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# Evaluation of the Danish National Research Foundation

Prepared for the DNRF, November 2025



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# Contents

|  |           |
|--|-----------|
| <b>1. Summary and recommendations .....</b>                              | <b>5</b>  |
| 1.1 Executive summary .....  | 5         |
| 1.2 Recommendations .....  | 9         |
| <b>2. About the evaluation .....</b>                                     | <b>13</b> |
| 2.1 Purpose and background .....   | 13        |
| 2.2 Data sources and activities.....                                     | 14        |
| 2.3 Structure of the evaluation .....                                    | 15        |
| <b>3. About the DNRF .....</b>   | <b>16</b> |
| 3.1 About the foundation.....  | 16        |
| 3.2 The DNRF programmes 2012-2025.....                                   | 16        |
| 3.3 The Centre of Excellence Programme.....                              | 18        |
| 3.4 Governance and management of the DNRF .....                          | 22        |
| <b>4. The role of the DNRF in the research funding system.....</b>       | <b>23</b> |
| 4.1 Introduction .....   | 23        |
| 4.2 Comparing the CoE grant with other large research grants .....       | 25        |
| 4.3 Links to other programmes.....                                       | 29        |
| 4.4 Timeliness and relevance of other DNRF instruments .....             | 32        |
| 4.5 Conclusion.....  | 33        |
| <b>5. Scientific impact .....</b>  | <b>35</b> |
| 5.1 Introduction .....   | 35        |
| 5.2 Academic production .....  | 36        |
| 5.3 Scientific impact.....   | 43        |
| 5.4 High-risk research and scientific breakthroughs.....                 | 47        |
| 5.5 The role of the CoE grant in generating impact.....                  | 54        |
| 5.6 Differences across research areas and CoEs .....                     | 54        |
| 5.7 Conclusions .....  | 60        |
| <b>6. Centres of Excellence and the host environment .....</b>           | <b>61</b> |
| 6.1 Introduction .....   | 61        |
| 6.2 How does a CoE grant affect the research environment?.....           | 61        |
| 6.3 The role and engagement of the host institution.....                 | 63        |
| 6.4 What happens after the grant expires? .....                          | 65        |
| 6.5 Conclusions .....  | 66        |
| <b>7. Career Development of affiliated early-career researchers.....</b> | <b>68</b> |
| 7.1 Introduction .....   | 68        |
| 7.2 Institutional support for affiliated PhDs and postdocs.....          | 68        |
| 7.3 Career paths of affiliated PhD students and postdocs.....            | 72        |
| 7.4 Attraction of funding.....   | 76        |

- 7.5 CoEs' impact on career development ..... 78
- 7.6 Conclusions ..... 81
- 8. Societal impact of the CoEs..... 82**
  - 8.1 Introduction ..... 82
  - 8.2 The majority of centres generate societal impact ..... 84
  - 8.3 Business development and commercialisation ..... 85
  - 8.4 Public health and healthcare ..... 88
  - 8.5 Climate and environment..... 90
  - 8.6 Public services..... 92
  - 8.7 Regulation and policy development..... 94
  - 8.8 Culture and/or social practices ..... 97
  - 8.9 Potentials for increasing the societal impact of the CoEs ..... 99
  - 8.10 Conclusions ..... 100
- 9. Funding principles and administration..... 101**
  - 9.1 Introduction ..... 101
  - 9.2 The assessment and selection process ..... 101
  - 9.3 Evaluation and monitoring..... 102
  - 9.4 The grant levels ..... 105
  - 9.5 Support and interaction with the centres ..... 105
  - 9.6 Enhancement of diversity..... 107
  - 9.7 Communication ..... 108
  - 9.8 Conclusions ..... 110
- Appendix 1. Methodology ..... 111**

# 1. SUMMARY AND RECOMMENDATIONS

## 1.1 Executive summary

### **The DNRF remains a cornerstone of the research funding system**

The Danish National Research Foundation (DNRF) was established in 1991 with the mandate to fund research of the highest calibre. Two previous evaluations (in 2003 and 2013) concluded that the DNRF largely has fulfilled this mandate, and that the strong international position of the Danish research sector could not have been achieved without the DNRF and its main instrument: the Centres of Excellence (CoE).

