DNRF
Self-assessment

THE DANISH NATIONAL RESEARCH FOUNDATION
2025 PUBLICATION

Danmarks
Grundforskningsfond
Danish National
Research Foundation

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Preface

The Danish Ministry of Higher Education and Science has requested an evaluation of the Danish National Research Foundation in 2025. The IRIS Group is carrying out the evaluation.

This self-assessment forms part of the input to the evaluation. Once the evaluation report is published, the DNRF board will thoroughly review the evaluator's analyses and recommendations to develop its future priorities.

This self-assessment provides an overview of the DNRF's performance, role and mode of operation within the context of the broader research landscape and policy developments. It places particular emphasis on the Center of Excellence program, which has been the cornerstone of the DNRF's funding schemes.

The main themes of the self-assessment are the DNRF's role and relevance in the Danish research landscape, its societal and research impact, and its funding methods and patterns.

A significant portion of the self-assessment is reserved for conveying the DNRF board's reflections and considerations, which are based on its analyses of past performance and future needs. These reflections will continue after the overall evaluation has concluded, incorporating new insights into the Foundation's ability to "strengthen the development capacity of Denmark with regard to research", as stipulated in the act regulating the Foundation.

The Foundation looks forward to continuing discussions about its role, performance and potential with a wider range of stakeholders during the fall and winter of 2025.

On behalf of the Foundation, April, 2025

Professor Dorthe Dahl-Jensen, Chair of the Danish National Research Foundation

Niels Mejlgaard, CEO of the Danish National Research Foundation

Executive summary

The Danish National Research Foundation (DNRF) is an independent organization in both administrative and financial terms. Its remit is to fund groundbreaking basic research of the highest international quality in all fields, and the main instrument it uses is the Centers of Excellence program, which provides long-term, flexible funding. Each Center of Excellence has a budget of up to DKK 6 or DKK 10 million per year for six to ten years. These centers are large enough to foster highly creative research environments that endure, yet small enough to remain agile and non-hierarchical.

In the Danish research landscape, the DNRF promotes frontier research by nurturing a culture of very high ambition, including with regard to high-risk aspects of research activities, across the academic spectrum. Centers of Excellence perform at the highest international level, with grant holders securing 29% of the prestigious ERC Advanced Grants awarded to Danish research and receiving top scientific prizes and awards. Notably, Morten Meldgaard, a recent Nobel Prize winner, carried out his award-winning work at a Center of Excellence.

The DNRF prioritizes programs with innovative vision and significant potential over those with more predictable outcomes. The board looks for potentially transformative ideas, skilled research leaders, and teams with strong and complementary expertise. The Foundation encourages ambitious, long-term thinking among its grant holders by conducting the first formal evaluation of their work after five years. In the interim, the Foundation monitors progress through ongoing dialogue that focuses on leadership, organization and knowledge sharing.

Centers of Excellence create environments conducive to developing talented researchers for industry and academia – many of whom go on to make invaluable contributions in emerging and potentially transformative areas. The DNRF's strategy of focusing on research quality and potential rather than immediate societal and political demand enables the Centers of Excellence to use the foresight of leading researchers to pick tomorrow's winners. The Foundation's financial independence provides favorable conditions for this strategy.

Centers of Excellence are effectively funnels that facilitate the transition from discovery to innovation and from frontier research to practical implementation. They account for under 2% of the public research budget and yet are involved in more than 12% of

spinouts from public-sector research institutions. The 41 current centers encompass more than 400 active collaborations with non-academic organizations, and seven out of ten of them collaborate with private companies. They receive ample funding from the Innovation Fund and other foundations with strategic aims, and in the STEM areas, practically all of the centers see their work cited in patent literature.

Former center leaders attribute their success not only to the format but also the "spirit" – in other words, to the collective nature of the centers – and to their close and trust-based dialogue with the Foundation.

Despite greater access to competitive funding in Denmark, the success rate for applicants has remained very low over the past decade, at 7–8%, a figure which suggests that many high-quality proposals are rejected and significant potential left untapped.

The DNRF is committed to improving its instruments in ways that stimulate excellence and that balance the Danish research landscape. Historically, this has included measures such as more flexible grant conditions and the introduction of new programs such as the Pioneer Centers and Niels Bohr Professorships. The Foundation is currently considering adjustments that would create more opportunities for talented mid-career researchers. It also continually monitors the relevance and impact of its instruments and discontinues ones deemed to have a diminishing impact.

In addition to the Centers of Excellence, other instruments have had a significant impact. Niels Bohr Professorships and DNRF Chairs have attracted talented senior researchers to Denmark, enriching local research environments and creating ties with leading universities abroad. Dale Mortensen, a Niels Bohr professor of economics at Aarhus University, won a Nobel Prize while based in the country. The Pioneer Centers integrate highly ambitious basic research with practical applications established and monitored in close collaboration between the DNRF and the major private research foundations.

The DNRF has improved its administration over the past decade without costs increasing. It has introduced new ways of supporting grant holders, streamlined data collection and set up an investment committee to promote further the robustness of the sustainable financial model that underpins the Foundation's financial independence.

Key messages and figures 2012-2023

The Danish parliament set up the Danish National Research Foundation (DNRF) in 1991. It is an independent organization in both administrative and financial terms. The board focuses on funding research at the highest international level, mainly through the Centers of Excellence program.

The Foundation maintains a close, trust-based dialogue with each of its grant holders. It keeps administrative costs low, and its budget has remained unchanged since 2012.

Funding

- The DNRF allocates **1.8%** of the total public research funding in Denmark.
- Since its inception in 1991, the DNRF has provided over DKK 10 billion (€1.4 billion) in grants to Danish research institutions, distributing up to DKK 470 million (€63 million) annually.
- The DNRF has funded 131 Centers of Excellence, of which 41 are currently active. The Centers of Excellence program continues to be attractive to Danish researchers. Since 2012, the success rate for applicants has remained stable at **7-8%**.
- At present, the DNRF also funds:
  - 4 Pioneer Centers co-funded with the Lundbeck Foundation, the Carlsberg Foundation, the Villum Fonden, the Novo Nordisk Foundation and the Ministry of Higher Education and Science.
  - 19 DNRF Chairs, of which 12 are currently active.
- Over their lifetime, Centers of Excellence attract external funding from Danish and international foundations, averaging 150% of the funding provided by the DNRF.
- The institutions that co-fund the Centers of Excellence commit to contributions equaling approximately 50% of the DNRF's contribution to the center budgets.

Performance

Research

- Past evaluations show that Centers of Excellence are particularly good at producing high-quality academic papers that are regularly cited and contribute to driving the research front.
- The Centers of Excellence are highly competitive in international terms:
  - The 2022 Nobel Prize in chemistry was awarded to Professor Morten Meldal for work carried out at a Center of Excellence.
  - In 2023, Eske Willerslev was awarded the Balzan Prize for his contribution to the study of ancient human DNA, building on work carried out at a Center of Excellence.
  - 29% of the Danish share of ERC Advanced Grants has gone to researchers who are core staff at Centers of Excellence.

Talent

- Centers of Excellence are involved in the training of **6%** of Danish PhDs. Center staff teach at graduate and undergraduate levels on par with other staff from the host institution.

Innovation and collaboration

- Publications by Centers of Excellence support innovation – for example, publications from 2008 have now been cited over **1,000** times in patents.
- The Centers of Excellence actively transform basic research into innovation. From 2012–2023, they:
  - were involved in **12%** of spinouts from public research in Denmark, more than doubling the number since the previous evaluation.
  - took out **7%** of patents and submitted **10%** of patent applications in this context.
- Centers of Excellence are highly active collaborators and actively promote the use of their frontline expertise for the benefit of society as a whole. In 2024, the 40 active Centers of Excellence were involved in over **400** collaborations with private and public organizations outside of the universities, and **73%** of them collaborated with private companies.

Introduction

This self-assessment serves as input to the evaluation of the Danish National Research Foundation (DNRF) requested by the Ministry of Higher Education and Science. The overall evaluation is being conducted by IRIS Group during the course of 2025. The Foundation's self-assessment will be one of several elements that will inform the evaluation. The DNRF was previously evaluated in 2003 and in 2013.

The overarching purpose of the evaluation is to determine how well the Foundation continues to fulfill the objective of "strengthening the development capacity of Denmark with regard to research", as stipulated in the Act regulating the Foundation.[1] The Terms of Reference provided by the Ministry of Higher Education and Science specify the aims of the evaluation and the topics to be covered.

THE DNRF IN BRIEF

The DNRF is an independ ent organization established by the Danish Parliament in 1991 to improve Denmark's ability to develop its research potential.

The legal framework stipulates that the Foundation supports excellent research. Grants must be allocated to activities that include key elements of research training and can involve international collaboration and joint funding activities. The grants must be substantial and run for a set number of years. The Foundation is obliged to monitor the activities it funds and is authorized to distribute an annual average of DKK 470 million (for more about the DNRF's legal framework, see section 5.1).

The DNRF's ability to fund the very best research, regardless of discipline, location, objective, etc., is fundamental to its short- and long-term performance. As explained in greater depth below, the Foundation is able to do this because other important funding bodies play complementary roles.

While its grant holders contribute dedication, talent and ambition, the Foundation creates the optimal conditions for research via the Centers of Excellence (CoE) program, which provides substantial trust-based, flexible, long-term funding for up to ten years to bring together the requisite talent. The CoEs are small enough to remain agile but also large enough to address demanding research questions.

CoEs build up creative environments over the years and serve as lighthouses for excellence in Danish research. They attract highly qualified research talent, lead to remarkable innovations and enrich the research culture in Denmark. The program has stood the test

1 Bekendtgørelse af lov om Danmarks Grundforskningsfond. LBK nr 200 af 26/02/2019 (*link*); unofficial UK translation *here*.

of time, required relatively few improvements, and inspired similar schemes in other parts of Europe, e.g., the European Research Council.

To date, 11 application rounds have spawned 131 Centers of Excellence, with contract negotiations for the 12th application round ongoing. The Foundation has invested more than DKK 10 billion (€1.4 billion) in Danish research over the years, including in other initiatives. However, the CoE program is the primary funding mechanism, and this self-assessment report is mainly devoted to describing, assessing and reflecting on it.

STRUCTURE OF THE SELF-ASSESSMENT

The structure of the self-assessment report is outlined below. Each chapter includes descriptive sections highlighting the mechanisms employed by the Foundation to enhance excellent research. These are then followed by the board's reflections, which identify areas with potential for further improvement.

- **Chapter 1** provides an overview of the past performance of the DNRF as background for the current evaluation. It introduces previous evaluations since 2012 regarding research, talent, development and innovation from a Danish and international perspective, including the last official DNRF evaluation published in 2013 and covering the period up to 2012.
- **Chapter 2** explores the role of the DNRF in the Danish research landscape, including a brief account of the research system in which the Foundation operates and its developments. It also explains the particular role played by DNRF grants and how they complement the broader Danish research landscape.
- **Chapter 3** provides an in-depth account of the DNRF's main funding instrument, the Center of Excellence program.
- **Chapter 4** introduces other DNRF funding instruments since 2012, including the Pioneer Centers and DNRF Chairs, which are still running.
- **Chapter 5** provides insight into the Foundation's organization, finances and the support it provides for grant holders.
- **Appendix:** DNRF SWOT 2025, which summarizes the board's perspectives on current strengths, weaknesses, opportunities, and threats.

1. DNRF performance 2012-2023 – in a Danish and international perspective

1.1 Research impact

Denmark 2012-2023: Peak and decline

When the previous DNRF evaluation was published in 2013, the general perception of Danish research performance was highly influenced by a widely cited report by the Royal Swedish Academy of Sciences: "Fostering breakthrough research: A comparative study".[2] This report compared the research output of five European countries, quantified in terms of the number of papers that ranked among the top 10% of the most highly cited[3] papers between 1990 and 2012. It concluded that Denmark had risen from an average position to one of the very best in the world, a transformation that became known as "the Danish miracle".

In 2016, the Danish Council for Research and Innovation Policy followed up on the Swedish Academy's report with the publication "Viden i Verdensklasse" ("World-class knowledge"). Adding further bibliometric data, this publication confirmed the overall conclusion that Danish research had achieved a remarkable turnaround in 20 years, while

2 Fostering breakthrough research: a comparative study. Gunnar Öquist and Mats Benner. The Royal Swedish Academy of Sciences, 2012 (*link*).

3 A commonly used indicator of research performance involves the assessment of the share of a publication portfolio that is among the 10% most cited publications in a given field. If the share is above 10%, it means that the performance is higher than the global average. According to some accounts, a share above 30% is an indicator of extremely well-performing research groups.

also pointing to possible imbalances in the Danish research system. It also highlighted that Denmark ranked second among EU countries on the European Innovation Scoreboard (EIS), surpassed only by Sweden.[4] In 2018, an OECD research barometer added to the picture by describing Denmark as a research leader.[5]

The 2023 report "The scientific impact of Danish research 1980–2020" marked a sea change by demonstrating that the research impact of Danish journal papers had declined since 2010.[6] The trajectory in Denmark conforms with the general trend in Western countries, which is thought to be a consequence of heavier investment in research in a number of countries – particularly China – during this period. However, the decline of the scientific impact of Danish research appears to be comparatively steep. While the volume of Danish publications has risen more than for most comparable countries during the period concerned, the number of Danish researchers contributing to the top 10% most highly cited papers has not gone up. Although the influx of early career researchers has led to a higher volume of output, it would appear that it has not resulted in output with the same high impact.

Comparable countries like Sweden and Norway have made progress since 2012. Swedish research now produces a larger share of highly cited papers than Danish research, and Norway appears to be on course to do the same. However, Denmark has maintained its leading position on the EU Innovation Scoreboard, overtaking Sweden as the EU innovation leader since 2023.[7]

The DNRF's role

The 2013[8] international evaluation concluded that the DNRF played a key role in turning Danish research around in the early 1990s, citing bibliometrics as well as the analysis by the Royal Swedish Academy of Sciences. The panel concluded that the success of the DNRF is closely related to its legal status as an independent foundation, which enables it to adhere to the guiding principles for scientific and scholarly excellence and maintain close links with the CoEs. The panel highlighted the DNRF's cultural role:

> *The orientation towards scientific and scholarly excellence, which now characterizes the Danish research sector could not have been achieved to this extent without the DNRF and its CoE instrument, which is working very well and has created poles of excellence for Denmark, which have a strong catalytic effect on universities and research institutions in general.*

4 Viden i verdensklasse – hvorfor klarer dansk forskning sig så godt? Danmark Forsknings- og Innovationspolitiske Råd. 2016 (*Link* (in Danish)).
5 Ny opgørelse: Dansk forskning har stort gennemslag og relevans. Uddanelses-og forskningsministeriet. 2018 (*Link* (in Danish)).
6 Ny rapport tager temperaturen på dansk forskning. Villum Fonden. 2023. (*Link* (in Danish)).
7 European innovation scoreboard. European Commission. 2024 (*Link*).
8 Evaluation of The Danish National Research Foundation. Ministry of Science. Innovation and Higher Education. 2013 (*Link*).

This is also confirmed by the analysis underpinning the report by the Danish Council for Research and Innovation Policy (2016), which investigated the causes of 'the Danish Miracle'[9]:

> *For Denmark, it is shown how changes in the research funding system (including the establishment of the Danish National Research Foundation), the prioritization of PhD education and a general increased emphasis on academic quality and internationalization during the late 1980s and early 1990s contributed to reversing a negative development and subsequently laid the Foundation for the constant increase in the aggregated Danish research performance during the following decades.*

The DNRF commissioned a research-based study of the long-term research impact and mechanisms of CoEs, focusing on those launched between 1993 and 2005. It concluded that the centers have been particularly efficient in producing highly cited papers that are important in driving the research front, and that they excel in different ways. Some make high-profile breakthroughs, while some consistently produce a large number of highly cited papers.[10] The study links these findings to key aspects of CoEs –flexibility, stability and ongoing dialogue with and support from the Foundation. Former leaders and CoE participants identified interdisciplinarity and the "spirit" of the CoE as key factors contributing to their success.

9 Links between research policy and national academic performance: A comparative study of Denmark, Sweden and the Netherlands, p.3. Report from the Danish Center for Studies in Research and Research Policy (*Link*).

10 Centers of Excellence from the Danish National Research Foundation 1993–200. Report from the Danish Center for Studies in Research and Research Policy, Aarhus University. Emil D. Alnor, Jesper W. Schneider, and Lise Degn, 2023 (*Link*).

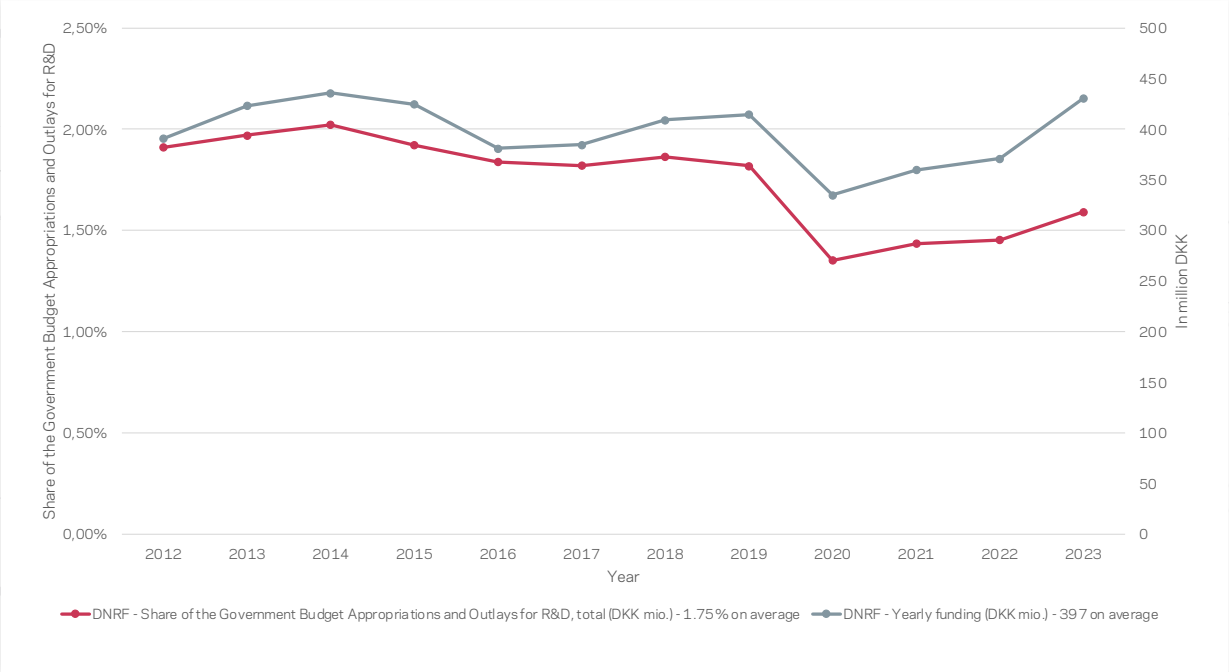


Figure 1 - The DNRF's share of the public R&D expenditure (current prices). Apart from the COVID years, DNRF funding is around or above DKK 400 million per year. Taking inflation and prices into consideration, DNRF funding has generally decreased. As a share of public research investments, DNRF activity has fallen from around 2% to around 1.6% during the period covered. CoEs have more than doubled their total funding by attracting additional grants from other sources.

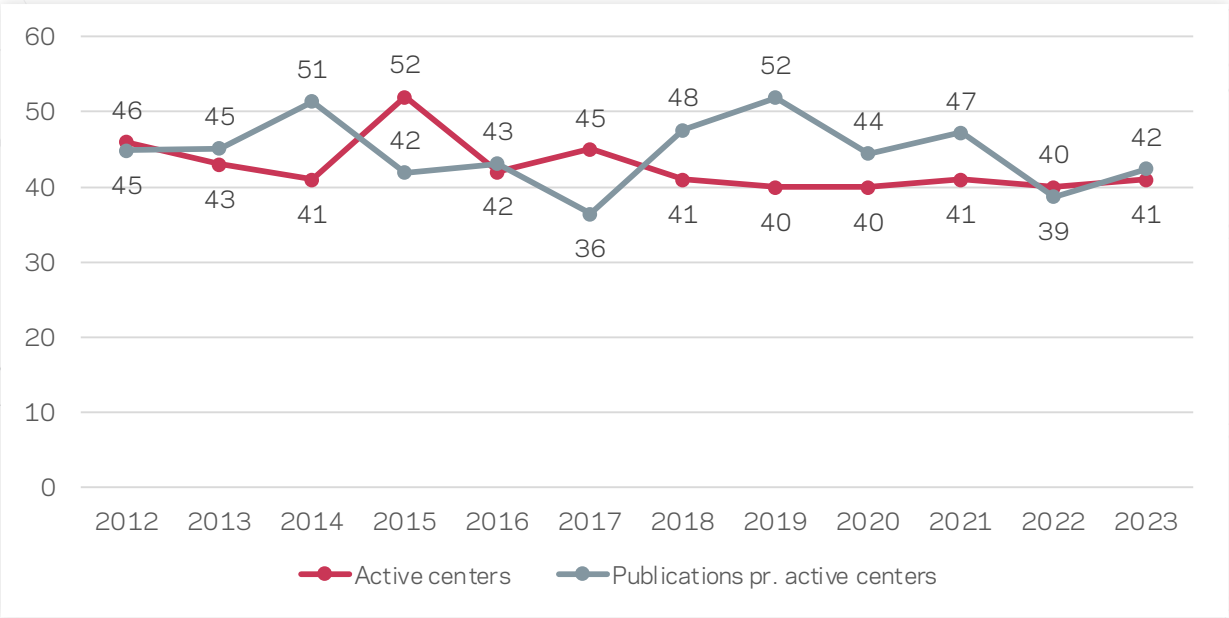


Figure 2 - Yearly reported publications divided by number of active Centers of Excellence in the period 2012-2023. Seen against the number of active Centers, the CoE publication volume has been quite constant.

NOBEL PRIZE IN CHEMISTRY, 2022

Morten Meldal, professor, University of Copenhagen, center leader at the Solid-Phase Organic Chemistry and Enzymatic Reaction Center (SPOCC), 1997-2007.
One of the most cited papers stemming from a Center of Excellence, published in 2022, pioneered a functional form of chemistry – click chemistry – in which molecular building blocks snap together quickly and efficiently. The widespread applications of this basic finding have been demonstrated ever since. For example, it is now used in the development of pharmaceuticals, mapping DNA and creating materials that are more fit for purpose.

