools

- The universities have established PhD schools for all PhD programmes. As a result of the establishment of the PhD schools, the distribution of the responsibility for the PhD programmes is now clearer and the consistency of the PhD programmes has improved compared to the former graduate schools. The individual PhD schools are very different in terms of size and how they are organized.
- Some PhD schools need to cooperate with other schools to offer PhD courses as they cannot muster enough students and researchers within the individual disciplines to create a range of courses of sufficient breadth and profundity. The universities have created the framework for a formalised cooperation, but as of now not all relevant PhD schools have set up concrete arrangements of cooperation.

Completion and drop-out rate

- Statistics on the PhD education indicate that on average it takes well over four years to complete a PhD programme. Only 72 per cent of the PhD students have completed the programme after six years, whereas 10 per cent have dropped out and 18 per cent are still studying. The statistics have not changed significantly in the period 2000 to 2009, but there are large differences between the various faculties.

- However, the statistics are incomplete as the numbers do not adequately reflect the completion time and drop-out rate, and the data on the various PhD schools are not comparable. Since 2008 the Ministry of Science has together with Statistics Denmark worked on improving the data basis. Rigsrevisionen considers this sensible and necessary, but the effect of the work cannot be measured at this point.

Efforts made by the PhD schools to improve the quality and the completion rate

The PhD schools have taken relevant steps to improve the quality of the PhD programmes and the completion rate. The universities should, however, improve the coordination of the PhD study plans between the PhD schools and the university departments.

Steps taken by the PhD schools

- The PhD schools have taken several steps to improve the management of the individual PhD courses. However, many of the schools need to tighten up the practice governing approval of the PhD research and study plans as the plans may help the students complete the education. Improved research and study plans may facilitate early matching of expectations and provide the basis for ongoing follow-up on the performance of the student measured against the plan. The schools should also ensure that the students meet with their supervisor and a representative of their PhD school when the PhD programme is being evaluated.
- The PhD schools are currently enhancing the qualifications of the supervisors. Several schools should, however, define the tasks of the supervisors more clearly and take measures to ensure that the students receive a minimum of supervision. The schools should also evaluate the quality of the supervision provided.
- The PhD schools are focused on improving the research environment despite their limited possibilities of exerting any direct impact, as the responsibility for the research environment lies primarily with the university departments. The universities should continue their efforts to improve the research environment for the PhD students.
- Overall there is no clear connection between the size and organisation of the PhD schools and the scope of their activities to improve the programmes. The important thing is that the PhD schools follow the students closely and coordinate the PhD study plans with the departments and possibly also the faculties.

The Ministry of Science's preparation of and follow-up on the investment in the PhD education

The Ministry of Science analysed the future demand for PhDs before it was decided to double the intake of PhD students in 2004 and 2006. The ministry also addressed the demand issue in its mid-term progress report, worked out in 2009-2010. Rigsrevisionen recognises the difficulties of forecasting the demand, yet is of the opinion that the ministry should have been more thorough in its investigations. In the future the ministry should monitor more carefully how the demand for PhDs in the private sector develops.

In 2004 the ministry analysed how an increase in the intake of PhD students of 500 would affect the recruitment of PhD students. But in 2006 the ministry failed to analyse the impact of the increase in the intake of 700 PhD students, despite indications that the universities would then be forced to rely on enrolment of international students. Neither has the ministry in its mid-term progress report in 2009-2010 addressed the fact that the proportion of international students is high and on the increase. The ministry should obtain more knowledge on this development and its consequences for the effect of the PhD investment.

Preparation of the increased intake of PhD students

- In 2004 the Folketing decided to increase the intake of PhD students on the basis of the results of an analysis performed by the Ministry of Science according to which there would be sufficient qualified candidates to increase the intake by 500 PhD student annually. According to the analysis there would also be increased demand for PhDs at the universities and in the private sector. However, the analyses conducted by the ministry are not providing a clear picture of the future demand in the private sector. Rigsrevisionen recognises the difficulties of forecasting the future demand, yet is of the opinion that the ministry should have been more thorough in its investigations.
- The ministry did not conduct any further analyses prior to the globalisation agreement in 2006. The ministry has stated that it is of the opinion that the analyses that were conducted in 2004 also underpinned the decision to increase the intake by 700 additional PhD students. The ministry did not consider how this increase would affect recruitment, nor did the ministry consider the extent to which the universities would perhaps be forced to recruit more international PhD students.

Follow-up on the increased intake

- In its mid-term progress report on the PhD investment in 2009-2010, the Ministry of Science reported on progress made against the targets set for intake of PhD students, and estimated how many PhDs the universities would need in the years leading up to 2016.

- Rigsrevisionen's study shows that the proportion of international PhD students that are enrolled in the faculties of natural and technical science has increased from approximately 15 per cent in 2000 to approximately 30 per cent in 2009. The consequences of the increased number of international students following the PhD investment are not yet reflected in the statistics, but the number of international PhDs that are leaving Denmark after graduation has been on the increase in recent years. The ministry has not in its mid-term progress report addressed the issue of the international students, and how this development will affect the objective of the PhD investment, which was to contribute to continued growth and welfare in Denmark.
- The relationship between the number of master graduates and the number of enrolled PhD students in the same year may be indicative of the number of master graduates enrolling into a PhD programme. In the prioritised areas, the number of master graduates seeking enrolment in PhD programmes has increased in the period 2003 to 2009. For instance, the intake of PhD students at the faculty of health sciences represented 25 per cent of all health science master graduates in 2003 against approximately 40 per cent in 2009. The ministry should follow up on the significance of this development in respect to the PhD completion rate and the recruitment of new master graduates.
- It is too early yet to assess whether the demand for PhDs in the private sector will match the supply of PhDs in the years to come. The ministry has in its mid-term progress report assumed that the private sector will employ three times as many PhDs in 2015 as in 2011, i.e. 1,500 PhDs annually.
- In 2011 the ministry initiated a study of the impact of PhDs on company productivity. The ministry is expecting to publish the results of the study in the course of 2011. Rigsrevisionen considers it positive that the ministry now more systematically examines the impact of PhDs on productivity and growth in society.
- The ministry has informed Rigsrevisionen that it will conduct an analysis in 2011 – 2012 of the recruitment of international PhD students and how to retain them. The ministry will also examine the society's requirement for PhDs and their job opportunities. The objective of this analysis work is to create a basis for the Folkeeting's decision concerning the PhD investment after 2012.