Since the last evaluation, the research funding system has undergone significant changes. Most notably, the role of private foundations has increased, with their share of public research funding more than doubling to 23%.

Previously, the CoE instrument also stood out clearly in terms of grant size. Today, however, both private foundations and the EU provide funding for centres and projects that are comparable in scale to a CoE grant.

Moreover, the average size of a CoE grant is today 25–30% higher than in the first round (1993/94), while cumulative inflation over the same period, has exceeded 75%. Consequently, in real terms, the average CoE grant has declined substantially.

In spite of these trends, the evaluation suggests that the DNRF continues to play a key role in the Danish research funding system. This is primarily because the foundation distinguishes itself by supporting curiosity-driven research with a strong emphasis on scientific quality, originality, and risk-taking. In this way, the DNRF also stands out from most other programmes supplying large grants, which are often more mission-driven in character.

In this context, the following features stand out as unique to the CoE instrument:

- *Capacity building:* The CoE is designed to establish new research environments or to enable existing ones to pursue entirely new research hypotheses.
- *Long-term perspective:* The ten-year horizon provides stability and the opportunity to pursue ideas that emerge along the way.
- *Flexibility:* Centres enjoy considerable freedom to adjust budgets and research activities during the funding period.

In addition, the size of the grant is unique for a number of research fields, particularly within the humanities and social sciences.

These characteristics create fertile ground for high-risk research and for establishing interdisciplinary environments where competences are closely aligned with the scientific challenges.

The interviewed researchers and research leaders characterise the CoE as Denmark's most prestigious research grant. They also stress that applicants compete across all scientific fields, which signals quality system-wide and strengthens the badge value of the grant. Both centre leaders and heads of department stress that receiving a CoE markedly raises national and international profile and is widely regarded as a hallmark of excellence.

Over its lifetime, the foundation has supported Danish research institutions with more than DKK 10 billion. Since the first round in 1993/94, the DNRF has awarded 143 CoE grants across 12 application rounds, of which 44 centres remain active.

In addition, the DNRF has launched a new funding instrument in the form of the so-called Pioneer Centres. With the ambition of lifting the pinnacle of Danish research to Nobel Prize level, the Danish Government commissioned the DNRF to form partnerships with private foundations. The

purpose is to create stronger synergies in the funding landscape and to establish an ambitious framework with a long-term perspective (a 13-year horizon without a stop/go evaluation) that enables research results capable of competing with the very best internationally. While the CoE scheme focuses exclusively on scientific excellence in basic research, the Pioneer Centres aim to bridge frontier research with application-oriented efforts.

Since 2021, four Pioneer Centres have been established, and with a combined budget of DKK 1.15 billion, they contribute significantly to the overall volume of large-scale grants for excellent research environments in Denmark.

It is still too early to evaluate the Pioneer Centres, but initial evidence shows that the instrument has proven successful in attracting world-class international research capacities.

### **Strong international profile**

The CoEs also play an important role in the internationalisation of Danish research. This is reflected in several ways:

- A large number of visiting researchers spend time at the centres and give lectures, including leading international scholars.
- Approximately 50% of affiliated PhD students and 70% of affiliated postdocs are recruited from abroad.
- 72% of the scientific articles from the centres are co-authored with researchers from foreign universities.
- The CoE grants appear to have enhanced participation in international expert groups.

In addition, many centres host major international events, and some have even evolved into global knowledge hubs, organising what are regarded as the most important international activities and/or data collections within their respective fields.

### **High degree of gearing**

The evaluation shows that CoE grants often serve as a platform that systematically leverages

additional funding — often on at least a 1:1 basis over the lifetime of the centres, and in several cases substantially more.

Many centre leaders describe the CoE as deliberately structured to attract further resources: the centre organisation and capacity building provide a long-term platform that enables coordinated grant seeking.

In addition, the CoE instrument is perfectly geared to generate ideas for new projects, allowing affiliated research talents to establish their own groups and to secure grants from other public programmes as well as programmes supplied by private research foundations.