Video interview with Morten Meldal about the Nobel Prize and his Center of Excellence (Danish subtitles – link to UK version on its way). *UK link.*

BALZAN PRIZE, 2023

Eske Willerslev, professor, University of Copenhagen, center leader at the Center for GeoGenetics (CGG), 2009-2019.
Since opening a Center of Excellence in 2009, Eske Willerslev and his team have repeatedly made the front page of leading scientific journals and newspapers worldwide. Their research into ancient DNA fragments has effectively rewritten much of the history of mankind.

In 2023, Eske Willerslev was the recipient of one the most prestigious scientific accolades, The Balzan Prize.

1.2 Talent

DENMARK 2012–2023: DOUBLED PHD UPTAKE

In November 2006, the Danish government earmarked DKK 21 billion (€2.8 billion) for R&D as part of the Globalization Fund. The idea was to raise the national research budgets to 3% of GDP (with public investment accounting for 1% of it) as per the Barcelona objectives adopted by the European Council in 2002. The main objective was to improve Danish innovation capacity.[11] Public-sector spending on R&D in Denmark has remained at 1% ever since.

Much of this funding was dedicated to increasing the intake of PhD students. By 2011, the universities had doubled their intake in the natural, technical, and health sciences.[12] The PhD intake has remained at this level since then (2,200–2,600 graduates per year). PhD unemployment rates have remained low (1% in 2022).[13]

In 2011, one-third of the PhD students were recruited from outside Denmark, which reflected the political priority of attracting more talent from abroad. However, concerns were raised about the tendency of international students to return to their home countries after graduation, and that this would make Denmark a net exporter of PhDs.[14]

A study found that just over one-third of international students leave Denmark within a year of graduation (very few leave later than this, and fewer than 5% return to Denmark later, including Danish nationals). This data resembles the figures for undergraduate students from abroad.[15]

A 2018 study found that about half of international Master's students leave Denmark within five years of starting their studies. Despite this, the net economic result was found to be favorable to Denmark.[16]

The DNRF's role

The 2013 international evaluation found that the significant output of talent from CoEs was the most important direct contribution the DNRF makes to Danish society.

From 2012 until 2021, more than half of the total allocated by DNRF in grants was spent on training early career researchers. When combined with funding from other sources, CoEs are involved in training 6% of Danish PhDs. Many of these PhDs and postdocs go on to work outside academia. However, the number of early career researchers who dream of an academic career is higher than the system accommodates. The DNRF encourages career advice and engages in direct dialogue with young researchers to promote careers outside academia.

11 *https://fm.dk/udgivelser/2006/november/aftale-om-udmoentning-af-globaliseringspuljen-mv/*
12 Beretning om satsningen på ph.d.-uddannelse. Statsrevisorerne. 2010. (*Link* (in Danish)).
13 Tal om danske universiteter 2023. Danske Universiteter. 2023 (*Link* (in Danish)).
14 Beretning om satsningen på ph.d.-uddannelse. Statsrevisorerne. 2010 (*Link* (in Danish)).
15 DEA // Copenhagen Talent Bridge: Arbejdsmarkedet efter endt uddannelse for ph.d.er. 2014 (*Link* (in Danish)).
16 Flere internationale studerende skal blive og arbejde i Danmark efter studierne. 2018. (*Link* (in Danish)).

In 2023, the DNRF studied the enduring value of former CoEs and shed light on how many talented researchers transition from CoEs to work in industry, academia, etc. The study shows that even though CoEs focus relatively narrowly on scientific excellence – i.e., without regard to broader societal impact – they are significant contributors to areas in societal demand, e.g., quantum science, green energy and the green economy.[17]

The study may be seen as an illustration of the way in which CoEs nurture and promote talent and other forms of capacity at an early stage, well in advance of global competition in their fields intensifying, and that this gives Danish strategic initiatives a head start. The study also illustrates the role of curiosity-driven research strongholds in the build-up of pre-competitive capacity. The DNRF strategy of focusing on academic quality effectively utilizes the foresight and creativity of top scientists in Denmark to pick some of tomorrow's winners.

1.3 Innovation and collaboration

DENMARK 2012-2023: LEADER WITH POTENTIAL

The main aim of the political ambition to increase R&D investment in 2006 was to enhance Denmark's innovation capacity. At the time of the 2013 evaluation of the DNRF, Denmark ranked third on the EU Innovation Scoreboard (EIS). The rankings reflect various societal innovation criteria, of which research-based innovation is just one. Since 2023, Denmark has ranked first.

The EU as a whole lags behind South Korea, the USA, Canada, and Australia, with China expected to soon overtake the EU's collective fifth place. The EU Commission's 2024 report ("The Draghi report") strikes an even more pessimistic note, concluding that the EU needs to quickly ramp up its efforts to avoid losing even more ground.[18]

In 2019, the EU Commission appointed an international panel of experts to conduct an overall peer review of Danish R&D performance. It concluded that while Denmark does well, it should do better at research-based innovation. The panel recommended that Denmark identify a clear, overarching strategic direction to raise the level of innovation and ensure the country remains an attractive one for research and development.[19]

The DNRF

While innovation is not among the DNRF's stated aims, basic research leads quite naturally to greater innovation, and reporting on the contribution DNRF-funded activities make to society – commercial or otherwise – is a legitimate political expectation.

17 Lasting value from DNRF Centers of Excellence. The Danish National Research Foundations. 2023 (*Link*).
18 The future of European Competitiveness. EU Commission. 2024. (*link*)
19 Peer Review of the Danish R&I System – Ten steps, and a leap forward: taking Danish innovation to the next level. EU Commission. 2019. (*link*)

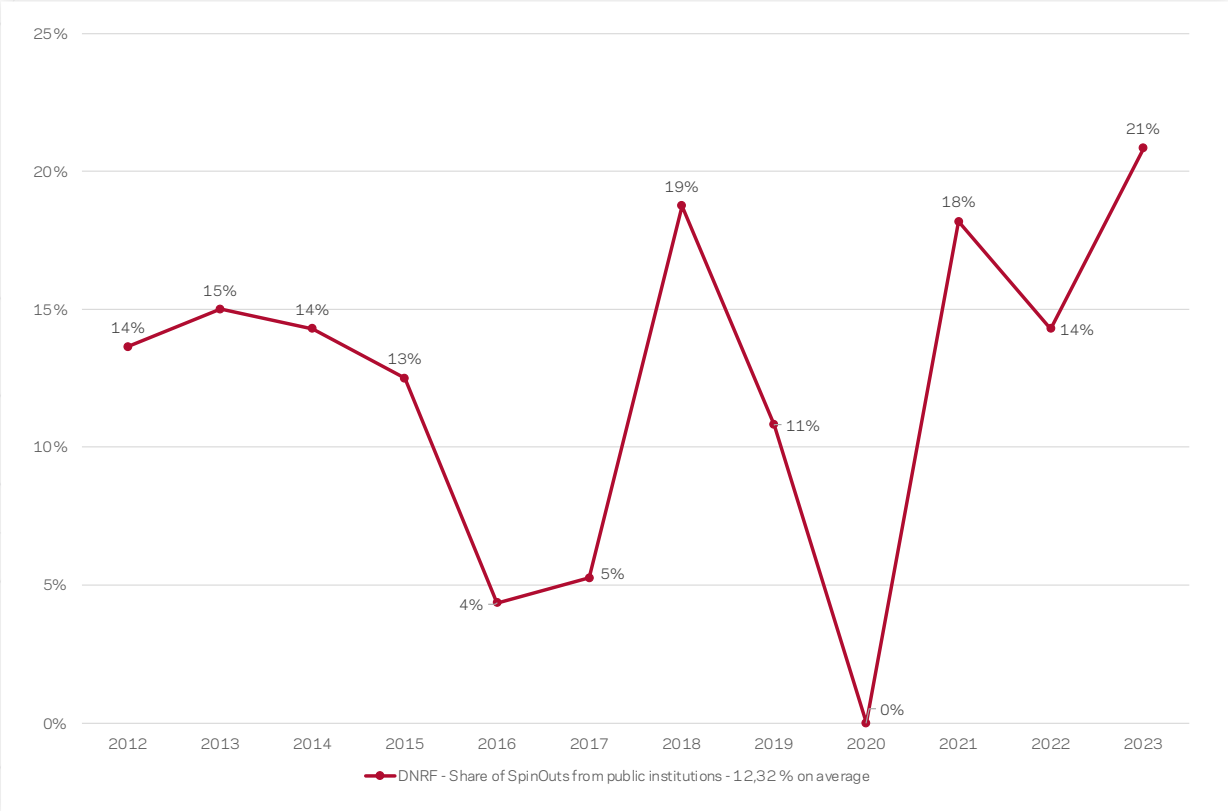
"Application and Commercialization" was also covered in the 2013 DNRF evaluation, when the evaluation panel noted the surprisingly high number of patent applications from CoEs.

Innovation activities at the CoEs have changed significantly since the program began, reflecting shifting political views on the role of research and related policy changes in Denmark (see Section 2.1). In the 2000s, commercial activities at CoEs became more widespread. While there is no evidence of spinout activities from the earliest centers (rounds 1–3 starting between 1993 and 2005), about half of those early centers report that their innovations were still being used by Danish companies in 2023. Similarly, half of the centers reported that their innovations were still being used in the Danish public sector.[20]

The DNRF has initiated several studies aimed at gaining a better understanding of the nature and volume of CoE activities that have short-term or long-term benefits for society.[21] Here are some of the main findings and conclusions from these studies and from the data the DNRF has received from Centers of Excellence:

- **Spinouts**
  From 2012 until 2023, the number of spinouts per year doubled compared with the preceding five-year period, averaging 3.3 spinout companies per year.[22] This means that CoEs were involved in 12.3% of all spinouts from public research institutions during this period. This should be weighed against the fact that the DNRF allocates an average of 1.8% of the public funding for Danish research and that the CoE activities are co-funded by the universities and other foundations.

20 Centers of Excellence from the Danish National Research Foundation, 1993-2005. Alnor, Schneider and Degn, Center for Studies in Research and Research Policy, Aarhus University. 2023. (*link*)
21 Read more *here* and *here*.
22 The 2013 DNRF evaluation reports an average of 1.4 spinouts per year during the five-year period measured (2007–2011). (*link*)



- **Patents and patent applications**
  Between 2012 and 2023, 522 patents were granted to public Danish research institutions. DNRF grant holders were involved in 37 of these, corresponding to about 7%. CoEs were involved in 10% of patent applications.

- **Patent citations**
  It is useful to monitor citations of CoE publications in the prior art section of patents. Trends in patent citations provide a useful indicator of the role basic research plays in commercially relevant fields by providing insights that are useful for others preparing patent applications. The figure above shows the number of patent citations over the last several years. For example, until 2022, publications that were published by CoEs in 2012 had been cited 762 times, while publications that were published in 2022 had 'only' been cited nine times.

  - Almost all citations stem from publications in the life, natural and technical sciences.
  - On average, 72% of all centers had at least one publication cited in a patent between 2012 and 2022. The ERC conducted a similar analysis of the ability of high-quality research to underpin technological developments. Based on data from Framework Programme 7 (2007–2014), the study showed over 40% of ERC projects were cited in patents.[23]

23 Assessing the Influence of ERC-funded Research on Patented Inventions. The Eruopean Research Council. 2022. (*link*)

19% of all centers active in 2012 were cited more than 100 times. The most-cited centers were each cited about 350 times by 2022.

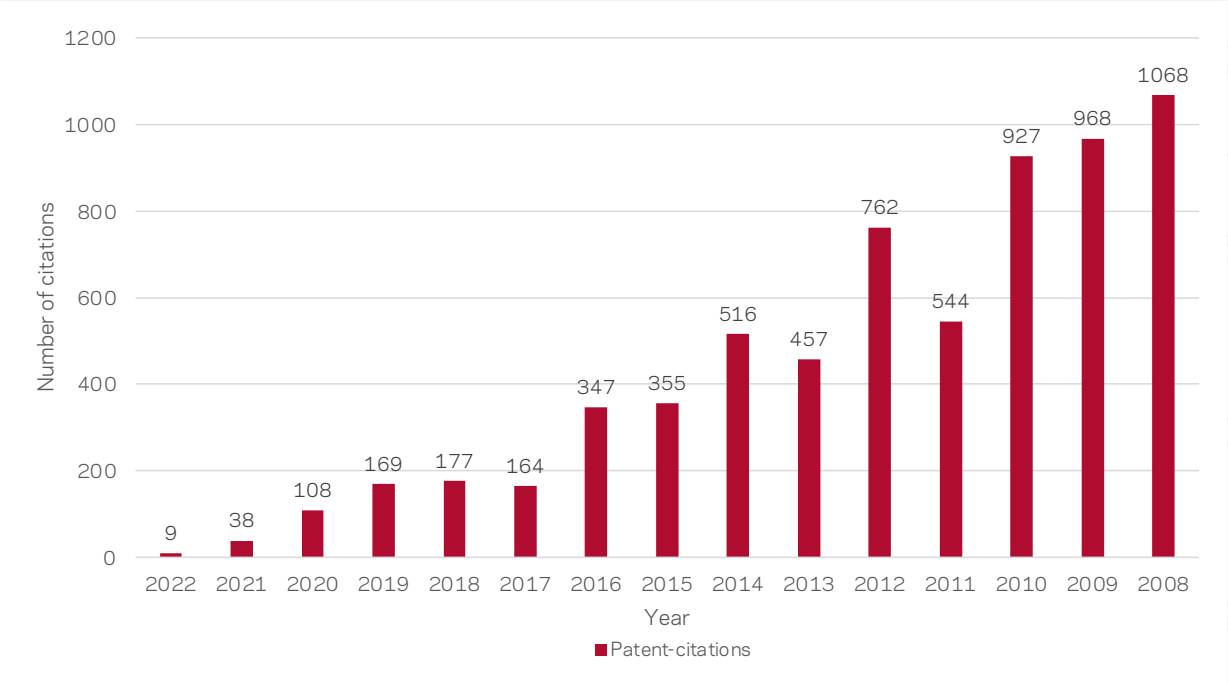


Figure 4 - Patent citations of CoE publications[24]

- **Inventions**

  Spinoffs and patents are two indicators of the inventiveness of the CoEs. Another is invention itself. Inventions are often evaluated in the context of commercial applications and patents. Many of the inventions that stem from CoEs, however, are not designed to make a commercial impact, not even at STEM centers. The standard indicators of innovation do not include aspects such as new instruments, treatments, databases, know-how, new business areas, processes and methods.

  One indicator of inventiveness that is not exclusively defined by commercial purposes is the number of grants given to CoEs by Innovation Fund Denmark and similar programs. In 2023, DNRF CoEs had 28 active grants from Innovation Fund Denmark.

24 Patent-citations have been accumulated using SciVal.

- **Advice and collaboration**
  The DNRF has in recent years started collecting data on the nature and volume of advice provided by CoEs and the number of collaborations they enter into – in other words, how external parties make use of their specialist knowledge. In 2024:
  - 73% of the CoEs collaborated with Danish private companies.
  - 38% of the CoEs collaborated with the Danish healthcare sector.
  - 30% of the CoEs collaborated with a Danish public or non-profit organization.
  - In total, the 41 currently active CoEs were involved in 459 distinct collaborations. The DNRF collected examples of innovation and collaboration with obvious benefits to society in the 2021 publication "Curiosity Benefits Society".[25] This report provides examples of the societal impact of research outside STEM areas, such as the effect of natural and cultural history research on educational quality and the preservation of cultural heritage as a result of research collaborations with cultural institutions (e.g., museums).

1.4 International competitiveness

The ability of CoEs to compete for international accolades, such as grants and awards, can be seen as an indicator of their international competitiveness.

Grants

ERC grants are highly competitive, with a success rate for applications of 10–20%. Danish research is number four in terms of attracting ERC grants per full-time researcher.[26]

In some ways, the ERC Advanced Grant mirrors CoE grants in that both involve relatively large sums and a focus on excellence. Danish researchers received 2.37% of all ERC Advanced Grants in the period 2012–2023 and 29% of those involved core CoE staff.[27]

Awards and rankings

DNRF grant holders have received numerous international awards in direct competition with other leading international researchers. While awards only constitute a partial, somewhat random picture of scientific strength, they nonetheless indicate recognition.

The ERC lists eight awards that span the academic spectrum and are considered to be highly prestigious.[28] Danish research has been the recipient within four of these. Almost all of the Danish researchers awarded these four prizes since the DNRF opened in 1991 are former DNRF grant holders. Two of the prizes were awarded for research that emerged from work carried out in a CoE (italics).

25 Curiosity Benefits Society, The Danish National Research Foundation. 2021. (*link*)
26 ERC research grants by country, university and domain. Rathenau Institute (checked in 2024). (*link*)
27 The share is calculated as the number of CoE core staff who were also ERC Advanced grant recipients between the start and end of their CoE grants, plus six years during the reported period.
28 Scientific Prizes. The European Research Council (checked in 2024). (*link*)

Nobel Prizes

- *Chemistry, 2022: Morten Meldal, University of Copenhagen, second CoE round (1997–2007)*
- Economics, 2010: Dale T. Mortensen, Aarhus University, DNRF Niels Bohr Professor (2006-2010)
- Chemistry, 1997: Jens Christian Skou, Aarhus University, not associated with the DNRF.

Balzan Prizes

- 2022, Dorthe Dahl-Jensen, fifth CoE round (2007–2017), current chair of the DNRF board
- *2023, Eske Willerslev, sixth CoE round of (2009–2020); and eleventh CoE round (2022–)*

Kavli Prizes

- 2022, Jørgen Christensen-Dalsgaard, seventh CoE round (2012–2022)

Crafoord Prizes

- 2024, Jørgen Christensen-Dalsgaard, seventh CoE round (2012–2022)

Center staff have also regularly been the recipients of prestigious national grants, as well as international prizes and awards granted by Danish foundations examples of which are the Carlsberg Foundation Research Prize, the Lundbeck Brain Prize, the Novo Nordisk Prize, and the Villum Kann Rasmussen Annual Award.

Reflections

DNRF performance, 2012-2023

- **Peak over average performance**
  The DNRF expects its grant holders to excel, as it believes the CoEs enjoy optimal conditions in which to conduct excellent research. The Foundation also appreciates that risky frontier sub-projects may fail or at least fall short of expectations. Indeed, some do, as risk invariably accompanies ambition. The DNRF board prefers some centers to do extremely well rather than a good average performance by all of them. Similarly, it prefers the quality of publications over quantity.

- **Focus on potential**
  One of the DNRF board's main priorities is that its grants make a difference. The Foundation considers how well-studied a subject already is, the use of bold new methods or experimental setups, and how well-funded an applicant or area is at the outset. When considering staff, the emphasis is on leadership skills, the ability to enhance team science, and complementary competencies rather than narrowly focusing on the past performance of the center leader.

- **Focus on conditions for long-term impact**
  Based on center visits and evaluations, the Foundation finds that most centers are performing very well. The DNRF believes that the impact of CoEs should be assessed on a long-term basis. As Chapter 3 highlights, this is directly reflected in the DNRF's practice of refraining from formal assessment during the first five years of a CoE.
  In recent years, the Foundation has focused on two questions in an attempt to identify potential performance improvements: The link between the long-term performance of DNRF grant holders and the conditions given to the grantees – especially the roles of the CoE instrument itself and of the Foundation – and how the research activities it funds ultimately help society make progress.
  The DNRF considers these findings from past evaluations particularly important:

- Former center leaders identified the format of the Centers of Excellence – in particular, their stability, volume, visibility, flexibility, interdisciplinarity, the special CoE "spirit," and interaction with the Foundation – as key to their performance.
- CoEs are especially good at publishing research that is highly cited. However, excellence takes many forms – sometimes centers produce many highly cited works, and sometimes they make breakthroughs.
- CoEs have provided industry and academia with a wealth of talent and invaluable capacity in emerging areas. In effect, the CoEs utilize the foresight of top researchers to pick and train future winners, a process underpinned by the Foundation's independence and by its overall strategy of focusing on excellence rather than on society's current needs.
- In addition, CoEs provide direct returns on society's investment in the form of advice, collaboration, patents, innovation and spinouts – demonstrating that, at CoEs, basic research and societal benefit are not two different spheres. Many centers effectively function as conduits between frontline research and frontline advice and innovation.

These findings demonstrate the ongoing success and adaptability of the CoE program. Previous center leaders have mentioned certain challenges, but these have been addressed in the intervening period (see more in Section 5.3). Nonetheless, the current evaluation presents an opportunity for critical revision.

2. The DNRF's role in the Danish research landscape, 2012-2023

2.1 Policy since 2012: Innovation takes center stage

In the early 2010s, there was a marked political shift in Denmark and the EU in favor of focusing on societal challenges and establishing closer ties between research and innovation, as reflected in the EU's growth strategy Europe 2020 and the European Commission's research and innovation framework, Horizon 2020.

In the innovation strategy published in December 2012 *(Denmark – a nation of solutions: Enhanced cooperation and improved frameworks for innovation in enterprises)*, the Danish government set out a plan for reform of the research and innovation system.[29]

The first recommendation called for a review of Danish research and innovation councils. Innovation Fund Denmark (IFD) was set up in 2013 as an amalgamation of previous foundations for strategic research, high technology and innovation.

29 Denmark – a nation of solutions. Enhanced cooperation and improved frameworks for innovation in enterprises. Ministry of Science, Innovation and Higher Education. 2012. (*link*)

The background to this was that "the large public investments in research and innovation are to an increased extent to contribute to solutions to societal challenges and create growth and employment. The revision of the research and innovation system aims to support that the system becomes more simple and effective, to strengthen the link between research and technology and innovation efforts in companies."[30]

In 2017, following up on a political agreement from 2016, the legal framework for the Independent Research Fund Denmark (DFF) was adjusted. One significant change was that it opened up the possibility of the DFF allocating thematic funding for politically prioritized areas.[31]

In June 2017, the RESEARCH2025 catalog was published. It was the result of a broad and inclusive process that began in 2016 and identified the "most promising" areas of research likely to benefit Denmark. The need for the catalog arose when "the government, together with the Danish Parliament, must prioritize the research areas that must be funded with strategic research funds from the research reserve. The catalog can also be used by universities, foundations and other grant providers in connection with prioritization and disbursement of research funds."[32] Similarly, business development initiatives have sought to identify, match and strengthen positions and clusters of strength, bridging business, innovation and research.[33]

Since then, national strategies have been drawn up for key areas, e.g., quantum technologi and personalized medicine.