### **Strong scientific impact**

The scientific impact of the centres is strong across all major fields of science.

Scientific articles originating from CoEs constitute almost 5% of all Danish research articles in the period 2012–2023. By comparison, during the same period the DNRF accounted for approximately 1.8% of the total public research funding allocated to Danish research institutions.

In addition, articles authored by CoE researchers receive significantly more citations and are far more frequently published in leading journals compared with Danish research overall.

The scientific impact of the centres exceeds that observed in other Nordic CoE programmes and is close to the level of the ERC Advanced Grant scheme, underlining the CoEs' capacity to generate research of very high quality.

It is particularly the strong research outcomes in engineering and the natural sciences that contribute to the high performance of the Danish centres compared with those in other Nordic countries.

Many of the centres also demonstrate research outcomes that are groundbreaking within their respective fields, setting new directions for global research. The evaluation highlights several examples of how the CoE grant has enabled the emergence of entirely new research areas and the establishment of research environments that have

developed into world-leading hubs within fields of major international interest.

Finally, the evaluation also points to considerable variation in scientific impact across the centres. Such variation is not unexpected in a programme that supports new and untested research ideas, but it also illustrates that high-performing centres account for a substantial share of the overall results.

### **Most centres deliver societal impact**

Although generating societal impact is not part of the DNRF's statutory purpose, the evaluation shows that most CoEs generate impact reaching far beyond academic excellence. Examples include the creation of spinout companies, contributions to solving pressing societal challenges, shaping regulatory frameworks, and enriching Denmark's cultural landscape.

Two out of three centres indicate that they have delivered societal impact and more expect to do so. Four distinct roles or pathways to impact appear to emerge:

- *Formation of new companies:* Startups that aim to translate the research into market-ready products and solutions.
- *Centres as Knowledge Hubs:* Some centres have built unique insights, databases, and tools that both public authorities and companies can access and tap into.
- *Public engagement:* Certain centres generate knowledge of broad public interest; dissemination of this knowledge contributes to public welfare, engagement, and understanding of history, nature, and societal challenges.
- *Follow-up projects:* In some cases, research conducted in the CoEs does not directly lead to impact. However, the results may pave the way for research and innovation projects with an application focus, creating the link between the research conducted in the centres and value creation in society.

The examples also underscore that the boundaries between basic and applied research are increasingly blurred.

An important explanation for the significant contribution is that applicants compete for grants based on novel and innovative angles and hypotheses. Many of these naturally emerge from current societal challenges and trends that shape societal development. The implication is that research findings and insights from the centres often have significant societal value or can lead to technologies and tools that do.

### **CoEs as talent factories**

While the primary objective of the CoEs is to advance excellent, curiosity-driven research, the centres also play a key role in shaping the careers of early-stage researchers. Around 60% of the total grant volume is allocated to salaries for PhD students and postdoctoral researchers.

By equipping early-career researchers with strong research skills and valuable networks, the CoEs not only strengthen the immediate research environment but also enhance the long-term capacity of the Danish research system.

The findings support the view that the CoEs accelerate talent development – both for researchers who continue along the academic track and for those who pursue careers outside academia. Research in the centres contributes to building competences and networks at a level difficult to achieve in more traditional research environments.

However, there are considerable differences in the extent to which centres explicitly invest in talent development. Some centres and departments use the grant as an incentive to develop ambitious training programmes and to attract additional funding for this purpose. Other centres perform less well when early-career researchers assess the quality of career guidance.

### **Monitoring practices create value for the centres**

The evaluation reveals a very high level of satisfaction with the programme's administration and the DNRF's engagement in the centres.

The DNRF's monitoring practices, including the annual report and annual meetings with the centres, are seen as valuable elements that help raise motivation levels and facilitate internal dialogue on progress, results, and expectations. In terms of interest, engagement, and accessibility, the DNRF secretariat also receives top marks. Many centre leaders describe their relationship with the DNRF as trust-based, enabling open discussions of challenges and adjustments that benefit the research.

### **Transparent review process, but greater emphasis could be placed on leadership skills**

Overall, the assessment and selection process is viewed as transparent and characterised by a high standard of academic quality. Centre leaders and heads of department emphasise that a degree of chance is unavoidable when proposals involve new, high-risk research ideas.

However, given the tough and highly competitive nature of the final selection, the evaluation also highlights the potential to place greater emphasis on the leadership skills of the core team as a whole during the final selection process. This could include inviting more teams for a final interview.

### **Gender balance is most evident among centre leaders**

The DNRF is expected to promote diversity across the research environments it supports, with particular attention to gender balance and disciplinary breadth. A clear majority of centre leaders indicate that the DNRF is committed to the diversity agenda, for example by raising the topic during annual visits to the centres.

Regarding gender diversity, the data show that balance is most evident at the leadership level. Thus, female centre leaders accounted for 30–36%

of grant holders in the most recent rounds, while only 25% of professorships at Danish universities are held by women. When it comes to affiliated researchers, however, the picture is somewhat different. While 35% of all associate professors at Danish universities are women, the share of female associate professors affiliated with CoEs in the period 2012–23 was only 26%. Similarly, women accounted for 38% of PhD students and 34% of postdocs and assistant professors in the centres during the same period. By comparison, the corresponding national figures for Danish universities in 2022 were 52% and 43%, respectively.

### **Imbalances in the distribution of centres across scientific disciplines**

The evaluation shows that over 40% of the centres funded in the most recent six rounds are hosted by institutions within the natural sciences, and that the natural and health sciences together account for nearly 70% of all centres - above their 60% share of academic staff at public research institutions, indicating a modest over-representation in these fields.

By contrast, the social sciences - representing 9% of the centres compared to nearly 20% of Danish research measured in academic staff FTEs - are underrepresented. Only around one in five centres are based in the humanities or social sciences, despite the fact that these fields are at a clear disadvantage in attracting private foundation funding.

### **Conclusion - The DNRF continues to fulfil its mandate**

The legal framework establishes that the DNRF must support excellent, world-class research. In agreement with existing research institutions and for a specified number of years, the foundation may establish centres at or across institutions, after which the foundation's commitment will cease.

In addition, the foundation is normally required to distribute funds through open competition based on applications from researchers. Supported activities must include key elements of research

training. The foundation may also undertake initiatives in cooperation with other public or private councils, foundations, or companies.

The foundation is obliged to monitor all research activities it funds, and over a 10-year period, its annual distributions must on average amount to DKK 470 million (2018 level).

As the conclusions above demonstrate, the DNRF fully lives up to its statutory purpose. Moreover, the positive results in terms of societal impact and the leverage of the DNRF's funding represent highly significant add-ons. This shows that although the DNRF accounts for only about 1.8% of total public research funding in Denmark, its impact extends far beyond its legally defined mandate and beyond the isolated research impact of its financial means.

## 1.2 Recommendations

The DNRF, and in particular its CoE instrument, plays a very important role in the Danish research funding system. In many ways, the CoE acts as the glue that makes it possible to build excellent research environments, which over time also result in highly qualified applications to private foundations, the EU, and other sources.

Thus, the Centres of Excellence should remain the foundation's core instrument – and, in effect, its DNA. The programme's defining features – curiosity-driven scope, interdisciplinarity, long-term and flexible support, and professionalised centre organisation – are precisely what enable durable capacity building and world-class results. Maintaining and sharpening the CoE model, while ensuring complementarity with other national and private schemes, is therefore the most effective way for the DNRF to sustain its unique contribution to the research ecosystem.

The primary recommendation is therefore that the DNRF be provided with the resources necessary to continue supporting CoEs at least at the current level. The additional recommendations should primarily be viewed as suggestions for minor

adjustments aimed at further enhancing the impact of the foundation's investments.