In 2019, a comprehensive review by the EU Commission recommended an overarching strategy for Danish research and innovation. The Danish Council for Research and Innovation Policy (DFiR) made a similar recommendation in 2023, which points to imbalances related to, e.g., increased thematic funding. It makes five recommendations regarding challenges faced by the Danish research and innovation system.[34]

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30 Translated from *Retsinformation*
31 Aftale om rammerne for Danmarks Frie Forskningsfond. Uddannelses- og forskningsministeriet. 2016. (*link*)
32 Forsk2025 – fremtidens løfterige forskningsområder. Uddannelses- og forskningsministeriet. 2017. (in Danish - *link*).
33 Danske styrker inden for forskning, teknologi og uddannelse – og deres betydning for vækst og erhvervsudvikling. IRIS Group. Udarbejdet for Erhvervsstyrelsen, 2019 (in Danish - *link*)
34 Årsrapport 2023. Danmarks forsknings- og innovationspolitiske råd. Uddannelses- og forskningsministeriet. 2024. (in Danish - *link*)

2.2 Organization and roles in the Danish public research landscape

The Danish Agency for Higher Education and Science is an agency in the Ministry of Higher Education and Science and handles tasks within preparation and administration of grants for research, higher education and research-based innovation. The Agency is the supervising authority for the DNRF and Innovation Fund Denmark (IFD). The Independent Research Fund Denmark (DFF) is part of the Agency; apart from calls for funding applications it advises the government. Also part of the Agency, the Danish Council for Research and Innovation Policy (DFiR) is responsible for providing the Minister of Higher Education and Science and others with independent and expert advice on research, technology and innovation at the system level.

ROLES AND FUNDING STREAMS IN THE DANISH RESEARCH LANDSCAPE

In 2023, about 70% of public funding for research was allocated through the annual finance act. The remaining 30% was allocated by the municipalities and the Danish Regions (i.e. the public health care system) and by the DNRF (1.6%).

Since 2014, there have been three Danish public research foundations:

- **Independent Research Fund Denmark (DFF)** aims to strengthen the quality of Danish research by providing grants for concrete research activities based on the researchers' own initiatives, giving priority to breakthrough research.
  - Open calls and theme calls
  - Grants for individual researchers, research projects, networks, etc.
  - Grants up to DKK 6 million (€0.9 million)
- **Innovation Fund Denmark (IFD)** provides grants for the development of knowledge and technology, including high technology, in order to strengthen research and develop innovative solutions that spur growth and employment in Denmark. In particular, the Fund supports solutions to specific societal challenges and greater research and innovation in companies, including small and medium-sized enterprises.
  - Strategic, thematic and open calls
  - Support for research collaborations, entrepreneurs and companies
  - Grants of up to five years and DKK 40 million (€5.4 million)

- **The Danish National Research Foundation**
  - Open calls
  - Large, flexible grants for ambitious, often interdisciplinary research projects
  - CoE grants of DKK 6 or 10 million (€ 0.8 or 1.3 million) per year for up to 10 years
  - The DNRF co-funds and administers the Pioneer Centers with the four private foundations mentioned below and the Ministry (read more in Section 4.1).

The three public research foundations have different roles that complement each other and the universities. Universities serve as the core, while external funders incentivize specific forms of research through competition. The universities and DFF are the major contributors to basic science and the growth layer, and the DNRF boosts research and innovation capacity by providing the most promising and ambitious ideas, teams and research leaders with long-term, flexible grants. The IFD provides funding to develop ideas with societal impact, emerging from across the academic spectrum.

The fast-growing private foundations provide ample funding for Danish research, mainly for specific themes and in particular areas, amounting to DKK 10.6 billion/€1.4 billion in 2023. Of this, DKK 6.2 billion (58%) was disbursed to the health area.[35] The five largest foundations are (2023-figures):

- Novo Nordisk Foundation: DKK 7,700 million/€1,030 million – mainly health and sustainability
- Villum Foundation: DKK 1,350 million/ €180 million – natural and technical sciences
- Carlsberg Foundation: DKK 800 million/€107 million – the humanities, social, and natural sciences
- Lundbeck Foundation: DKK 600 million/€80 million – neuroscience
- Leo Foundation: DKK 217 million/€29 million – skin research

Supplementary private funding has a highly positive effect on CoEs. Most receive additional funding from private foundations, which allows them to grow and expand, generate more results, and develop talent and innovation, leveraging the center's research agenda. In some cases, the additional funding eventually far surpasses the original DNRF funding. The DNRF welcomes this, as it affirms the quality of the centers.

35 Fonde uddelte 10,6 mia. kr. til forskning i 2023. Danmarks Statistik. 2024. (in Danish – *link*)

Trends in Danish R&D expenditure

- The public research budget corresponds to about 1% of GDP (from DKK 24.8 billion in 2012 to DKK 28.1 billion in 2023). Research budgets in the private sector have fallen since 2010, accounting for 1.72% of GDP in 2021.
- Basic funding for Danish universities remained unchanged between 2012 and 2022.
- The share of thematic funding at universities has increased relative to curiosity-driven funding. The share of the public research funding that has been prioritized politically for strategic areas ("Forskningsreserven") has grown from around 3.8% in 2017 to 20% in 2024.
- External funding for university research from private sources, mainly foundations, has increased from DKK 1.9 billion (2012) to DKK 4.4 billion (2022).

Funding by public research foundations

Between 2012 and 2023, funding by public research foundations has increased by 52%, from DKK 2.5 billion to DKK 3.8 billion.

- Innovation Fund Denmark: DKK 1.6 billion (2014) to 1.7 billion DKK (2023)
- Independent Research Fund Denmark: DKK 1.25 billion (2012 – only open funding) to DKK 1.8 billion (2023 – of which DKK 1.11 billion was open funding and DKK 650 billion was politically prioritized)
- Danish National Research Foundation: DKK 391 million (2012) – DKK 431 million (2023)

Sources: Tal om Danske Universiteter, 2023; DEA; Statistics Denmark; Annual reports from the foundations

Reflections

The DNRF's role in the Danish research landscape, 2012-2023

- **New instruments, or adjustments to the DNRF selection process, may alleviate imbalances in the Danish research landscape**
  The DNRF is always prepared to introduce new instruments in response to ongoing dialogue with the universities concerning imbalances in the Danish research landscape. A recent report points to a potential lack of priority in funding schemes when it comes to supporting mid-career talents and helping them turn into accomplished top researchers. Following the external evaluation, the Foundation will consider the need for new instruments or to adjust CoE selection process so that they can promote the advancement of promising mid-career research leaders.
- **Exploiting and promoting CoEs as ramps for innovation**
  The combination of top-level curiosity driven research of CoEs - spurring ideas at the research front - and the seamless orientation towards innovation at many centers - generating research-based innovation at the front and often spin-outs - makes the Center of Excellence format a highly attractive platform for societal impact. The DNRF board is considering ways of exploiting this ability even more – without putting the foundation's unique strength at risk.
- **University finances mean CoEs generate less long-term value**
  It is not only the funding landscape that has changed – the universities have, too. They have become more international, more competitive and more ambitious. Their finances are under pressure, and they are less able to co-fund research centers. Lower levels of commitment from university staff also make it harder to embed CoEs firmly in host organizations and ensure that they continue to produce value in the long term.

- **Despite growth in external funding opportunities, the role and popularity of CoEs remain unchanged**
  The DNRF is an integral part of the wider public and private research funding landscape in Denmark, which is rapidly changing and focuses more closely on mission-driven research and greater contributions by corporate foundations that support specific research areas, especially in the health and natural/technical sciences. The number of applications to the DNRF in the health and natural/technical sciences remains unchanged. The DNRF has a key position, along with the universities, the DFF and ERC, in supporting basic research in all academic fields and subfields. As the DNRF provides long-term support via the CoEs and focuses on basic research, researchers see it as one of the most attractive sources of funding.
- **Untapped potential**
  At a consistent 7–8%, the DNRF's CoE program has a very low success rate in the context of the Danish research landscape. Research at the centers involves large budgets and dream projects, and it was always the intention that only a few are afforded this privilege. However, we believe that the high quality of rejected applications is indicative of significant untapped potential.
- **Counteracting the fact that Danish research now makes less of an impact**
  Considering the apparent negative trend in the number of citations, the DNRF contends that there is still a strong need to cultivate Danish frontline research. This, in turn, also results in lasting frontline societal impact. It remains essential to ensure long-term, flexible funding for brilliant ideas.

3. Centers of Excellence as a funding instrument

3.1 What is a Center of Excellence?

Center of Excellence grants are large and have a long-term perspective, covering up to ten years, divided into two periods.

CoE grants fund outstanding researchers working in large groups, who look at a set of intriguing, overarching and ambitious research questions. Headed up by a center leader, each CoE seeks to build a creative research environment and foster the exchange of ideas across generations, disciplines and research environments.

In the DNRF model, a CoE is a joint physical research environment. In the Foundation's experience, significant daily interaction among each center's members is crucial. Centers may also enter into partnerships with researchers at other institutions, either in Denmark or abroad.

So far, the Foundation has established 131 CoEs, of which 41 currently receive funding from the DNRF. [36]

CoEs are established after what the Foundation calls application rounds – or competitions. The first round was in 1992/93 and the latest, the 12th, was in 2023/24.

36 Active Centers of Excellence. (*link*)

Frontline research and innovation

The Foundation supports what may be defined as *frontline research*. CoEs identify the frontier of knowledge and attempt to go beyond it. Researchers are expected to tackle big, unsolved research questions and address the challenges that intrigue them the most. DNRF's philosophy is that when excellent people get together to work on problems about which they are passionate, groundbreaking results are more likely to follow. In other words, the Foundation welcomes curiosity-driven research – or what might be described as exceptional researchers' "dream projects."

The emphasis in CoE calls is narrowly on basic frontline research, i.e. on research with the potential to make fundamental breakthroughs and discoveries, with no mention of their application. However, many centers later transform this basic research into applied research, which is also on the frontline. In this way, the centers contribute to driving both the innovation frontier and the research frontier.

Interdisciplinarity

CoEs can be established within and across all research areas. Many of the DNRF centers make use of competencies from a range of disciplines within the same field or across several fields of research.

It is widely acknowledged that interdisciplinarity provides fertile ground for highly creative research.[37] The interdisciplinary structure of the board is such that it is able to appreciate the value of several disciplines at once and support a high level of interdisciplinary research. Similarly, the structure of CoEs and the size of their grants encourage bringing complementary competencies together to address a scientific problem.

The size of the grant and the length of the funding period encourage interdisciplinarity by bringing together diverse competencies and allowing sufficient time for them to share and gain a deep understanding of each other's expertise.

Willingness to take risks

It is a common assumption that prioritizing breakthroughs is accompanied by a higher risk of failure than incremental endeavors. Both the grant holders and the Foundation itself are focused on high-risk/high-gain scenarios.

The Foundation's primary contribution to high-stakes research consists of awarding grants to projects with a high element of risk. In practice, of course, several factors weigh in. Significant weight is placed on the ambition and potential of the proposed research program. When considering whether to fund challenging research that entails a high degree of risk, the potential of the research is, of course, crucial. However, the applicant's merits and documented results are also pivotal. The Foundation supports breakthrough research that combines daring ideas with promising, talented researchers who may not yet have reached the top in their fields.

37 God tværfaglighed i forskning og innovation. Danmarks Forsknings- og Innovationspolitiske Råd. 2022. (in Danish – *link*)

While it is important that the board is willing to take risks, it is arguably more important that the centers do so, too. They are expected to pursue the unknown, and so they are afforded the stability and time to do so. Morten Meldal's discovery, which led to him describing the click reaction, is the most well-known example of this.

Over 75% of the leaders of centers opened from 1993 until 2005 found the format more risk-tolerant than alternative funding formats (while approximately one-third reported that their specific research project was relatively risk-prone). Recent dialog with the centers suggests that this still is the case. Grant holders report that they actively stimulate the unpredictable, e.g., by allocating the necessary resources to investigate unforeseen results or by designing protocols with unpredictable outcomes.[38] They find that the CoE format supports this because the stability and length of the grant provide the necessary freedom and flexibility.[39]

Size and organization

The CoEs are large enough to gather a critical mass of competencies to address a scientific problem. They are also small enough to be agile – in other words, the distance between any one researcher and the center leader is short enough to quickly change direction whenever relevant. It also means everyone can be acquainted with the other center members' complementary competencies, and it allows for a flat hierarchy, which fosters a more trusting and collaborative culture.[40]

The Foundation has a flexible approach to center grants, which means the centers can attract additional funding as long as the purpose is compatible with the original research plan. On average, over the centers' lifetime, they attract as much funding from other sources as they do from the DNRF.

Length, progression, exit and tail

Experience shows that the stability that comes with the long-term funding is important for the CoEs' performance. A recent dialogue with CoEs about creativity demonstrated a widespread view that this is one of the key conditions that distinguishes this instrument from others and allows centers to 'think big' and plan ahead. The transition between the first period and the second, which involves a mid-term stop/go evaluation and a new research plan, serves to stimulate creativity and ambition. It invites the center to reflect on its accomplishments and fruitful experiences during the first period and acts as a performance incentive for the second one.

When center grants run out, aspects of their activity – certainly their expertise, international network, teaching and continued talent production, and sometimes also their name and associated international brand value – may persist due to the stronghold the center has established. Most centers will have attracted sufficient additional funding to

38 The Pursuit of Novelty – how Centers of Excellence nurture creativity. The Danish National Research Foundation. 2024. (*link*)
39 Centers of Excellence from the Danish National Research Foundation, 1993–2005. Alnor, Schneider and Degn, Center for Studies in Research and Research Policy, Aarhus University. 2023. (*link*)
40 The Pursuit of Novelty – how Centers of Excellence nurture creativity. The Danish National Research Foundation. 2024. (*link*)

continue a high level of activity. This indicates that over the ten years they have existed, they have built up a strong foundation of work that is recognized by other foundations.

Previous CoE grant holders are not precluded from applying for a second one. Of course, the standard criteria apply – in other words, an application for a second grant must involve an entirely new idea. The DNRF board considers it very rare for center leaders to be awarded a CoE grant twice.

Historical background of the Center of Excellence
When the DNRF introduced CoEs in 1991, Denmark became a frontrunner among Western countries. The first 23 CoEs began work in 1993/1994.

CoEs were initially funded for approximately five years with the possibility of a second five-year grant. Many of the centers from the first round were discontinued, however, because the funds available at the time were insufficient to continue them all.

Starting with the seventh application round, the DNRF board changed the CoE format from 5+5 years to 6+4 years to encourage a greater willingness to take risks during the first period. From the 11th round, the board decided to signal the possibility of a CoE grant of around DKK 36 million rather than the traditional DKK 60 million, acknowledging that some areas consist of smaller communities, are less accustomed to working together in large centers and have much lower equipment costs, etc.

In response to requests from grant holders, various initiatives have been developed over time to support CoE operations, such as courses on leadership and organization, courses and networks for new potential academic leaders and dialogue on exit challenges (for more information, see section 5.3).

3.2 Selection, assessment and funding patterns

Selection and assessment
The watchwords for the assessment process are thoroughness and transparency. The Foundation puts effort into creating a process that applicants and the scientific community consider trustworthy.

Calls for new centers are announced approximately every two-and-a-half years and involve a two-stage application process. In the first stage, researchers from all scientific fields are invited to submit short outline proposals. These proposals are processed by the DNRF board. In the second stage, selected applicants are invited to submit full proposals, each of which is reviewed by three international experts within the relevant research

area(s) in an open review process. Prior to the final selection, the board interviews each applicant.

The figure below illustrates the timeframe of the latest CoE application round. The DNRF received 166 outline proposals by the deadline on December 4, 2023. Twenty-five of those applicants were selected to submit a full proposal by May 6, 2024. At its meeting in September 2024, the board spent two days interviewing each of the 25 applicants. On the third day, the final funding decisions were made on 13 new centers. A detailed description of the assessment process is described below.

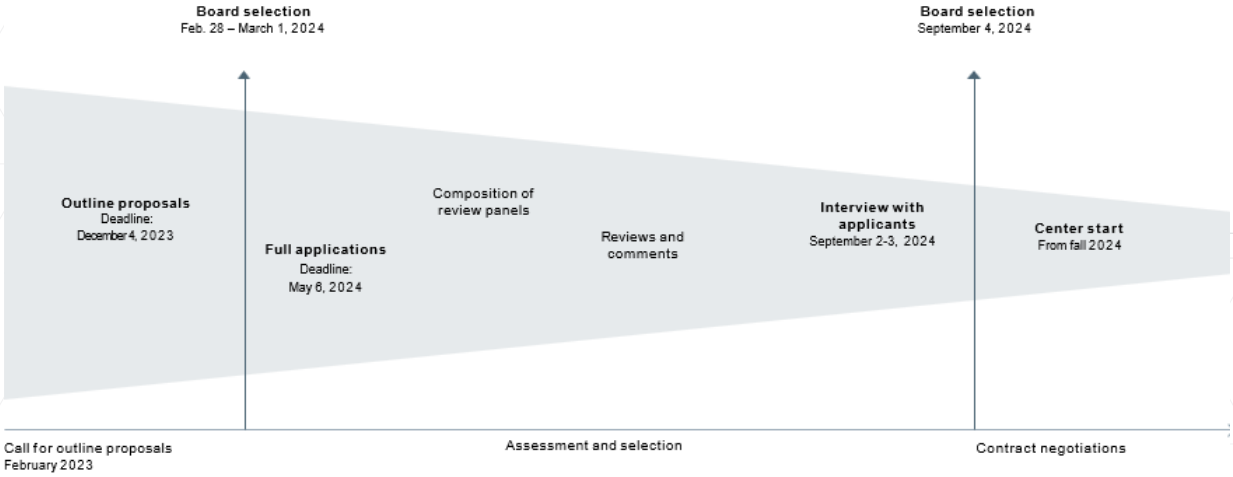


Figure 5 – Assessment and selection, 12th CoE application round

Criteria

When assessing new proposals, excellence is the overarching criterion. The board puts more emphasis on people, ideas, and potential and less on milestones and deliverables. All applications are evaluated on equal terms, and the same criteria are applied throughout the assessment and selection process:

1. **The research idea:** The research idea is ambitious and original and has the potential for real scientific breakthroughs in the relevant research field(s).
2. **The center leader:** The proposed center leader has a high standing in the international research community, the needed leadership skills, as well as the time and capacity to undertake the task of running a Center of Excellence.
3. **The team:** The center includes co-applicants with high-level scientific competences within their respective research field to establish a creative and dynamic international research environment that will also provide an inspirational training ground for young researchers.
4. **The structure/organization:** The focus, structure, and size of the proposed center are such that the center sets the stage for scientific ventures that are not feasible within conventional funding from other sources.

ABC scores

All board members assess all proposals using an ABC scoring system. Prior to a decision meeting, board members submit an evaluation form indicating whether, in their opinion, the proposal: A) should be supported; B) should be conditionally supported, further discussed, clarified, etc.; or C) should be rejected. Each board member has a limited number of As and Bs they can assign. Before the decision meeting, board members receive an anonymized tally of the scores. Each proposal is discussed in depth at the meeting.

It is the board's experience that this system of scoring is effective as a preliminary processing instrument. One advantage is that it brings into focus proposals about which there is disagreement. However, this scoring system alone cannot replace discussions on the individual proposals among the board members in plenary.

In addition to the ABC scores, the seventh application round included a P-score (for Potential) in order to maintain a focus on proposals that could potentially deliver highly transformative or groundbreaking research, even if the proposed endeavor may be considered high-risk. The P-score was used for several application rounds. However, during the 11th round, the board decided not to make use of the P-score, since it found that all proposals could be included in the A, B, or C scores. Instead, it was decided that board members should provide two sets of ABC scores on each application: one addressing the proposed research idea (criteria 1), the other addressing the proposed center leader and the core members of the research group (criteria 2 and 3).

Outline proposals

Outline proposals are short, concise documents reviewed by the board members. Rather than providing an in-depth description of the proposed endeavor, the outline should provide an argument for funding by addressing questions such as: How will the proposed endeavor redefine research in its respective field(s)? What kind of new insights and results may it produce? Why should this particular team pursue this research?

The proposal should include a description of the proposed research idea, compared with the "state of the art" within the given field(s), including the degree of novelty and potential for groundbreaking results, and an argument for its scientific relevance. It should also include a strategy for implementing the idea and how research challenges will be met. Finally, the proposal should include CVs for the proposed center leader and core members (for details, refer to Applicant's Guide 12th Application Round).[41]

The board evaluates the outline proposals without external input. In previous application rounds, the Foundation has received between 133–186 proposals.

41 Guide for Applicants - 12th Application Round. The Danish National Research Foundation. (*link*)

Full proposals

Successful applicants from the first stage are invited to submit full proposals. Although they are longer than outline proposals, full proposals are still relatively brief. Since the assessment criteria remain consistent throughout the process, the requirements for the proposals are much the same. Full proposals are essentially an expansion of the outline proposal but are sent to experts for review.

- Full proposals should consist of a visionary presentation (no more than five pages), which elaborates on the overall research idea, including a description of novel aspects and potential for groundbreaking results, an argument for its scientific relevance and expected impact, as well as a strategy for addressing the challenges.
- Applicants must also submit a description of the planned research program (not exceeding ten pages) that provides information on the different sub-projects, together with the active roles of the co-applicants and any new possible tenured staff positions.
- The appendices must include a detailed budget and CVs for the proposed center leader and core members. Applications must also contain a letter of support from the host institution documenting the institution's commitment and a letter of declaration from the proposed center leader (also signed by the co-applicants) affirming their commitment to the proposal.

Peer review process

Each full proposal undergoes external review by three high-level international experts from the relevant scientific area(s). The Foundation aims to ensure a balanced group of reviewers for each proposal, typically including one reviewer suggested by the applicant. The overall composition of the reviewers should cover the spread of the proposal, including possible interdisciplinarity, and take into consideration gender balance and geographical diversity. Each reviewer is asked to deliver a report of three to five pages, as per the Guide for Reviewers.[42] Rather than assigning grades or rankings, reviewers are expected to offer a thoughtful and well-reasoned evaluation of the proposal, for which the Foundation pays an honorarium of DKK 4,000.

No reviewers evaluate more than one proposal. No reviewer is assigned a proposal from an applicant that they have evaluated in a previous round.

The Foundation puts great effort into selecting the best possible reviewers for the proposals. Other actors may also be asked to help identify potential reviewers, e.g., the Foundation has previously sought advice from the Independent Research Fund Denmark. In the 12th round, the DNRF contracted the external provider Prophy to identify independent reviewers within relevant scientific fields: physical sciences and engineering, life sciences and medicine, economics and social sciences. The European Research Council

42 Guide for reviewers for evaluating proposals for new Centers of Excellence in the 12th application round. The Danish National Research Foundation. (*link*)

also works with Prophy. Once the suggestions from external sources have been exhausted, the secretariat identifies the remaining reviewers.

To avoid conflicts of interest and inappropriate research profiles, applicants are given the opportunity to comment on the list of identified reviewers. They are also entitled to comment on the reviews before the board makes its final decision. Under Danish legislation, the applicant and the reviewers must be aware of each other's identities.

Interview with applicants
Prior to the final decision, the DNRF conducts a 25-minute interview with each applicant (the proposed center leader). The applicant is asked to give a short presentation explaining the project's main outlines and perspectives, how to ensure a clear center organization and identity, and a plan for training the younger generation of researchers. One of the board members is selected in advance to initiate discussion, comments and questions during the remainder of the allotted time.

The interview helps board members gain an impression of the applicant and the challenges faced by the research project and address points raised by the external reviewers. It also enables the board to gain a sense of the applicant's personal drive. To ensure that the interview is not overemphasized in the overall assessment of a proposal, each board member submits ABC grades before the interview.

Board processing and decision
All proposals compete on equal footing, with no prior allocation of the budget to specific areas or disciplines. The board bases its decision on the full application, the three peer reviews for each application, the applicant's responses to the reviews, and the interview with the proposed center leader. The peer reviews provide important input, but the board makes the final decision.

The board discusses each proposal in depth and, in each case, clarifies why the application should or should not be funded. It formulates a reason for each rejected proposal, which is communicated to the applicant. Ultimately, the board funds relatively few proposals out of a large number of well-qualified applications.

Transparency and fairness
It is vital for the DNRF that the applicants and stakeholders see the selection process as transparent and fair and the Foundation as accountable. Several initiatives are in place to promote this:

- Once the call is announced, the CEO visits all universities to explain the process and the evaluation criteria and answer questions.
- The secretariat answers generic questions on an ongoing basis but does not answer specific ones related to individual applications.

- All aspects of the administrative processing and board assessment, including deadlines, reviewer identification, conflicts of interest, contract negotiation, etc., focus strongly on fairness.
- Rejected applicants receive a written explanation, as legally required. They are also invited to discuss the decision with the CEO of the DNRF and about half of the applicants take this opportunity. While these conversations are difficult, they are an important part of the Foundation's relationship with the scientific community.

FUNDING PATTERNS AND SUCCESS RATES

The CoE scheme has funded a total of 56 centers in the last five application rounds (rounds 8–12). The figures in this section provide an overview of funding patterns and success rates distributed according to field of research, host institutions, gender and age.

Overall success rate

In the last five application rounds, the overall success rate from submission of outline proposals to centers opening was 6–8%; 14–17% of the outline proposals moved on to the full application phase; and 40–52% of those proposals resulted in new CoEs.

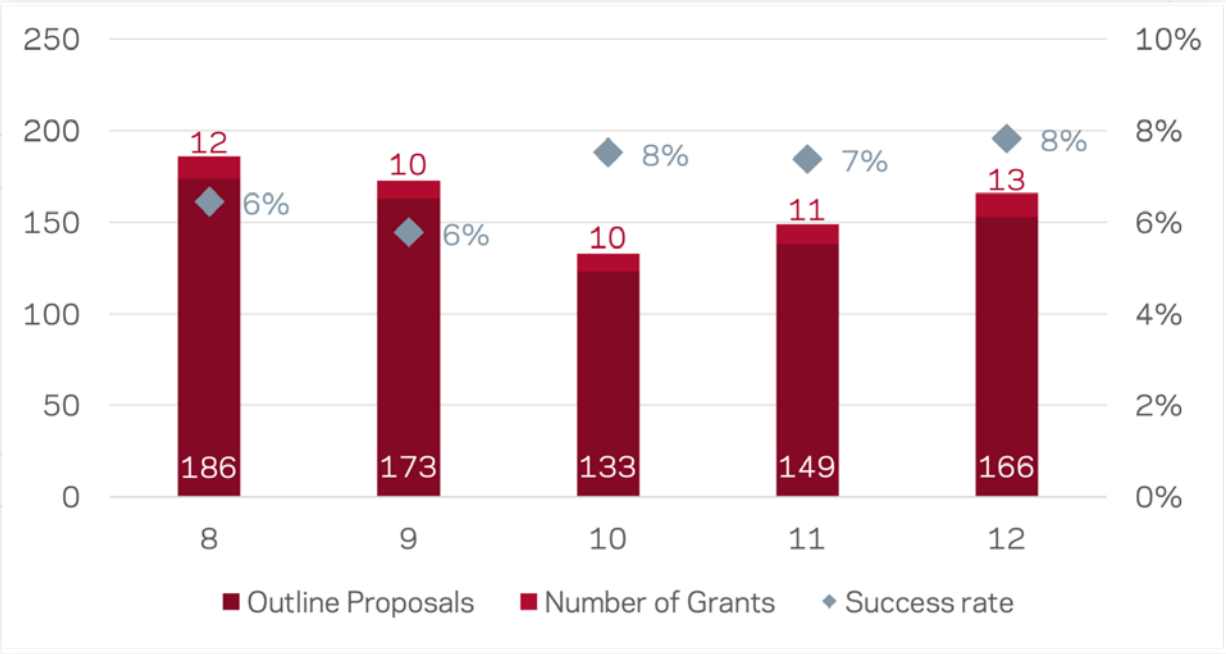


Figure 6 - The funding pattern and success rate based on data from CoE application rounds 8–12

Distribution by research area

In the last five application rounds, the majority of both grants and proposals (in both stages) have been in the medical, health and natural sciences. One reason for this pattern is that these fields have a longstanding tradition and a significant need to work in bigger units. However, the breakdown of centers into fields varies considerably from one grant round to the next.

Many of the centers are interdisciplinary, as the research often draws on competencies from various disciplines. The boundary between natural and technical sciences has become blurred – for example, centers from the Technical University of Denmark increasingly identify themselves as natural science.

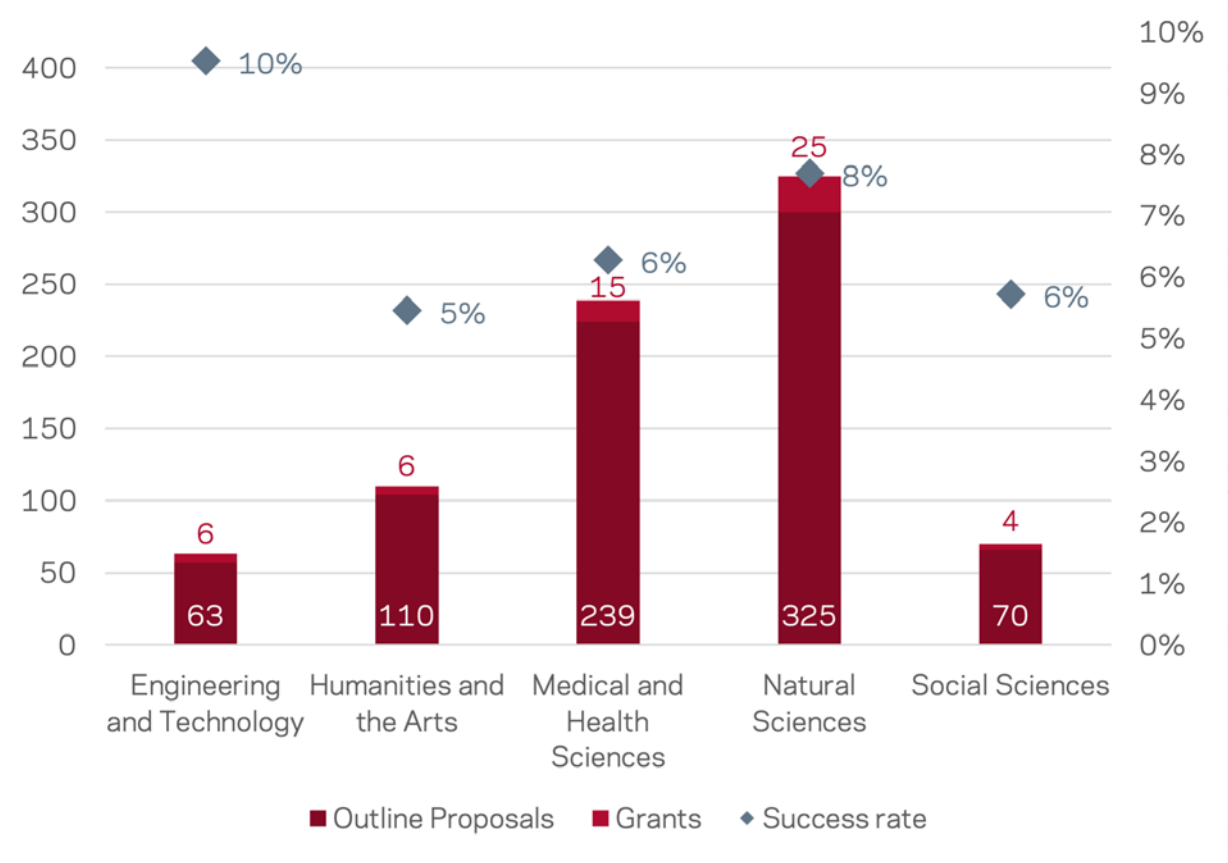


Figure 7 - Funding patterns and success rate per research field based on data from CoE application rounds 8-12

Distribution on institutions

The majority of applications are received from applicants employed at the two largest Danish universities, the University of Copenhagen and Aarhus University, which also host most of the CoEs.

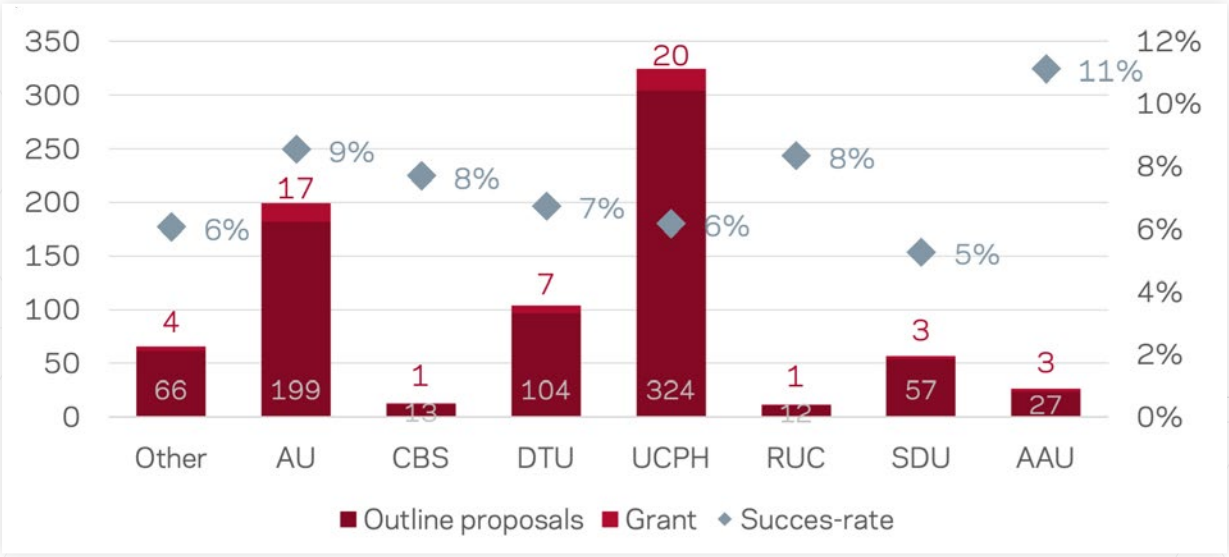


Figure 8 - Funding patterns and success rates at universities, based on data from CoE application rounds 8-12[43]

Distribution by gender

In rounds 8-12, the average success rate for women awarded a center grant was 9.4%, compared to 6.2% for men.

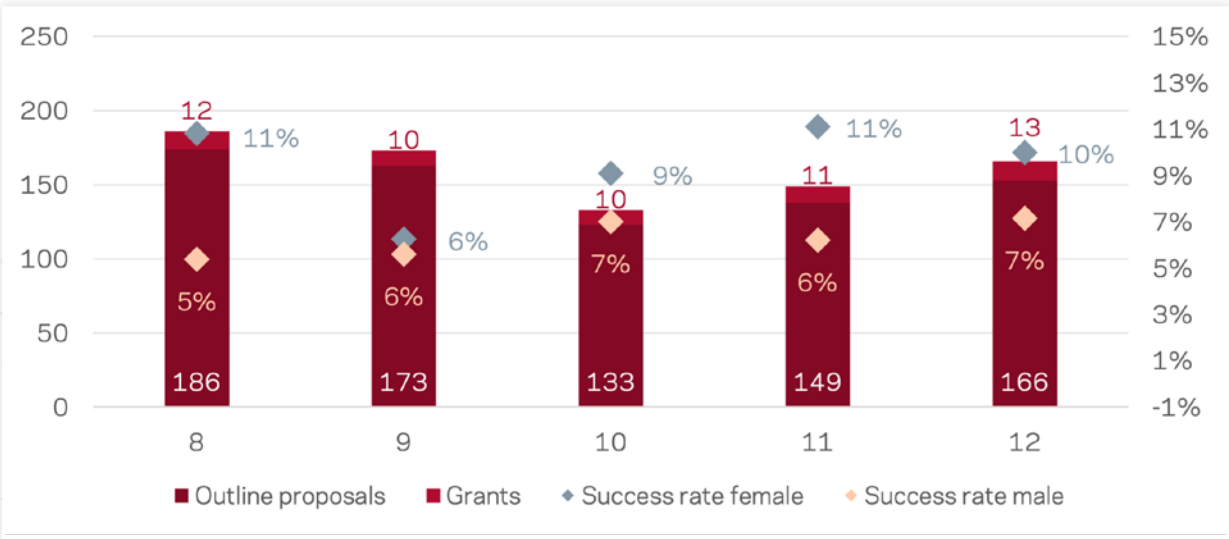


Figure 9 - Funding patterns and success rates across genders, based on data from CoE application rounds 8-12

43 ITU has been excluded because it submitted 5 outline proposals, but no full applications, and received no grants.

Distribution by age

Looking at the age of the applicants at the time of submitting outline applications, there is a relatively broad distribution, with a concentration of new center leaders in the 50–54 age range.

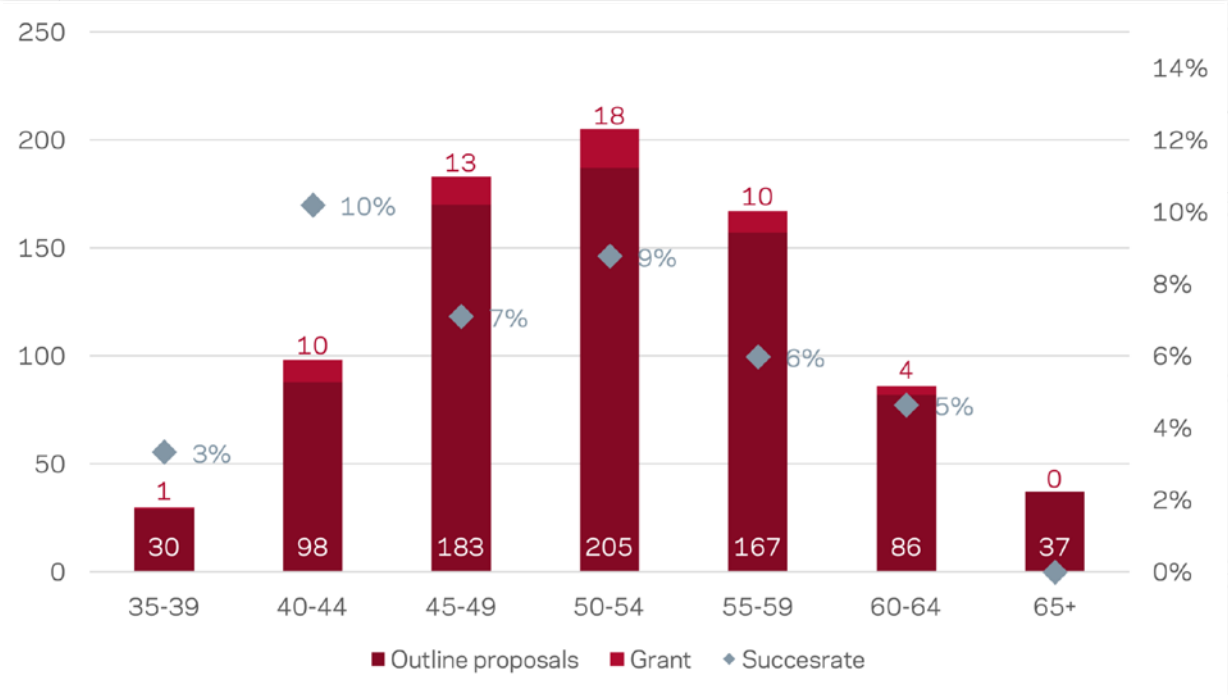


Figure 10 - Funding patterns and success rates by age group based on data from CoE application rounds 8–12. Age is calculated from the time of the submission of the outline proposal.

3.3 Follow-up and dialogue

The Foundation takes a keen interest in the development of the centers by maintaining close and ongoing dialogue throughout the funding period. Each center is assigned a contact person from the DNRF secretariat. This ensures that the center always knows who to reach for assistance and that there is someone at the DNRF who knows the center well.

The DNRF visits centers in all academic disciplines at the Danish universities, as well as at other research organizations, such as hospitals and the Danish Cancer Institute. This ensures that the Foundation obtains useful insight into the current state of Danish academia.

The Foundation aims to ensure regular, non-bureaucratic interaction with the CoEs. This involves an annual report from the center, a follow-up meeting at the center involving open dialogue, retreats, and annual meetings that function as a forum for experience-sharing between representatives from all centers. In the event that specific

challenges or opportunities arise at a center, the Foundation typically arranges a series of individual meetings to address them.

The annual follow-up serves multiple purposes:

- It gives the Foundation a broader view of the activities it is funding.
- It provides an opportunity for the CoE to update colleagues at both the center and the university line organization and to celebrate the center's accomplishments. The meetings have significant value in terms of bolstering the center's identity and cohesiveness.
- The follow-up helps to communicate not only traditional accomplishments in the form of publications or educational activity but also the DNRF's other priorities and values, e.g., outreach, gender and data management.

The section below describes the annual monitoring of the centers' progress through scientific reporting and follow-up meetings.

Annual scientific reporting

Every year, the centers must account for the scientific activities. The scientific report is an instrument that assists the Foundation in monitoring the development of the grant and its research results. The grant holder can also use the report as an internal tool to evaluate the past year's activities.

The report (a maximum of eight pages) must describe research activities carried out in the previous year and compare the results achieved to the objectives outlined in the research plan (for details, see Guidelines for Annual Reports[44]). It must also include information on communication initiatives aimed at the general public. Further, the reports must account for recruitment strategy, including considerations on diversity in a broad sense and gender balance of the center's staff, as well as reflections and initiatives regarding research integrity, as stated in the Danish Code of Conduct for Research Integrity.[45] To the extent that the grant holder produces, stores and/or shares data, they must describe how they have worked to ensure responsible research practice and fulfillment of the FAIR's guiding principles for scientific management of data. A one-page summary of highlights, to be published on the Foundation's homepage, must also be appended to the report.

In addition, the report includes appendices that contain data on the extent and nature of the center's collaborative relationships at the national and international levels, conference presentations, educational activities, external funding, innovation and publications. All data from the appendices is recorded in the Foundation's internal database.

44 Guidelines for the budget, the financial and scientific annual report: Centers of Excellence. The Danish National Research Foundation. (*link*)
45 Danish Code of Conduct for Research Integrity. Danish Ministry of Higher Education and Science. 2014. (*link*)

After reading the scientific reports, the secretariat then sends a letter of approval signed by the CEO to the grant holder. The report forms part of the material prepared for board members in advance of the annual follow-up meetings with the centers.

Annual follow-up meetings

Every year, the Foundation visits each center at their premises for a two-and-a-half-hour meeting. The centers prepare an agenda based on the Foundation's guidelines. The meeting should cover the center's activities during the past year and include one or two presentations on selected research topics.

The meeting is attended by one or two board members, the CEO and the center's contact person at the secretariat. It consists of an open and a closed session. During the open session, all center members are encouraged to participate along with the dean and/or head of the department. In the closed session, the DNRF representatives meet with a smaller group of center members (e.g., core members, PIs, the center coordinator). Normally, the dean and/or head of department also participate. In this session, issues regarding the host institution or financial or administrative matters are addressed.

On alternate years, the Foundation conducts closed meetings with either the PhD students or the postdocs at the center. The purpose of these meetings is to learn about the young researchers' experiences at the center, their involvement in teaching, how supervision works, their future career plans, their experiences of living in Denmark, how they were recruited, etc.

During the follow-up meetings, the DNRF takes the opportunity to discuss a selected research topic. In 2023–24, the centers were invited to discuss their experiences of fostering creativity, the challenges they face, and the ideal conditions for generating novel ideas. These discussions resulted in the catalog *The Pursuit of Novelty – How Centers of Excellence nurture creativity.*[46]

The specific topic for 2024–2025 is fair recognition of contributions to research. The inspiration for this was one of the core commitments of the ARRA agreement – namely, recognizing the diversity of contributions to and careers in research in accordance with the needs and nature of the research.[47]

The last item on the agenda is an exclusive meeting between the center leader and the DNRF to address any other relevant issues.

Minutes are taken at the meetings, and the attending board members brief the rest of the board at a subsequent meeting. In the event that the board raises concerns or wants to discuss a specific issue further, the CEO will communicate this back to the center.

46 The Pursuit of Novelty – how Centers of Excellence nurture creativity. The Danish National Research Foundation. 2024. (*link*)
47 The Agreement on Reforming Research Assessment. Coalition on Reforming Research Assessment. 2022. (*link*)

3.4 Evaluation

Midterm evaluation

The midterm evaluation covers the scientific quality of the center's output and the ambitions for a second funding period, which provides the DNRF board with important information for making decisions about the future of the center. If successful, the center can be funded for a second 4-year period (for details, see Guidelines for Midterm Evaluation[48]). The midterm evaluation also provides the researchers and their host institutions with a valuable report on the center's performance.

For the midterm evaluation, centers are asked to submit a self-evaluation report and an application for a second term. Three international experts in the field(s) are identified, using the same procedure as for applications for new centers (see section 3.2).

When assessing the research, reviewers focus on whether the quality of the scientific output meets the standard of excellent international research and whether the research proposal for the next four years remains original, ambitious and has the potential to deliver groundbreaking results. Other factors are also considered, such as organization, leadership and educational activities for young researchers. The reviewers are not asked to rate the centers but to present concluding remarks on the centers' standing in comparison to world-leading environments in their fields (for details, see Guidelines for Reviewers[49]).

The board conducts interviews with the center leaders to address concerns or clarify matters and discuss any issues raised by the reviewers before deciding on a possible second funding period.

The table below provides an overview of CoEs that do not receive funding for the full 10 years. It shows the number of CoEs discontinued since the fifth application round as a result of either the center leader's exit or an unfavorable midterm evaluation.

Application round (year of start)	Number of CoEs	CoEs discontinued during 1st phase	CoEs discontinued as a result of midterm evaluation
5 (2006/07)	8	1	0
6 (2009/10)	9	0	0
7 (2011/12)	11	1	1
8 (2015)	12	2	1
9 (2017/18)	10	0	0
Total	50	4	2

Table 1 - Centers of Excellence not receiving funding for the full 10 years.

48 Guidelines for 10th round center leaders. The Danish National Research Foundation. (*link*)
49 Guide for reviewers for evaluating proposals for new Centers of Excellence in the 12th application round. The Danish National Research Foundation. (*link*)

Final evaluation

As part of its standard procedures, the Foundation conducts an evaluation close to the time of the expiration of the center contracts. The board conducts this evaluation without external reviewers.

For the final report, the center leaders are asked to outline new insights and key results, including any impact on redefining research within its field or related disciplines. They must highlight the center's contributions and compare its accomplishments to those of leading international research groups in the field. They must also describe how the research environment fostered within the center will continue over the next five years. The centers are also asked to submit ten representative publications that document the center's research over the years.

The board meets to discuss each center and formulate a feedback letter to the center leaders. At the same meeting, the center leaders are invited to share their experiences of ten years of center leadership, addressing aspects such as suggestions for improving the CoE concept and the interaction between the grant holder and the Foundation, as well as the collaboration with the host institution.

Publications after the DNRF grant period

Due to the time lag between conducting research and publishing the findings, some of the CoEs' research outputs may be published after the end of the center's official existence. To account for publications published within two years following the end of the grant period, the centers are requested to provide a list of these publications.

3.5 Center finances, organization and host interaction

Center finances

Center of Excellence grants

A Center of Excellence grant ensures substantial long-term financial support. The grant is designed to provide consistent and robust resources that enable the centers to focus on achieving excellence in their field(s) of expertise over an extended period. In rounds 8 to 11, the average CoE grant for the first six-year period was DKK 57–66 million (including overheads).

Based on the understanding that each center has its own unique financial needs, the Foundation had no specific budgetary framework for funding until the 11th application round. However, over time, a misconception arose that the Foundation expected CoEs to have budgets of DKK 10 million per year, which caused concern in research environments

with lower levels of expenditure. To address this issue, the Foundation has introduced a formal budget framework. Applicants can now apply for six-year grants aimed at setting up a Center of Excellence with a budget of up to DKK 36 or 60 million (including overheads). This change signals that centers can be established in academic fields that might have lower research expenses but which are still big enough to establish an environment that has the potential to achieve critical mass in terms of excellent research and research training – key components of a CoE. In exceptional cases, applicants may also seek additional funding for extraordinary expenses, such as new equipment, costly experimental research, or field expeditions, on top of a DKK 60 million grant. Applicants must clearly justify and explain their request for this extra funding.

CoE grants are also flexible. The Foundation places considerable trust in center leaders to manage their budgets and affords them the flexibility to allocate funds effectively and adjust spending as the need arises. However, center leaders must consult the Foundation before making any substantial changes to the budget. Grants are closely monitored, and budgets and accounts reviewed annually.

Major budget posts at centers

A CoE grant may cover expenses that are directly attributable to the center. Salaries for PhD students and postdoctoral staff account for a significant portion of the grant, as shown in the figures below. On average, in every year in the period 2012–2023, about 60% of the total amount allocated by the DNRF was spent on the recruitment of early career researchers.

The grant may also cover technical staff salaries, to a limited extent, as well as costs for visiting staff, travel and conferences, operational costs, and relevant and necessary equipment.

The DNRF covers the costs of a center coordinator, who assists the leader and plays an administrative role throughout the lifetime of the center.

The DNRF grants rarely fund permanent positions. However, the Foundation is willing to cover an annual special duties allowance of up to DKK 155,000 (2023 figures) to supplement the center leader's salary.

DNRF grants include a calculation for overhead costs- 44% for universities and 3.1% for hospitals. This amount covers any indirect expenses at the host institution necessary to support the research, e.g., utility costs and building maintenance.

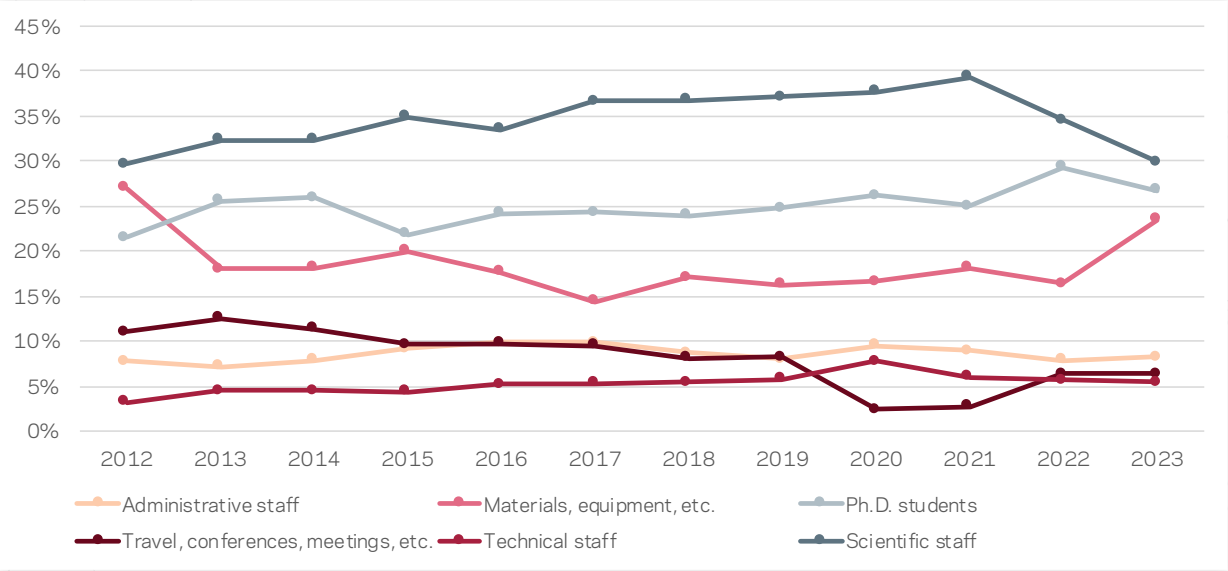


Figure 10 - Annual distribution of the DNRF CoE grants by expense category, 2012-2023. Salaries for scientific staff consist mainly of postdocs. Overheads are not included in the figure.

Host co-funding

Under the CoE scheme, host institutions are required to provide co-funding. The grant agreement specifies clear and detailed terms regarding this commitment. As a rule, salaries for tenured staff are not covered by the DNRF grant but are expected to be covered by the host institution. Further, the co-financing must cover salaries for other permanent staff but may also include other budget posts such as PhD students, postdoctoral staff, etc.

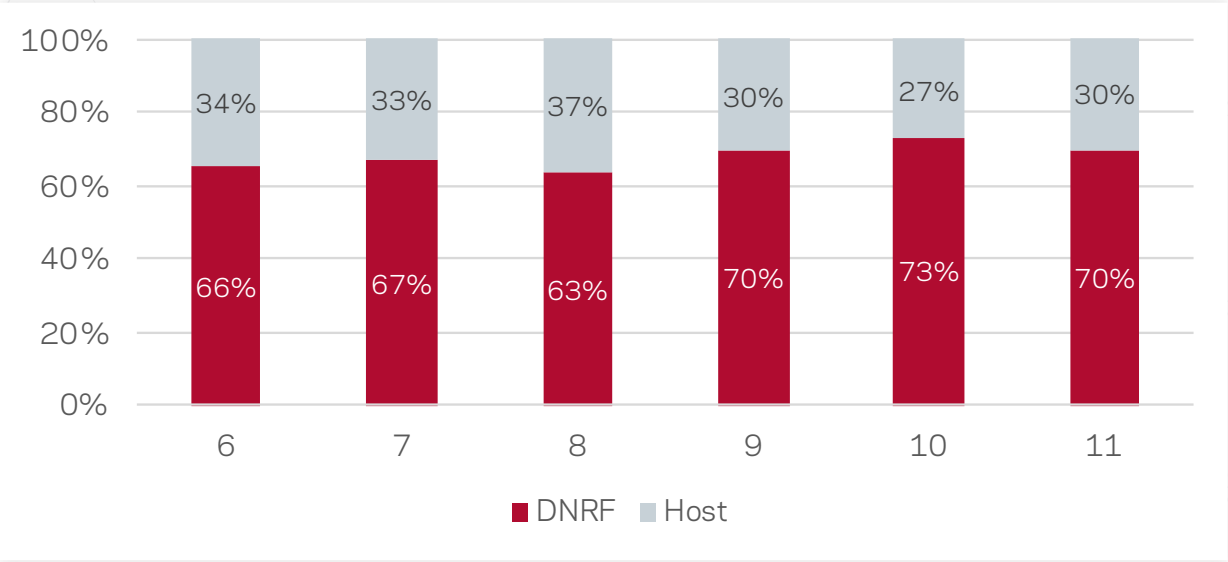


Figure 11 - Funding by the DNRF and host institutions in CoE rounds 6-11.

External funding

Centers generally secure funding from external sources on top of their DNRF grants. Some centers may grow substantially during the grant period, while others do not. Opportunities for external funding vary greatly between scientific disciplines, and private external funding has increased substantially in some fields in recent years.

DNRF funding to CoEs in the natural, technical and medical sciences amounts to about one-third of their total funding. In the humanities and social sciences, the split between external funding and DNRF funding is the other way around. This pattern seems to have been relatively stable over the years.

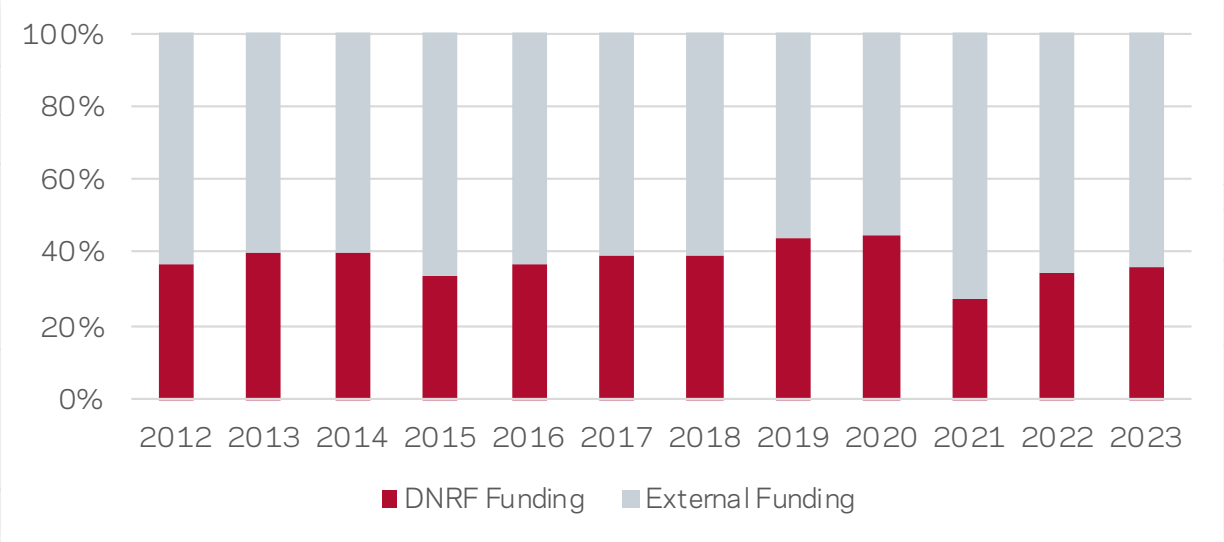


Figure 12 - DNRF grants and external funding in the natural, technical and medical sciences, 2012–2023.

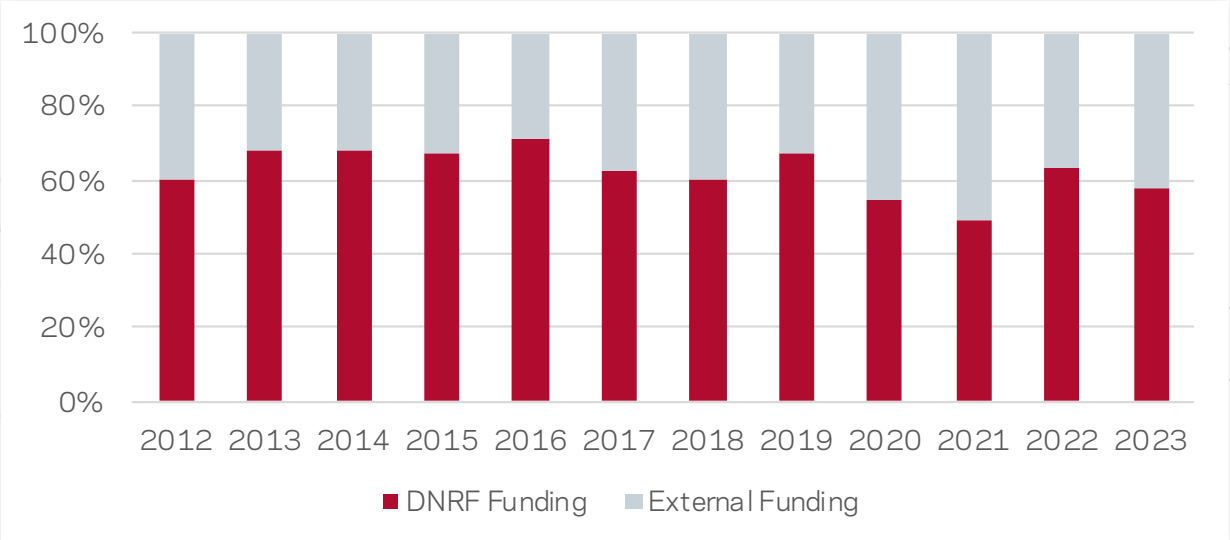


Figure 13 - DNRF grants and external funding in the humanities and social sciences, 2012–2023.

Organization and host interaction

A Center of Excellence consists of units located at a research institution. Although it may form partnerships with other researchers or institutions in Denmark or abroad, it is essential that the CoE is a physical community at the host institution, as this proximity facilitates intensive daily interaction.

Successful CoEs are vibrant, focused environments that promote intergenerational, interdisciplinary and international interaction. They are strongly encouraged to collaborate with leading international researchers and to include and attract exceptional and talented staff and visitors from abroad. Effective management and organization play key roles, often via regular seminars, journal clubs, annual retreats or other activities that facilitate discussion and collaboration on both specific research topics and the grand objectives.

The center leader

A center leader heads up each Center of Excellence throughout the grant period. The leaders must be visionary researchers who have the ability to demonstrate excellence in their own research, foster a creative and dynamic research environment, build the right team, and inspire others to achieve their highest potential.

The Foundation does not impose age restrictions. However, a center is usually funded for 6 + 4 years, and leaders should expect their scientific careers to continue for at least a decade.

Figure 10 presents an overview of how funding patterns and success rates affect the age distribution.

Center staff

There is no fixed formula for staff composition at a CoE. The size and organization vary depending on the center's subject and scope. Some centers need large laboratories, specialized instruments and large numbers of employees, including many PhD students and lab technicians. Others are naturally smaller and require fewer resources. During the grant period, some centers expand significantly and spawn multiple research teams, while others stick to smaller groups throughout. Some centers establish formal advisory boards, while others choose not to.

Despite these differences, there are certain commonalities. The center leader serves as the director, working full-time or close to full-time throughout the grant period. Co-PIs are core center members with scientific competencies in their respective research fields, who make a substantial contribution to the research and play an active and critical role, typically heading subprojects at the center. They are often faculty members who work full- or part-time at the center.

PhD students and postdocs carry out significant amounts of research at the centers and constitute a large proportion of the staff. Depending on the scientific field(s) in question, technical staff may also play a critical role in supporting the CoE's activities.

The Foundation strongly encourages hiring a center coordinator, and most centers do. The coordinator usually plays a pivotal role in handling administrative, organizational and communication tasks, which frees up the researchers to focus on their scientific work.

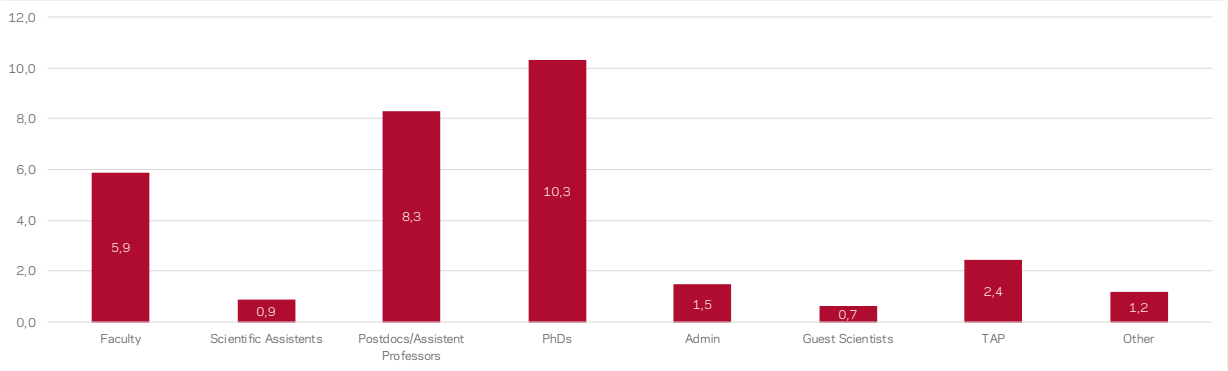


Figure 14 - Average full-time equivalents (FTEs) for staff groups in a CoE, 2012-2023. 'Faculty' includes professors, assoc. professors and other equivalent job titles.

Nationality

Centers of Excellence are very much international and attract increasing numbers of researchers from abroad. Across the centers' three staff categories – faculty members, postdocs/assistant professors, and PhD students – international recruitment increased from 2012 to 2023, apart from a small drop around 2020, probably due to COVID-19 restrictions at the time.

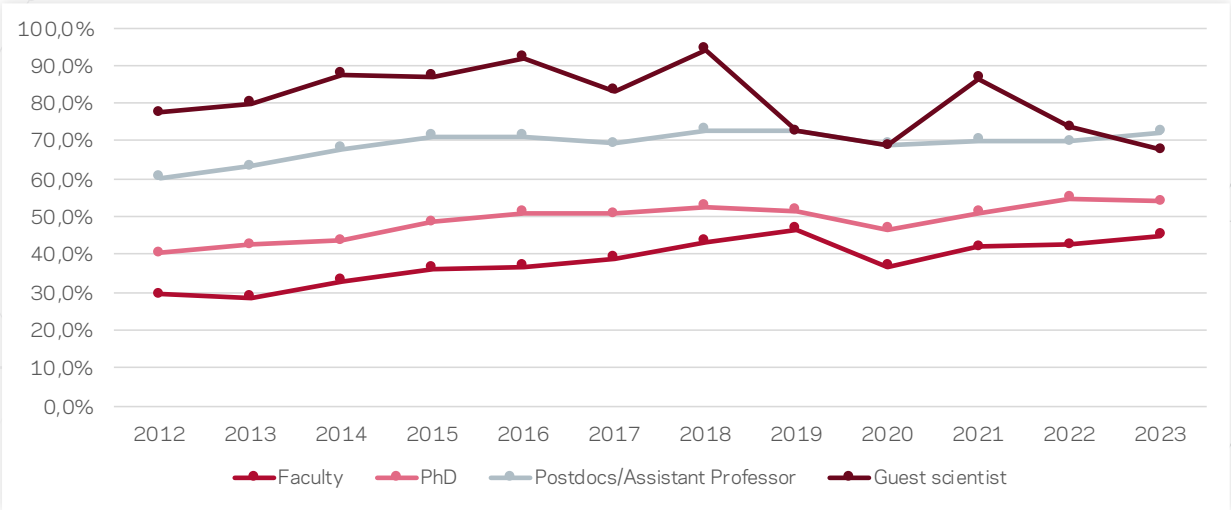


Figure 15 - CoE staff recruited abroad 2012-2023 (% of the total number in each category). 'Faculty includes professors and associate professors and other equivalent job titles.

Gender balance

The international panel that conducted the evaluation of DNRF in 2013 noted a less than satisfactory gender balance among the CoEs' leaders and senior researchers.

The panel recommended actively addressing the gender imbalance, and the Foundation made this a specific agenda item at the annual follow-up meetings in the fall of 2013 and the spring of 2014. The feedback was varied and, at times, even contradictory, indicating the difficulties involved.[50]

To maintain focus on gender imbalance, the centers are asked to include a brief section on recruitment strategy in their annual reports, including considerations regarding diversity in a broad sense, as well as the gender balance of the staff. In addition, when relevant, the Foundation raises the topic with the individual centers during the annual follow-up meetings.

Data collated from the centers' annual reports since 2013 show an increase in the proportion of women in all of the scientific staff categories on which the centers report, i.e., faculty, postdocs/assistant professors, and PhD students.

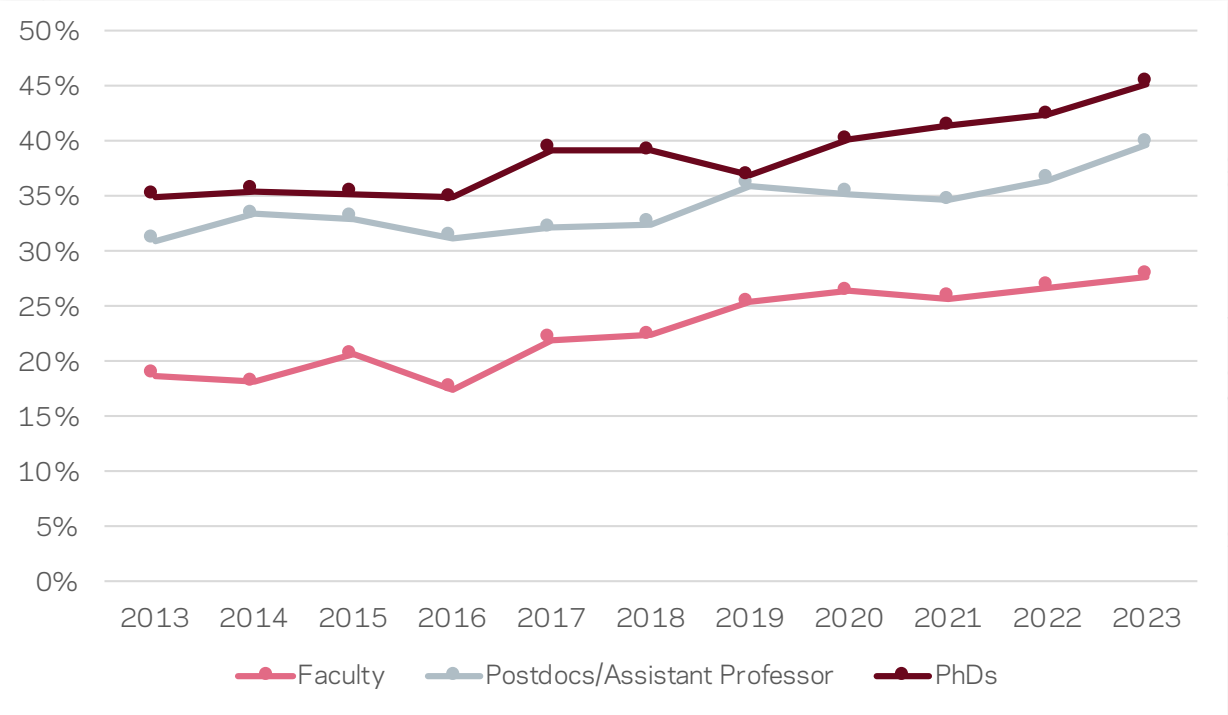


Figure 16 - Women in faculty positions (orange), postdocs/assistant professors (green) and PhD positions (blue), 2013–2023.

Figure 9 presents an overview of funding patterns and the success rate in addressing gender imbalances.

The host institution

Centers are established at Danish research institutions, most of which are universities. Some are hosted by hospitals or public-sector research institutes, with just a few at private research organizations.

50 *https://dg.dk/wp-content/uploads/2018/10/Getting_all_Talents_in_Play.pdf*

The centers are established as separate units within the host institutions, but it is important that they integrate with the host departments and do not operate in isolation. In fact, the Foundation expects the research conducted and knowledge generated in the centers to spill over into the host environment.

The Foundation seeks to maintain an ongoing and constructive dialogue with the host institutions. The dean and/or head of department are invited to take part in the annual follow-up meetings. These meetings provide an important platform for discussing the center's progress, challenges, and future plans. Involving the leadership of the host institutions fosters mutual understanding and support for the center's initiatives.

Research training

Research training is an important part of the center's activities. Working in a dynamic, international atmosphere alongside colleagues from multiple disciplines, nationalities and generations provides young researchers with ample opportunities to learn and explore their scientific fields.

The Foundation expects center members to play an active role in the host institutions' Bachelor's, Master's, and PhD programs to support the students' academic and professional growth. This type of involvement not only exposes students to cutting-edge research but also provides opportunities to receive valuable guidance and inspiration from experienced researchers.

In 2023, a total of 504 PhD students were affiliated with CoEs funded by either a DNRF grant or additional funding, corresponding to 5.1% of all PhD students at Danish universities that year.

The CoE agreement

It is important that all of the partners linked by each DNRF grant – the center leader, the host institution, and the Foundation – work together to create the best possible conditions for the center. Once the board has made its funding decisions, the center leader and the department head from the host institution are invited to a meeting with the Foundation to discuss specific conditions at the center concerned and the future of the collaboration.

A contract is then drawn up that includes appendices detailing the research plan, budget, and the host institution's commitments and co-funding. It also outlines the CoE's minimum space requirements for its offices, laboratories, meeting facilities, etc. These contracts have proven invaluable, not just as legal documents but also as a means of fostering a shared understanding of the individual center and its needs. It is likely that changes will need to be made to the research plan or budget during the funding period, and the Foundation is flexible (within reasonable limits). The center leaders are encouraged to maintain an ongoing dialogue with the Foundation on these matters.

3.6 Outreach

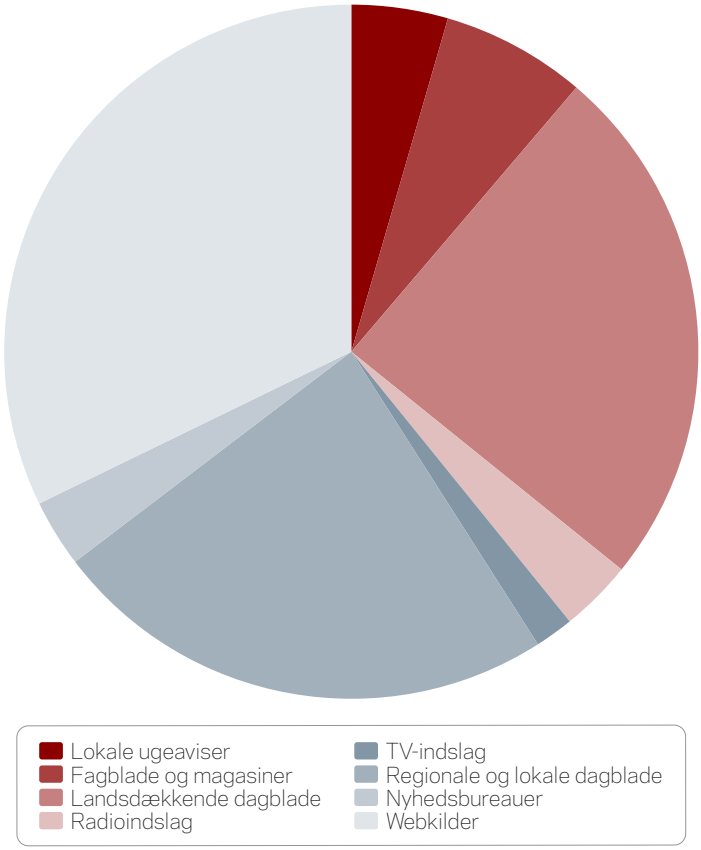
The 2013 evaluation suggested that the CoEs use social media for outreach activities in order to connect with new target groups.

The DNRF has noted that the CoEs are becoming increasingly aware of the importance of outreach and visibility on multiple platforms.

Many of the CoEs and their leaders are active on social media, targeting new audiences and promoting their research to a broader public outside academia. Similarly, a wide range of CoEs participate in Danish science festivals, events, and exhibitions to spread knowledge of basic research and its long-term impact on society.

In addition, public service broadcasters have frequently consulted several CoE leaders when they need an expert opinion on topical issues – COVID-19, immigration, the green transition, and so forth. Newspapers (national and local) and trade journals also regularly seek comments from center leaders.

Media coverage per type and media of centers and researchers from 01.01.2023 to 23.12.2024. A total of 8,189 articles (source: Infomedia.dk)).



Reflections

Reflections – what is a DNRF Center of Excellence?

- **The DNRF supports high-risk, high-reward research but is cautious about discontinuing centers after six years**
  In their evaluation of the DNRF in 2012–13, the international panel expressed concern about the board's limited willingness to take risks, as evidenced by the low number of CoEs terminated after the midterm evaluations. As previously noted, the DNRF board believes that the Foundation should support research proposals that are willing to embrace risk. The Foundation's financial independence creates an environment conducive to risk-taking.
  Inevitably, some CoEs or subprojects will fall short of their goals due to the inherent risks involved. However, the board rarely closes them down, as experience shows that that the centers are very good at finding new paths and at adjusting their research plans. This is underpinned by close, ongoing, trust-based dialogue between the Foundation and the CoEs. The Foundation sets a high bar for a second grant, and it is important to consider whether a reduced likelihood of a second one might actually discourage risk-raking during the initial funding period.

- **CoEs as points of stability in a dynamic research landscape**
  The international panel that evaluated the DNRF in 2012–2013 recommended leaving the highly successful CoE format unchanged and endorsed the board's decision to change the format from a 5+5-year model to a 6+4-year model to encourage greater willingness to take risks among the CoEs.
  Center leaders regularly tell the DNRF not to change the CoE format – and universities, too, urge it to resist the temptation to make changes. In a highly dynamic research funding landscape, these institutions greatly appreciate the necessary stability afforded by tried-and-tested instruments.
  The DNRF board will await the results of the external evaluation before making any changes to the CoE instrument.

Reflections – selection and assessment

- **Optimal basis for decision-making**
  The question of how to establish a robust foundation for funding decisions has

consistently been of interest, including in DNRF's 2013 self-evaluation.[51]
The DNRF board will use the current evaluation as an opportunity to explore options and investigate models that will ultimately enhance the quality of its funding decisions. Regarding the assessment of applications that make it to the second phase, concerns are sometimes raised about the adequacy of the reviewers' knowledge. In our experience, this has proven not to be a significant problem. The main challenge that the DNRF faces when conducting reviews is that they are often overly positive and insufficiently critical because the reviewers' identities are known to the applicants, who work in the same field. As a result, the most specific information is found in the part of the review that requires describing three weaknesses and three strengths of the proposed center. The board will consider the various aspects of the review process, including potential issues related to the selection of candidate reviewers.

Reflections – follow-up and dialogue

- **The spirit of DNRF – follow-ups and dialogue**
  The DNRF has found that an annual on-site follow-up meeting yields significant benefits in terms of both mutual understanding and stimulating center activity. These meetings involve close dialogue and generate insights that enable the board and secretariat to enhance DNRF's ability to advise centers. This also enables the Foundation to be flexible when necessary. It is crucial that this dialogue is honest. To that end, the focus at the annual follow-up meetings is not on traditional performance and output metrics but on progress – and on the people involved. These discussions are not used to inform future funding decisions.
  The time spent on annual meetings is also well spent in a financial sense because the advice from the DNRF secretariat and board can help the centers. As the CoEs can have budgets of up to DKK 10 million per year, the Foundation is careful to ensure that they run smoothly. Former center leaders testify that the annual meetings are highly valued. They play an important role in fostering a sense of belonging to the center, particularly for early career researchers. The DNRF board also believes that the dialogue is part of the reason why so few centers need to be terminated, which helps prevent the waste of large sums of research funding.

51 Read more about the considerations of the DNRF board in 2012, p. 16 in:
https://dg.dk/wp-content/uploads/2018/10/Self-assessment_report_2013.pdf

- **Balancing DNRF oversight with researchers' time**
  The annual report uses both standardized forms and free text. This format, in conjunction with the annual meeting, has proven to be a good way of documenting a center's progress. The report provides essential information that helps the Foundation prepare for follow-up meetings and is useful for DNRF evaluation purposes. The centers generally find the format and workload manageable. DNRF regularly reviews the format to ensure that only essential information is included. However, no matter how good an annual report is, it is no substitute for the dialogue and oral presentations that take place during the annual meeting.
  Other foundations use different reporting systems, e.g., Researchfish. As a consequence, centers that also receive funding from other sources sometimes have to report the same data to different systems. Understandably, they have appealed for a common standard. It is DNRF's impression that, at present, there is no widely accepted standard. Rather, different foundations have their own preferred reporting systems, and some use commercial reporting systems that are considered unsatisfactory. The DNRF's finds that it makes sense to keep things as simple as possible and as well-suited to the instruments and context as possible.

Reflections – Evaluation

- **Evaluations are conducted at year five**
  The DNRF makes it clear to new centers that they should be looking ahead to the midterm evaluation when drawing up their ambitious, sometimes high-risk plans. To be granted an extension, a CoE must not only produce convincing results but also present plans for novel, groundbreaking research and talent development. The Foundation only evaluates the center's results after 4–5 years, which the center leaders say is highly important for fostering flexibility and long-term thinking – precisely the attributes that make the CoEs a uniquely suitable vehicle for creative research. In a highly competitive scientific environment, where output is increasingly measured and benchmarked, and short-term publishing targets are incentivized – even when doing so is not in the interests of the science – the DNRF believes this setup is as important as ever.

- **Site visits canceled at mid-term**
  The DNRF is well aware of the difference between assessing a center, reviewing written materials, making site visits and engaging in direct dialogue. Up until the ninth round, the midterm evaluation process included a site visit and a joint report written by a panel of three reviewers. Although this approach was a great success and received highly positive feedback from reviewers and centers, in 2020, the DNRF board decided

to discontinue the site visits, as they were not deemed to enhance the quality of the evaluations significantly. This new system works because the Foundation is already visiting the centers annually to engage in dialogue with them about their progress, including during the mid-term evaluations.

- **Final evaluation with no review**
  Prior to the fourth application round, the DNRF conducted a comprehensive final evaluation of the centers, which included a 15-page self-evaluation report and the use of external reviewers. The fourth generation of center leaders indicated that they thought excessive time is spent on the evaluation material despite the external evaluations not looking at the center's embedding at the host institution and its potential for securing future funding. As the Foundation already collated all the data it needed from the CoEs' annual reporting, starting with the fifth application round, it introduced a limited process for the final evaluation. The new approach included a short, 2–4-page final report and no longer involved external reviewers. The response from the fifth generation of center leaders was very positive.

- **Assessing responsibly**
  Since the DNRF's 2013 evaluation, growing attention has been paid to the unintended consequences of potentially unfair and inaccurate research assessment practices – in particular, overreliance on quantitative methods.[52] Recent DNRF assessments take these considerations into account and are in line with its longstanding tradition of prioritizing dialogue and qualitative assessment.
  Like many other Danish foundations and universities, the DNRF has signed the Agreement on Reforming Research Assessment (ARRA). Overall, the longstanding DNRF tradition of prioritizing dialogue and qualitative assessment aligns well with ARRA. The Foundation is committed to continuously improving its assessment practices and is currently reviewing them. The board will decide on an action plan in 2025 as part of its strategic considerations. To inform this process, the Foundation is gathering researchers' experiences and perspectives on responsible research assessment during the CoE follow-up meetings in 2024–25.

Reflections – Center finances, organization and interaction with hosts

- **The magic of organization**
  It is easy to understate the importance of organization, but much of the magic of a Center of Excellence can be summed up as follows: Give a group of talented researchers a pot of money to share, and they will start working together toward a common goal. They will consider each other co-workers rather than competitors and seek out complementary skills rather than tasks they can accomplish individually. Knowledge about fit-for-purpose CoE organizations is now passed from one generation of centers to the next as new ones continue to refine the concept.

52 Read more *here*.

- **Incubators for tomorrow's top-level researchers**
  According to the DNRF's legal framework center grants must incorporate a significant degree of research training. The CoEs have unequivocally demonstrated that they are an ideal means of achieving this goal. Researcher training is a cornerstone of the centers' operations, as PhD students and postdoctoral researchers play a pivotal role and conduct a substantial portion of the research.
  Using education-based training to provide individuals with advanced skills and knowledge is the most effective way to transfer knowledge – within the academic community and to the private and public sectors. The approach ensures that the benefits of academic research extend far beyond the confines of a university setting. For the DNRF board, training early career researchers will undoubtedly remain a key priority to ensure that the next generation of scholars is well-placed to advance both science and society.

- **The diversity challenge**
  Embracing diversity is a prerequisite for utilizing the whole of the Danish research talent pool. As such, the Foundation welcomes outstanding proposals from a wide range of applicants. It is encouraging that, in recent years, the proportion of women in all scientific staff categories in the CoEs has increased. The Foundation encourages and supports applications from female researchers and will continue to focus on gender balance.

Reflections – outreach

- **The importance of supporting science communication**
  Science communication and dialogue with the wider Danish public are highly important. The DNRF believes that the research activities it funds should be disseminated widely, and it values the grant holders' visibility and engagement with Danish society. Transparency and openness enhance the legitimacy of research. In general, the Foundation is eager to share the often groundbreaking and always fascinating insights from Danish researchers who have become international leaders despite intense competition in the global research community.

4. Other funding instruments

The legal framework under which the DNRF board operates gives it the option of devising new instruments, and it has continuously done so in consultation with others, including the universities. In the period immediately after the last evaluation in 2013, one of the main goals was internationalization. More recently, the Pioneer Center initiative reflected the board's desire to build strong and sustainable pillars of excellence that deliver transformative solutions in key strategic areas.

4.1 Pioneer Centers

The Pioneer Center initiative is an ambitious national undertaking launched by the Ministry of Higher Education and Science and developed in close collaboration with the Danish National Research Foundation, the Carlsberg Foundation, the Lundbeck Foundation, the Novo Nordisk Foundation, the Villum Foundation, and the universities.

The goal was to attract the very best researchers from around the world and establish three or four co-funded, world-class research centers dedicated to basic research aimed at transformative solutions to major societal challenges. The participating foundations decided that the Pioneer Center initiative would focus on artificial intelligence and climate/energy.

The Pioneer Centers enjoy considerable freedom in terms of research, financial stability, and long-term grants. They are funded for a minimum of 13 years without stop/go evaluations. The implementation plan for the Pioneer Centers includes the possibility of a five-year extension, but a prerequisite for this is that the participating foundations decide to set aside additional funding.

The expectation is that the Pioneer Centers will use these resources to run well-defined, high-risk sub-projects that have particularly high potential for advancing research at the highest international level in the area concerned. They will conduct basic research and produce societal impact.

All four Pioneer Centers have now been set up (see the box below).

The foundations have topped up the original pool of DKK 1 billion, bringing the total funding for the pioneer centers to DKK 1.15 billion (€150 million):

- The Ministry of Higher Education and Science: DKK 177 million
- The Danish National Research Foundation: DKK 233 million
- The Villum Fonden: DKK 175 million
- The Novo Nordisk Foundation: DKK 200 million
- The Lundbeck Foundation: DKK 200 million
- The Carlsberg Foundation: DKK 165 million

Selection and assessment
A steering committee comprising representatives from the foundations involved has:

- selected two broad subject areas in which to set up Pioneer Centers: artificial intelligence and climate/energy
- collaborated on identifying potential center leaders, and worked with the host universities to draw up research proposals
- evaluated these proposals based on peer reviews and interviews. Based on this the participating foundations have made individual funding decisions.

The DNRF organized the implementation process and conducted the contract negotiations on behalf of and in close dialogue with the other foundations, as represented by the members of the steering committee.[53]

Follow-up and evaluation
The DNRF administers the Pioneer Centers, which operate in much the same way as the Centers of Excellence. For example, the foundations make annual visits to them for follow-up meetings.

One major difference between the CoE and Pioneer Centers goals is that the latter are expected to deliver societal impact. Another is that Pioneer Centers are not subjected to stop/go evaluations. They are evaluated in years four and eight, and this process consists of visits by a scientific advisory board and the submission of a self-assessment report and a new staffing plan. The foundations are involved in these evaluations.

53 Read more about *the Pioneer Center initiative*

Pioneer Center for Artificial Intelligence (P1)

- Center leader: Serge Belongie, University of Copenhagen
- Host: University of Copenhagen
- Acceding universities: DTU, IT University, Aarhus University

Land-CRAFT: Pioneer Center for Landscape Research in Sustainable Agricultural Futures (P2)

- Center leader: Klaus Butterbach-Bahl, Aarhus University
- Host: Aarhus University
- Acceding universities: University of Copenhagen, Colorado State University, Karlsruhe Technical University

CAPeX: Pioneer Center for Accelerating P2X Materials Discovery (P3)

- Center leaders: Tejs Vegge, DTU, and Frede Blaabjerg, Aalborg University
- Host: DTU
- Acceding universities: Aalborg University, University of Southern Denmark, Aarhus University

SMARTbiomed: Pioneer Center for Statistical and Computational Methods for Advanced Research to Transform Biomedicine (P4)

- Center leader: Naomi Wray, Aarhus University and University of Oxford
- Host: Aarhus University
- Acceding universities: University of Oxford, University of Copenhagen

4.2 The DNRF Chair

Following a dialogue with the Danish universities about their needs vis-à-vis funding instruments, the board decided to replace the former Niels Bohr professorships program with a new start-up research initiative: the DNRF Chair.

The first round of funding applications under the new instrument was launched in 2020. The overall purpose was to strengthen and enrich Danish research communities. More specifically, the aim of the DNRF Chair grant was to motivate and support Danish universities in attracting and recruiting particularly outstanding researchers from abroad, including Danes seeking to return from international positions. The DNRF Chair grant is designed to support and enhance start-up research activities with three-year grants of up to DKK 10 million. Like the Centers of Excellence, DNRF Chairs have been established in all research fields.

The initiative was planned to continue for five years, ending in 2024. Evaluating the instrument, the board decided not to extend it due to the lower-than-expected number of applications and an uneven distribution of submissions among the universities. By the end of 2024, the Foundation had received a total of 65 applications, leading to 25 invitations to set up DNRF Chairs.

4.3 Discontinued instruments

Professorship programs
Initially, the Niels Bohr program was a response to recommendations from the first evaluation of the Foundation in 2003, which suggested increasing support for the internationalization of Danish research.

Over the years, the Foundation has launched several professorship programs with overlapping objectives, namely recruiting international top-level researchers and introducing new research fields to Danish universities. In 2005, the DNRF launched the *Niels Bohr Visiting Professorship*, followed in 2006 by the *DNRF Professorship* and new rounds of the *Niels Bohr Professorship* in 2011 and 2015. In total, the DNRF awarded 21 grants worth DKK 503 million. Individual grants ranged from DKK 11 to 30 million, and the last one expired in 2022.

Danish-Chinese research centers
The DNRF and the National Natural Science Foundation of China (NSFC) set up a joint program that funded ten Danish-Chinese research centers in the life sciences, natural sciences and technical sciences from 2008 until 2017. The program sought to establish new contacts between leading researchers from the two countries. Over a six-year

period, the DNRF paid out grants of DKK 21 - 25 million to finance the activities of the Danish partners in these centers. The total investment was approx. DKK 220 million, of which the former Danish Agency for Science, Technology and Innovation paid DKK 11.3 million. NSFC financed the Chinese participation. The last grant expired in 2017.

Collaboration with the NSF
From 2009 to 2019, the DNRF was part of a global program established by the US National Science Foundation (NSF). Known as Graduate Research Opportunities Worldwide (GROW), the program allowed NSF PhD fellows to spend 2–12 months on research visits to DNRF Centers of Excellence. Since 2012, the DNRF has invested approximately DKK 9 million in this initiative, funding 43 visits to Centers of Excellence. In 2019, the NSF decided not to continue the program.

Collaboration with the CNRS
In 2008, the DNRF entered into an agreement with the French National Center for Scientific Research (CNRS), which was extended for another four years in 2011. The purpose was to develop closer scientific cooperation between the Danish Centers of Excellence and CNRS laboratories and institutes. The program aimed to facilitate greater mobility between Danish and French research institutions and promote exchange visits by scientists, especially for younger researchers. The initiative ended in 2014.

Collaboration with India
In 2012, the DNRF launched a program to facilitate and stimulate research collaboration with Indian researchers. The funding took the form of additional collaboration grants to existing Centers of Excellence. The agreement resulted in three additional grants over a three-year period. Each center leader involved in a Danish-Indian collaboration received approx. DKK 4 million from the DNRF for Danish activities, amounting to a total investment of DKK 11.5 million. The Indian partner funded activities on the Indian side. The last grant expired in 2016.

Reflections

- **The DNRF continuously revises its funding instruments**
  In the past, the Foundation's involvement in bilateral collaborations was mainly due to a desire to internationalize Danish research. This situation has changed as the international perspective has gained ground. The CoE instrument has also proven highly successful at attracting desirable collaboration partners from excellent research environments abroad. Investments in research centers of a high international standard are, per se, a driver for internationalization, since these environments attract collaborators, talent and top researchers from abroad. In addition, private foundations are also now providing substantial funding aimed at attracting talent from abroad.
  For this reason, the DNRF has decided to discontinue the DNRF Chair program. This decision reflects the Foundation's commitment to investing in areas where the funding will have the greatest impact. The board is regularly assessing the need for new funding initiatives.

- **Lessons from the Pioneer Center initiative**
  It is too early to evaluate the Pioneer Center initiative's final outcomes, success, or effectiveness.
  It proved challenging to attract world leaders in highly competitive fields. The view of the DNRF board is that this makes the successful establishment of four highly promising Pioneer Centers even more notable.
  The implementation process itself also produced significant unforeseen benefits. For example, it led to the devising of a full-cost model that combines elements of the public and private foundations' funding models. More generally, the initiative has brought the DNRF and the private foundations closer together, showcasing a form of collaboration that benefits Danish research.

The DNRF considers the introduction of this ambitious instrument aimed at strategic basic research very timely. Pioneer Centers differ from Centers of Excellence in a number of important ways, which illustrate how they complement each other:

- Pioneer Centers focus on areas of strategic importance, which has the advantage of underpinning innovation in areas in need of urgent societal attention. CoEs, on the other hand, focus on scientific excellence and, as such, are likely to generate broad value and capacity for tomorrow's areas of importance.
- Pioneer Centers focus on application as much as on discovery and, therefore, can potentially bridge the two in a new way. The DNRF board looks forward to evaluating the impact of the Pioneer Centers and discussing it with the other foundations.

5. The Foundation

5.1 Legal framework

The Foundation is regulated by the Act on the Danish National Research Foundation (the "DNRF Act"), the Charter for the Danish National Research Foundation (the "Charter"), and the Executive Order on the Financial Management of the Funds of the Danish National Research Foundation (the "Executive Order").

- Act on the Danish National Research Foundation: Consolidated Act No. 200 of February 26, 2019, as amended by Act No. 1188 of June 8, 2021, Section 3 and Act on the Danish National Research Foundation: Consolidated Act No. 158 of February 13, 2025.
- Royal Decree No. 944 of September 8, 2008, on the Charter of the Danish National Research Foundation.
- Executive Order No. 325 of March 29, 2016, on the financial management of the funds of the Danish National Research Foundation.

The Foundation's activities are also subject to the Act on Danish Public Administration, the Act on Danish Public Records Access, the EU General Data Protection Regulation (GDPR) and the Act on Data Protection, as well as Danish legislation in general.

The Foundation is managed by a board of directors (the "board") whose chair and eight members are appointed in their personal capacity by the Danish Minister for Higher Education and Science. The chair and the individual board members are not entitled to appoint an alternate or be represented by anyone else.

Within this legal framework, the Foundation is required to support excellent world-class research. It has the power to establish centers in one or more institutions by agreement with existing research institutions and for a specified number of years, after which the Foundation's commitment ceases.

Normally, the Foundation is required to allocate funding in open competition based on applications by institutions and individual researchers. The activities funded must include

an element of research training. The Foundation can also undertake initiatives along with and wholly or partially funded by other public or private councils, foundations or companies, including public or private councils, institutions, foundations or companies abroad.

The Foundation is obliged to monitor any research activity it funds. Over a 10-year period, the DNRF can payout an average of DKK 470 million annually (2018 level). The Foundation will strive to maintain this level of funding until 2036 with its current capital.

5.2 Organization

The board
The DNRF board has nine members, all of whom are appointed in a personal capacity by the Minister of Higher Education and Science. Their skill set must include financial expertise and insight into research at an international level.

The Minister of Education and Research directly appoints the chair and one member of the board. The others are nominated by the following institutions: three by the Independent Research Fund Denmark and one each by Universities Denmark, the Director-Generals' Board of Applied Research Institutes, the Royal Danish Academy of Sciences and Letters, and the Academy of Technical Sciences. Then the nominated persons are finally appointed by the Minister of Education and Research.

Since the DNRF is an independent body, the board has wide-ranging responsibilities. At the overall level, these include:

- Drawing up the Foundation's overarching strategy
- Allocating funds in open competition, with a particular focus on transformative research. This process is based on applications from research institutions and researchers.
- Supervising the research activities it funds, including annual follow-up meetings and reporting
- Managing the investments by striving for adequate security, preservation of the real value of the assets, and the highest possible return and comply with the Executive Order on the Financial Management of the Funds.

The board members represent a broad range of scientific fields and include members from Denmark and abroad. This combination not only ensures basic knowledge of the Danish research landscape but also invites new input and experiences from other countries. In addition, the inclusion of members from abroad also expands the recruitment pool for potential board members.

The Secretariat
The Foundation operates independently and is responsible for its own administration. However, the Foundation Act and the Charter determine the division of responsibilities between the board and the CEO.

The board appoints and dismisses the CEO based on the chair's recommendation. However, the CEO cannot be dismissed without prior notification from the Minister of Higher Education and Science.

The CEO is responsible for the day-to-day running of the Foundation and Secretariat under guidelines set by the board. The CEO's contract, the Rules of Procedure for the DNRF Board and CEO, and an internal framework document regulate the division of responsibilities between the CEO and the board.

In addition to the CEO, the Secretariat comprises a CFO, three research advisers who serve as contact persons for the grant holders and oversee the application rounds, a chief accounting officer, a portfolio manager, a head of communications, a head of IT, a secretary and three student assistants.

In practice, they all perform many different tasks – ranging from strategy to implementation – which means they need a diverse skill set and extensive experience.

The DNRF is able to operate as a lean organization because the Foundation administers relatively few instruments and grants and because the application rounds for Centers of Excellence take place every two-and-a-half year. However, the Foundation visits all grant holders every year, and these visits require resources. It also administers other grants, e.g., for the Pioneer Centers initiative and the DNRF Chairs program. The DNRF is responsible for running the Pioneer Centers on behalf of the private foundations involved.

5.3 Values and support for CoEs

Supporting excellence
The preceding sections (on selection, assessment and evaluation, and follow-up) describe in detail how values such as trust, thoroughness, transparency, flexibility, fairness, and accountability play out in the day-to-day practices of the DNRF board and secretariat.

The Foundation's overall aim of providing optimal conditions for excellence informs how its staff support grant holders.

The staff supports the centers while continuously learning from them. On a day-to-day basis, this involves providing accessibility and guaranteeing rapid responses based on genuine understanding – if one center has a challenge, others are likely to have it too.

More complicated and persistent challenges are addressed in a systemic manner. The secretariat's support functions, the form of networking and communication, are

described below. Over the years, the DNRF has tailored the format of these functions for selected staff groups. In different ways, these activities are illustrative of the complexities of running a center, and show how the Foundation has always sought to improve its support functions by offering new initiatives – some of which are specifically requested, while all of them spread best practices, foster connections, etc.

Networking activities
The DNRF is convinced that networking activities provide ideal conditions for reflection and inspiration and regularly organizes retreats for staff associated with CoEs.

Young academic leaders
The Foundation has been arranging annual networking retreats for younger researchers associated with the CoEs since 2021. The focus is on sharing experiences of key issues, with a view to nurturing the next generation of top scientists and preparing them to lead large research groups. The retreat is for members of active CoEs, and the participants – one from each Center – are chosen by the center leaders.

Speakers at the two-day event share current and past experiences of CoEs and shed light on various aspects of the role of a head of research. The participants discuss topics, engage in group work, and share their thoughts on successes and failures, originality and creativity, and some of the challenges they face.

The concept for the Young Academic Leaders networking retreat was inspired by insights gained during discussions at follow-up meetings in 2019/2020 on that year's theme ("The Next Generation: The Transition from Young Assistant or Associate Professor to Top Research Leader"). Center leaders and members recommended fostering networking opportunities among individuals who are at similar stages of their careers but not necessarily in the same research fields. This recommendation exemplifies how the Foundation's close communication with grant holders generates valuable insights that enable the Foundation to adapt and provide the most effective forms of support.

New center leaders
Research management is crucial to the success of a CoE. It is essential that the center leader is not just an outstanding researcher but also a visionary leader.

The Foundation has run tailor-made courses in research management for each new round of center leaders since 2007. These courses not only offer inspiration and advice on topics related to the start-up phase but also serve as a forum for new center leaders to compare experiences and inspire one another.

Center leaders
The leaders of the Centers of Excellence and Pioneer Centers meet once a year to share experiences and discuss topics of importance to the successful operation of the centers. The participants decide the theme for the annual retreat – e.g., recruitment, developing

talent, promoting excellent research, and the post-DNRF transition. The speakers are usually past and present center leaders.

Center coordinators
The Foundation has been arranging networking retreats for center coordinators approximately every two years since 2017.

At these retreats, the focus is on the coordinator's key functions. The aim is to enhance their skills and equip them to contribute to the success and sustainability of their centers by discussing what they do and sharing experiences with each other.

Accounting staff
The DNRF is committed to being accessible to all of the employees covered by its grants, including the CoEs' accounting staff. When new centers are established, the Foundation invites the accounting staff to attend a meeting about budgetary and accounting matters. The Foundation's Chief Accounting Officer also makes annual visits to the host institutions, during which accounting staff are asked to participate in short, individual dialogues to clarify any issues related to the annual accounts.

Communications
The DNRF's communications strategy underpins the Foundation's commitment to being transparent about its activities. The strategy also facilitates the dissemination of the grant holders' research. This involves a strategic communication approach that clearly sets out the focus, target groups, goals, and plans and utilizes various DNRF communication channels.

In recent years, the Foundation has increasingly focused on creating content (e.g., articles, interviews, and videos) that feature center leaders, young scientists, award-winners, etc. The idea is to draw attention to the research conducted by grant holders and reach a wider audience beyond the academic community.

Channels
The 2013 evaluation strongly recommended that the DNRF incorporate social media into its communication strategy to engage younger generations of potential applicants. This recommendation has resulted in the DNRF establishing profiles on platforms such as X (Twitter), LinkedIn, and Bluesky, targeting younger demographics, politicians, political organizations, and the private sector, both in Denmark and abroad.

In addition to its social media presence, the DNRF also has a website, issues press releases, sends out newsletters, and organizes an annual photo competition. In the last two years, the Foundation has also hosted a photo exhibition at its annual meeting.

Collaboration with grant holders
All DNRF grant holders are introduced to the communications team and encouraged to reach out for assistance with communications-related queries or to share updates on publications, awards, and other milestones. The Foundation's head of communications works closely with the centers and regularly visits them to conduct interviews and keep up to date.

The DNRF also engages with grant holders on social media and showcases their publications, events, and achievements.

In 2023, the DNRF ran two workshops for CoEs on writing articles for a wider audience. The workshops were run in partnership with the online news platform *Videnskab.dk*.

In addition, as discussed in the previous section, the DNRF invites center coordinators to a biannual retreat to review communication strategies. At these retreats, participants are encouraged to prioritize the public dissemination of their research and findings.

5.4 Investments

Background
The DNRF was set up in 1991 with a start capital of DKK 2 billion (about DKK 3.8 billion in 2024 prices). Initially, the idea was to use the return on investments to finance research. However, in 1997, it was decided that the Foundation could use half of its original capital to ensure payouts of DKK 200 million per year. This amendment to the DNRF Act in 1997 also allowed the Foundation to invest in equities, starting in 1998. In 2003, it was decided that the DNRF could use all of its capital, as well as returns on investment, to fund research.

In June 2008, the DNRF received a capital injection of DKK 3 billion (about DKK 4 billion in 2024 prices) from the Danish government. In March 2015, it received a further DKK 3 billion (about DKK 3.6 billion in 2024 prices). When it received the DKK 3 billion in 2015, it was decided that the capital should last until the end of 2036.

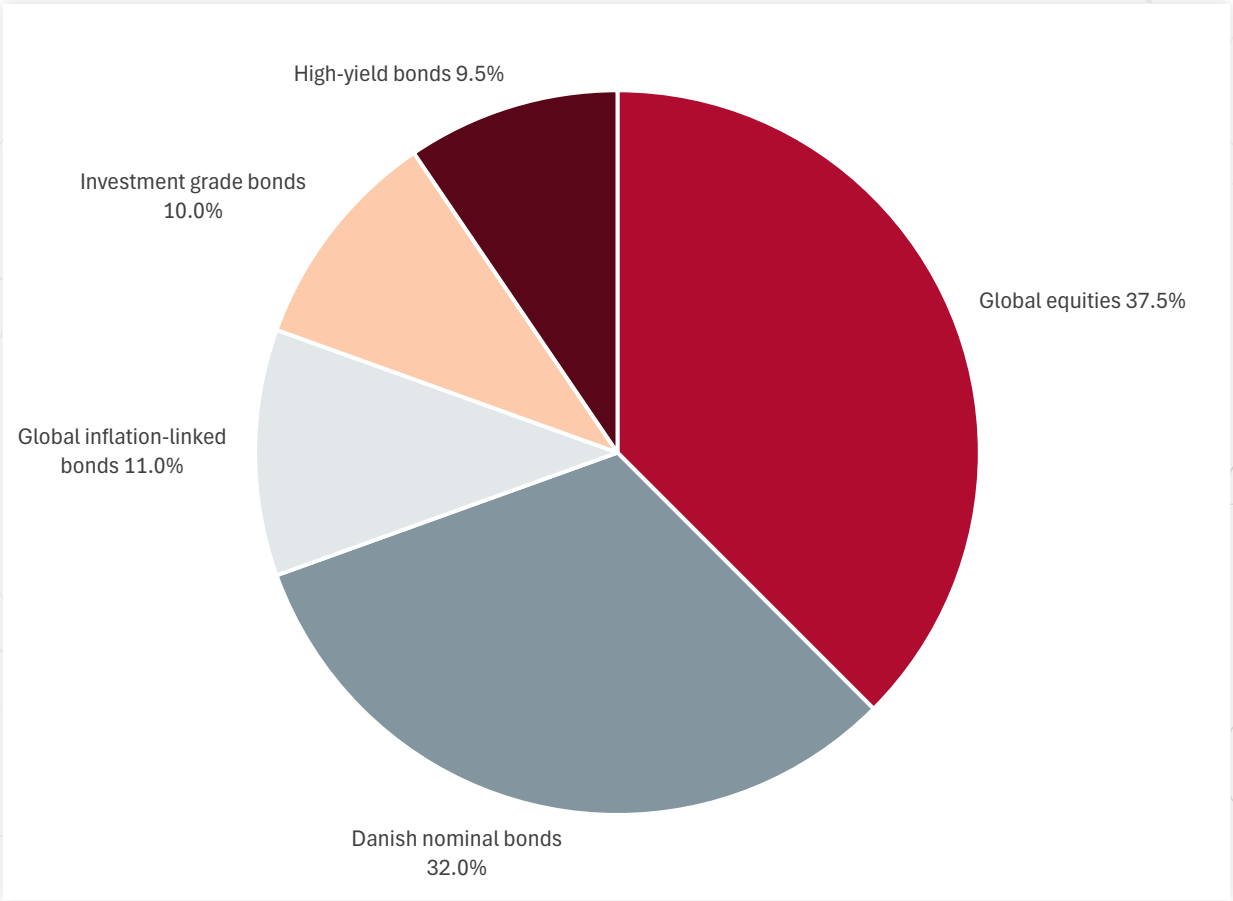
Legal regulation of investments
The Foundation's investments are regulated by the Executive Order on the Financial Management of the Funds of the DNRF: Executive Order No. 325 of March 29, 2016. This order imposes restrictions on the allocation of funds to risky assets (equities, high-yield bonds, etc.) and places specific limits on exposure to companies, mortgage bond institutions and mutual funds etc. It also requires that at least 80% of the investments must be in or hedged against DKK (assets denominated in EUR can be used to meet half of the requirement). To manage its assets, the Foundation is also required to engage external portfolio management companies that are subject to public oversight.

The portfolio and investment strategy

Under the Executive Order on the Financial Management of the Funds of the DNRF, the Foundation is obliged to document in writing the investment principles and policies regarding, at the very least, the methods used to quantify investment risk, the risk management methods, and the strategic asset allocation. These principles should be reviewed whenever necessary, but at least once a year. The investment principles also include the Foundation's policy for responsible investments.

At the last board meeting of the year, the secretariat presents the proposed asset allocation, which has been discussed at a prior meeting with the investment committee. The board then makes a final decision.

The portfolio consists of a mix of asset types, each with its own characteristics, to ensure that it is diverse and to reduce the overall risk. The assets are split between equities (37.5%) and bonds (62.5%).



The main objective for strategic asset allocation, as stated in the Executive Order on the Financial Management of the Funds, is to balance the pursuit of high returns with an acceptable level of risk. Every effort is also made to maintain the real value of the funds.

When deciding on the asset split, the Foundation takes multiple factors into consideration, e.g., the time horizon (the current capital expires at the end of 2036), expected return and risk, liquidity and costs.

The expected return and risk are key to assessing the suitability of the different types of assets. The Foundation uses J.P. Morgan's annual publication *Long-Term Capital Market Assumptions* for this purpose.

Given that the Foundation pays out DKK 400–500 million a year, it is important that an adequate portion of the assets are liquid and easily tradable.

The DNRF Investment Committee meets with the Foundation at least twice a year. The meeting has a fixed agenda comprising the following items:

- Report on the portfolio, including the return on investment
- Strategic asset allocation
- Responsible investment policy
- Risk management and compliance
- Portfolio managers.

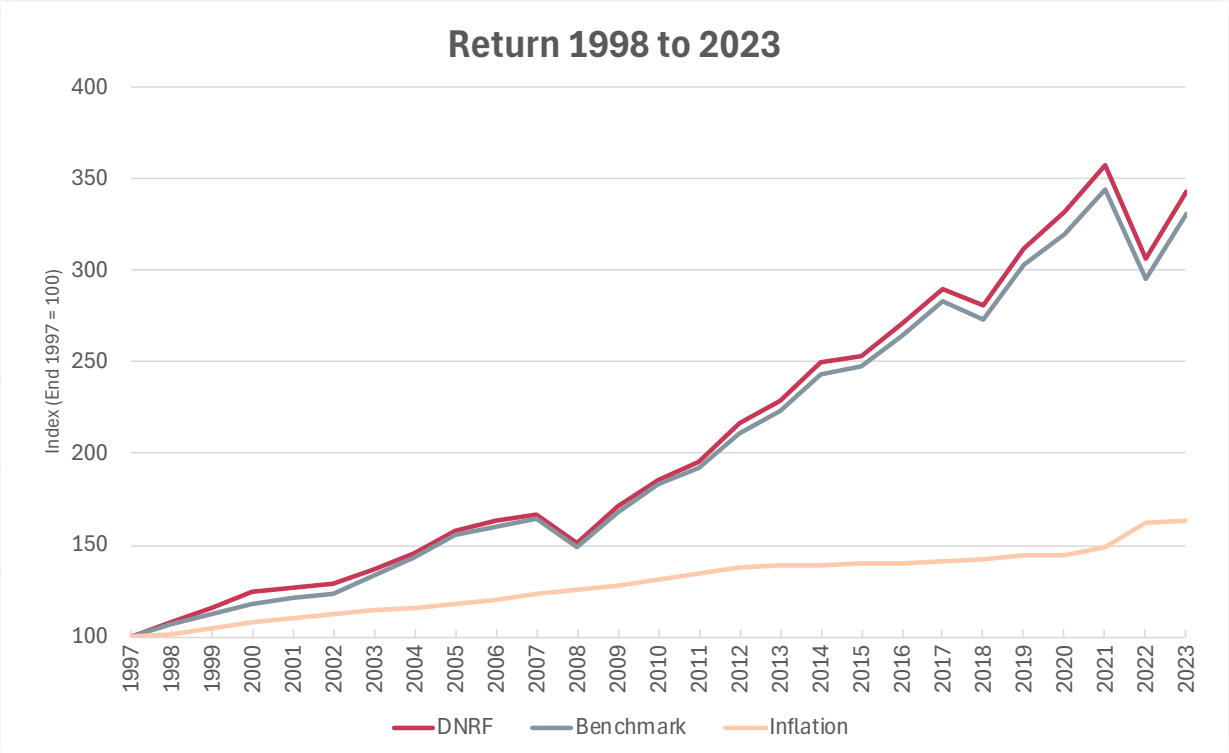
The committee consists of three members, all of whom must be independent and not work for an organization that sells financial products of potential relevance to the DNRF. The current members are drawn from a private foundation, a pension fund, and academia. This diversity fosters constructive discussions, which allows topics to be viewed from different angles and results in well-informed advice and recommendations to the Foundation board.

Return on the portfolio

This section focuses on the period from 1998 onwards, i.e., after investment restrictions were relaxed. Prior to this, the DNRF was not allowed to invest in equities.

The Foundation achieves its objective of balancing high returns with an acceptable level of risk through a combination of portfolio diversification and risk management.

The DNRF has achieved its goal of maintaining the real value of the funds – see the following graph showing the returns, benchmarks and Danish inflation.



The return on investment consistently mirrors the benchmark. One reason for this is that, for many years, the equity portfolio has been designed to track the benchmark (passive management). The return from the portfolio between 1998 and 2023 was 4.9% per year compared to the benchmark return of 4.7%. The portfolio risk level was slightly higher than the benchmark risk (6.2% versus 6.0%).

Responsible investment policy

The foundation has a responsible investment policy which the portfolio manager must live up to when investing.

The core principles of the responsible investment policy are:

1. To invest in companies that live up to commonly accepted international principles and norms for addressing environmental, social, and governance (ESG) issues, that are not involved in the production of controversial weapons or derive 5% or more of their revenue from tobacco production, and,
2. To invest in a manner consistent with the Paris Agreement's goal to limit global warming to well below 2 degrees Celsius, with the aim of 1.5 degrees Celsius, compared to pre-industrial levels. This will be done by halving the emissions of global greenhouse gas by 2030, and by 2050 that greenhouse gases have a neutral climate impact.

To monitor progress towards the goal of achieving climate neutrality by 2050, DNRF will report annually on CO_2 emissions from the portfolio. The purpose of reporting on portfolio carbon footprint, is for the foundation to track its progress over time and validate its focus on investing in line with the goals of the Paris Agreement. Initially, the report focuses on the CO_2 emissions from the equity portfolio.

Engagement is a part of being a responsible investor. Therefore, the foundation's external portfolio managers are at a minimum expected to have a publicly available engagement approach and voting policy. DNRF aims to have as high a share of exercising voting rights as possible, however it is important to highlight that the DNRF's scope of engagement is limited by the foundation's size, especially relative to other investors which will have larger influence over the external portfolio managers.

The portfolio managers shall monitor the shareholder meeting agendas on an ongoing basis and use the voting rights on most of the items. Further, external portfolio managers should have a dialogue with/engage with the transition companies in the portfolio and companies that do not live up to the DNRF's responsible investment policy (excluded companies); and should exercise their voting rights on issues in a manner consistent with the DNRF's Responsible Investment policy's core principles. The foundation's portfolio managers engage with companies in which they have invested on an ongoing basis, for example, by having a dialogue with companies about the relevant issues.

The full Responsible investment policy is here: *Investments - Danish National Research Foundation*.

Risk management

Risk management is crucial in managing the DNRF's investments. The Foundation quantifies this using Value at Risk (VaR) and Conditional Value at Risk and uses a Monte Carlo simulation model to calculate the default risk. In addition, the Foundation uses historical market developments in relation to significant events in the financial markets, such as the financial crises, to illustrate portfolio risk with real life market developments. The five historical events are:

- The IT bubble in 2000
- The World Trade Center attack in 2001
- The beginning of the financial crisis in 2007
- The surge in US treasury yields due to the American central bank announcing that they would no longer be purchasing bonds (called Fed tapering)
- The COVID-19 pandemic started in 2020

The agenda for each board meeting includes a risk management report that shows the portfolio's VaR and CVaR figures and the interest rate risk (duration) of the bond portfolio. The

table below shows an example of the Value at Risk (VaR) and Conditional Value at Risk (CvaR) figures for the portfolio.

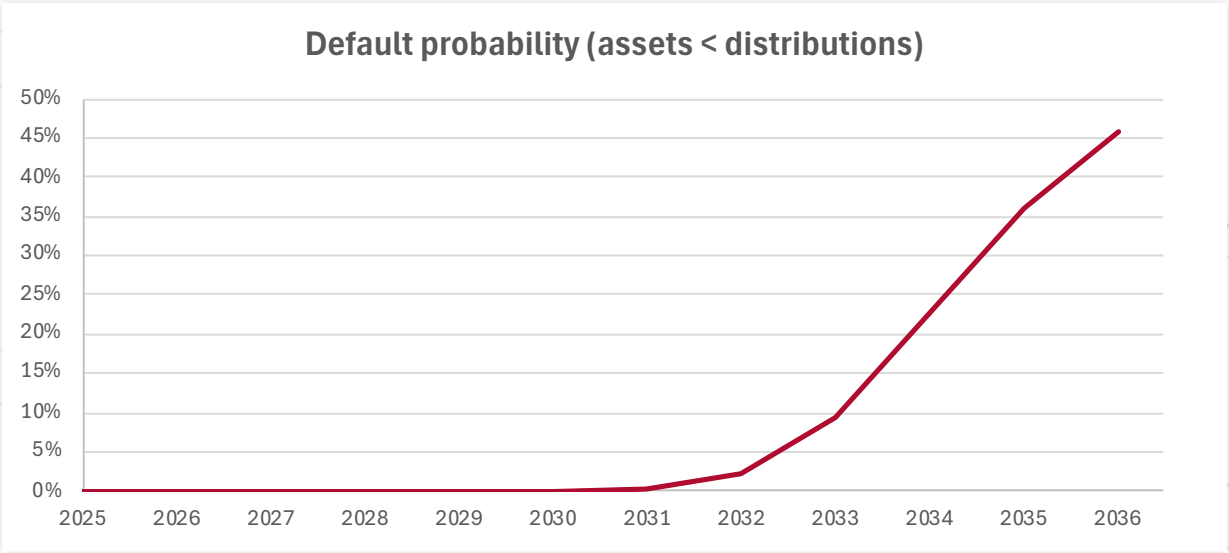
One-year horizon	Risk figures	
	Percent	DKK million
Expected return	4.6	233
Risk	7.5	382
97.5% VaR	15.3	770
97.5% Conditional VaR	19.2	979

Overall, the net capital must be able to absorb portfolio risk measured by CVaR (DKK 979 million in the example above).

The Foundation uses a Monte Carlo simulation as the starting point for reviewing its investment strategy. This calculation determines the level of risk in the assets and the anticipated future payments. The model calculates the theoretical default risk, defined as the years in which the DNRF lacks sufficient capital to cover the expected payouts.

The model uses the capital figure for each year up to 2036 based on the asset allocation, expected distributions and expected risk and return figures from the J.P Morgan Capital Assumptions report.

The capital for each year until 2036 is calculated 5,000 times, and the default risk is calculated on the basis of these simulations. The diagram below shows the result.



The Monte Carlo simulations show that the DNRF's bankruptcy risk will remain at zero until 2031, after which it will rise to 0.4% in 2031 and 2.3% in 2032. The drastic increase is due to the fact that the Foundation must use all of its capital by the end of 2036 – in other words, the size of the buffer diminishes as the endpoint approaches.

The calculations above assume unchanged asset allocation, no capital injections, and that the goal of utilizing all the current capital by the end of 2036 remains constant. The Foundation closely monitors its risk ratios and will reduce the portfolio risk if necessary.

Portfolio management

The DNRF does not manage funds in-house but has outsourced responsibility to external portfolio managers. Investments are made by bilateral agreements with portfolio managers or by investing in mutual funds. When searching for new portfolio managers or mutual funds, an EU tender process is conducted to ensure competitive prices.

Asset type	Portfolio manager	Type
Developed market equities	Nykredit AM	Segregated account
Emerging markets equities	Danske Bank AM	Mutual fund (Danske Invest)
Nominal Danish bonds	Nykredit AM	Segregated account
Global inflation-linked bonds	Danske Bank AM	Segregated account
European corporate bonds	Nordea AM	Segregated account
US high-yield bonds	Columbia Threadneedle	Mutual fund (SEB Invest)

Note: AM is an abbreviation for "Asset Management".

The equity portfolio is managed passively (indexed), which means that its composition reflects that of the benchmark, except for exclusions as a consequence of the Foundation's responsible investment policy.

Every year, the Foundation holds three or four reporting meetings with its portfolio managers to review the results and implementation of the responsible investment policy. A separate meeting is held to discuss responsible investments (ESG). The DNRF draws up factsheets for all of its portfolio managers and presents them at meetings of the Investment Committee as well as annually to the board.

In summary, the Foundation bases its portfolio management (including the necessary policies and reporting) on the same principles that govern large investors such as pension funds. The DNRF's investment principles encompass the investment strategy and reporting processes and are reviewed at least once a year. All meetings of the investment committee include a wide-ranging discussion of all matters related to investments. The committee then presents its conclusions and recommendations to the DNRF board, which makes the final decisions.

The investment committee and the board also receive several follow-up reports on portfolio management:

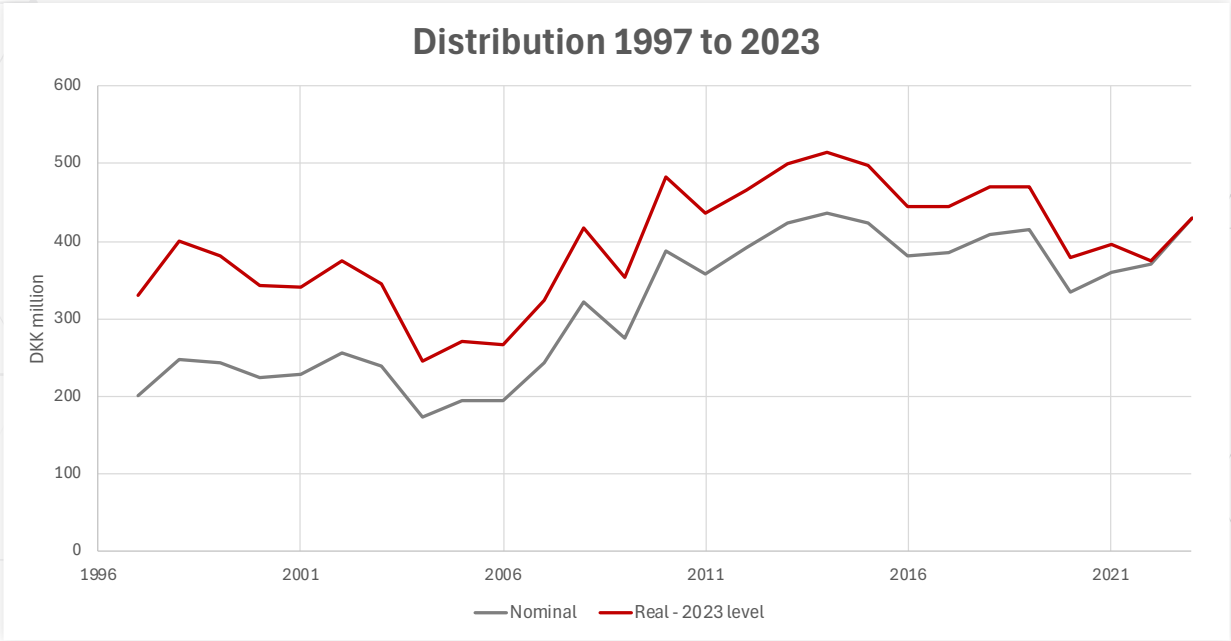
- Investment performance and results per portfolio manager (year-to-date and three-year horizon)
- Risk figures (including the size of the buffer) and compliance report
- Long-term forecast for the Foundation's payouts and capital
- Factsheets covering historical performance, return and risk ratios, and organization, and comments on the results and organization for portfolio managers
- Responsible investment

The DNRF deploys a systematic, EU tender approach to recruiting portfolio managers. As part of this process, potential candidates complete a questionnaire (RFP) that includes questions about their organization, investment processes, responsible investment policies, performance, etc.

Distributions

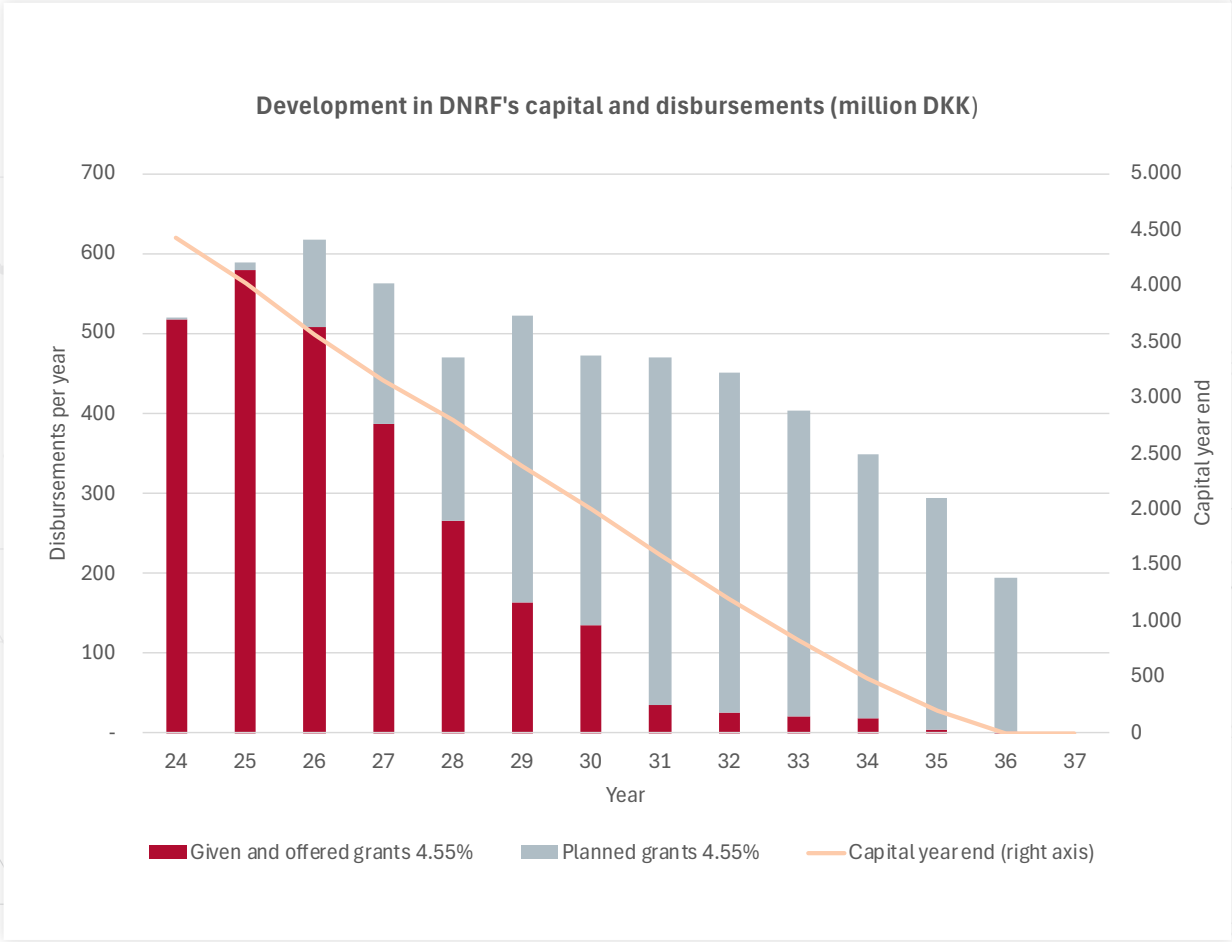
Under the Act on the Danish National Research Foundation, the Foundation can distribute an average of DKK 470 million annually (2018 prices) over consecutive ten-year periods. These distributions must also cover contributions to incidental costs related to the research (overheads), as per the current regulations. At the time of the capital injection in 2015, it was agreed that the capital at that point should last until 2036.

The distributions from 1997 to 2023.



The distributions are presented as both nominal and real values (adjusted for inflation). The real-terms level has remained relatively stable, at around DKK 450–500 million per year. The years 2020–2023 were affected by COVID-19 in the form of delays in hiring personnel and other factors. The projection for 2024 is DKK 420 million, and an increase to over DKK 500 million is anticipated in 2025 and beyond.

As part of its long-term planning, the DNRF uses a distribution forecast based on the expected returns from the J.P. Morgan Capital Assumptions. This forecast is presented at each board meeting. The diagram below shows the distribution per year, 2024–2036.



The bars in the diagram represent expected cash flow, including distributions and grants, planned grants (such as the 13th Center of Excellence round) and expected extensions of existing grants based on mid-term evaluations and expected administrative expenses. Due to the agreement that the current capital should last until 2036, the level of the distribution tapers off from 2026 onwards.

5.5 Administrative expenses

The table below presents the administrative expenses from 2019 to 2023, including a couple of expense ratios.

	2023	2022	2021	2020	2019
Administrative costs, DKK million	13.6	12.8	12.8	12.3	13.9
Annual distributions, DKK million	430.8	371.0	360.0	335.2	414.4
Administrative costs compared to distributions, %	3.2	3.5	3.6	3.7	3.4
Total number of grants at year-end	61	58	52	49	47
Administrative costs per grant, DKK million	0.2	0.2	0.3	0.3	0.3

For comparison, the European Research Council's (ERC) administrative expenses in the above period have been in the range 2.6–3.7% of distribution, compared to DNRF's 3.2–3.7%. The ERC has more than 500 employees, and unlike the DNRF, it does not have any portfolio management. While the figures cannot be compared directly, they do provide an indication of the cost levels.

5.6 Foundation reporting

The DNRF is committed to monitoring and reporting its performance and that of its grant holders. The Foundation continuously discusses and revises its assessment processes and initiatives to ensure accuracy and fairness. This section presents the Foundation's reporting and relevant reflections.

Annual report
The DNRF annual report includes:

- Finances and investments
- Grant holder activity, including the presentation of new grants and the status of the grant selection process for the given year
- Highlights of the year.

Research impact
In recent years, the DNRF has explored the possibility of reporting on the research impact of its grant holders. In order to understand the benefits and pitfalls of this practice, the secretariat has visited foundations and engaged with experts in Denmark and abroad.

The DNRF has begun using and refining bibliometric indicators for internal purposes and recognizes their value in terms of providing an overall picture at appropriate levels

of aggregation, as well as their potential for comparison. However, it decided not to use such indicators in its public reporting due to the following significant limitations:

- Comparisons are challenging because conclusions can vary significantly depending on the tools and approaches used due to the lack of a universally accepted gold standard for measuring research impact.
- For some indicators, sufficient data volume is a prerequisite – in other words, a large number of observations is required to facilitate comparisons over time or between programs.
- Using indicators that focus on specific aspects, such as the share of the top 10% of most highly cited publications at the grant holder level, may incentivize the reporting of certain publications – like those in the top ten for citations – while disincentivizing others. This could ultimately undermine the reliability of data collection as a whole.
- Relevant analysis relies on journal publications as the primary format, whereas some fields, particularly the humanities, utilize alternative formats.

Last but not least, comparison depends on equal conditions. For example, performance measures at the individual level should take into account disciplinary differences, academic age, and other conditions that may affect the parameters. In general, the Foundation promotes careful, qualitative assessment and considers quantitative indicators a helpful supplement.

Annual meetings

The DNRF's annual meetings are an important opportunity to disseminate information about the Foundation's activities to a wider audience. The annual meetings are attended by center leaders and other key figures in the research landscape. The Foundation sees these meetings primarily as a way of accounting for its activities and sharing experiences.

The meetings usually have a specific, topical theme that is important to and has consequences for Danish research and researchers. Recent examples include creativity in research, the long-term value production of basic research, FAIR data management, and changes in academic culture. These topics are usually discussed at follow-up meetings. The main conclusions from these meetings are then compiled into a short publication and discussed by the center leaders the morning before the annual meeting.

The DNRF considers these meetings valuable in two main ways: Firstly, they provide an opportunity for participants from the CoEs and other relevant parties to share experiences and derive inspiration; secondly, they provide the Centers of Excellence with an opportunity to discuss matters that may have consequences for their operations. Reflecting on and sharing experiences related to issues such as creativity or FAIR data empowers the CoEs to improve their leadership in these areas.

Reflections

- **Robust returns on investments from DNRF endowments and improved governance**
  The DNRF's portfolio management has continued to combine positive returns with relatively low portfolio risk, demonstrating once again the sustainability of the model that underpins the Foundation's financial independence. The average return on the investment per year has been 4.9% since 1998, compared to the benchmark of 4.7% per year. These results have added DKK 2.7 billion to the portfolio, which has been distributed to the CoEs since 2012.
  The Foundation is continuously improving its asset management. Most notably, in 2018, it set up an investment committee aimed at providing the board and secretariat with advice and guidance on investments. The committee comprises three members – from academia, a foundation, and a pension fund, respectively. The Foundation has also continuously refined its ESG approach (environmental, social, governance) to investment, and its responsible investment policy is in line with the policy of the Danish government.

- **Supporting excellence and administrative efficiency**
  The support provided by the DNRF secretariat has been refined over 30 years. Its focus has been on addressing the key challenges center staff face in relation to maximizing the CoEs' potential. The Foundation runs various retreats that generate significant value from limited resources. A well-run Center of Excellence thrives and grows to the benefit of all involved.
  The Foundation is pleased to have kept its administrative expenses (as a proportion of the money it distributes) very low, even lower than the overall level ten years ago. This achievement has been made possible by prioritizing assignments according to changing needs. As a result, the Foundation has successfully intensified its efforts in data management, grant holder support, reporting, and communication on an unchanged budget.

Appendix
DNRF SWOT 2025

The DNRF board has conducted a SWOT analysis as part of its self-assessment. The points below mirror the insights in the self-assessment itself.

Strengths

The DNRF's Centers of Excellence (CoEs) have proven their worth over the past 30 years, punching above their weight in frontline research and innovation.

The CoEs generate new research strongholds, build capacity in fields of societal importance, and bolster Denmark's position in international competition. These successes are due to its support for excellence, irrespective of the current societal focus, and its financial independence.

CoEs spearhead research that transforms into innovation and leads to breakthroughs for Danish industry.

CoEs are big enough to generate synergies and facilitate the creation of interdisciplinary research lighthouses but small enough to be agile and creative.

CoEs fit well into university organizations.

CoEs create robust and creative environments that continue to generate value long after their grants run out.

CoEs recruit, develop, and retain top international talent, which benefits Danish academia and beyond.

The open dialogue between the CoE and the university leadership, right from the start of the collaboration, as well as the support and flexibility offered by the DNRF, fosters academic leadership, encourages the sharing of experiences and mitigates the risk of failures. It provides the DNRF with a unique insight into the current Danish research landscape.

The combination of intriguing research questions, frontier knowledge, and a long time horizon has led to DNRF centers significantly outperforming expectations in terms of innovation.

The Foundation has built a strong reputation and has earned a high level of trust among stakeholders in the research community by prioritizing independence, fairness, accessibility, flexibility, transparency, clear criteria, and a consistent format.

The three public research foundations, along with the ERC, comprise a robust pipeline that highlights the many synergies between the foundations. Most PIs and co-PIs in the CoEs built their early career on grants from the Independent Research Foundation or ERC, and many CoEs feed projects into Innovation Fund Denmark.

Weaknesses

The DNRF's endowment is too small to sustain it indefinitely, and it relies on capital injections.

The board alone is responsible for evaluating outline proposals. As a result, the evaluation process depends heavily on the research background of its members.

The many non-commercial benefits of the grant holders' output are hard to quantify for reporting purposes.

The CoE concept assumes a need for intense collaboration, which may be less feasible in some fields in the humanities than it is in the natural sciences.

CoE grants are unevenly distributed between institutions.

Opportunities

Untapped potential: The proposals received indicate that many ambitious and promising ideas developed by Danish researchers do not attract fit-for-purpose, long-term funding. The current success rate of about 8% could be doubled without compromising the quality of CoE's.

The DNRF initiated collaboration with four Danish private foundations in the Pioneer Centers. This approach to combining forces and competencies has further potential.

Encouraging the centers to form wider networks in society at large could channel more young scientists to Danish industry and stimulate innovation.

CoEs represent opportunities to boost the reputation of basic science in society at large by showcasing how it underpins innovation, develops a valuable workforce, and generally drives societal progress.

CoEs could more directly work to leverage the opportunities afforded by mid-career, risk-taking researchers and projects.

Threats

The stalling base funding to universities complicates the CoE integration and promotes the idea of universities as researcher hotels. The high level of funding for overheads offered by DNRF grants partly mitigates this risk.

Danish corporate foundations have complementary and partly overlapping funding schemes. As such, in some fields, there is a risk that they could compete for the scientists' attention. However, the number of applications and the success rate have remained constant.

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