We have structured the additional recommendations under five headings:

- Securing the long-term relevance and effectiveness of the DNRF instruments
- A coherent research funding system with high impact
- Harvesting potential for societal impact
- Strong pipeline and balanced portfolio
- Preserving the foundation's Legal and Endowment Structure

### **Securing the long-term relevance and effectiveness of the DNRF instruments**

To maintain and sharpen the DNRF's position in the research funding landscape, we recommend the following with regard to the foundation's portfolio of instruments:

- The foundation's grants should remain concentrated on the CoE instrument.
- The relevance and additionality of the Pioneer Centres should be evaluated within 5-7 years, after which the future role of the instrument can be decided.
- A lower and upper limit should be introduced for the size of a CoE grant in the first phase (six years), replacing the current model with two funding levels (up to DKK 36 mill. or up to DKK 60 mill.).
- The upper limit should be increased by at least 15% compared with the current level, to ensure that CoE grants, within the supported research environments, continue to stand out significantly, compared to other grant types.

The evaluation shows that the DNRF's strength and prominent role in the Danish research funding landscape is closely linked to the CoE

instrument, which is internationally recognised and delivers unique outcomes for Danish research.

The Pioneer Centres may serve as a relevant supplement, but it is still too early to assess the effects of this instrument.

Over the years, the D NRF has also developed various instruments to support Danish universities in recruiting international professors. The evaluation indicates that the current need for such programmes is limited, as good alternatives exist (see Chapter 4).

The recommendation to operate with a funding interval rather than two separate levels reflects the perception that the current model often draws a dividing line between scientific fields, with the lower level typically targeting the humanities and social sciences. Several interviewees consider this an overly simplistic view of the variation in funding needs across disciplines, especially as interdisciplinary centres often require larger budgets (see Chapter 9).

Finally, it is essential that CoE grants continue to stand out in terms of size and provide a basis for building strong research environments with critical mass. Accordingly, the foundation's allocations should both reflect developments in salaries, equipment, and data costs, and remain above the grant levels of major programmes offered by private foundations (see Chapter 4).

It should also be noted, however, that increasing the average size of a CoE grant must not come at the expense of the number of grants awarded or the current success rate at 6-7% (see Chapter 3). The last recommendation above therefore assumes that any additional capital injection to the D NRF would reflect the ambition of adjusting the average grant size.

### **A coherent research funding system with high impact**

It is vital for maintaining Denmark's international research position that no major funding gaps

exist, and that the D NRF continues to prioritise basic research characterised by high risk/high gain. The evaluation highlights a high degree of complementarity between the CoE programme and other funding schemes, as many centres succeed in attracting substantial additional funding from both the EU and private foundations (see Chapters 3 and 4).

However, some centres call for closer dialogue on how continued capacity building or the retention of capacity can be ensured.

At present, CoEs seek follow-on grants that are linked, for example, to the strategies of private foundations. For many centres, this poses no issue, as the objectives and strategies of these foundations frequently align well with pursuing, for instance, application-oriented perspectives. However, there are also centres where the conclusion of a D NRF grant can result in the loss of unique research capacity or hinder its further development (see Chapter 4 and Chapter 6).

Consequently, there appears to be scope for fostering greater synergy between major public and private research investments. This is particularly relevant in emerging research fields that have not yet attracted significant attention in research strategies or in perceptions of Denmark's research strengths.

Going forward, we recommend that the D NRF take a more active role in maintaining ongoing dialogue with major private foundations regarding the emergence of new areas of strength in Danish research based on mutual knowledge from larger grants. This could help raise awareness of high-potential areas where coordination between public and private funding is important.

In addition, the D NRF Board could consider whether the current success rate for CoE continuation after the midterm evaluation is too high when the goal is to maximize the research impact of its investments.

The evaluation points to considerable variation in scientific impact across centres (see Chapter 5), and given the foundation's commitment to high-risk research, it may seem somewhat counterintuitive that only a very little fraction does not proceed to phase 2 (see Chapter 9).

It is, of course, essential for centres' long-term planning and investment that they can anticipate renewal if they deliver solid research results in the first period. At the same time, it is important to emphasise that the DNRF Board rejects many qualified applications (see Chapter 9), and that each extension has consequences for the number of centres that can be supported in phase 1.

### **Harvesting potential for societal impact**

It is crucial for the role and position of the CoE instrument that scientific quality remains the sole criterion when selecting new CoEs.

However, the evaluation indicates scope for a stronger focus on harnessing societal impact when clear pathways emerge – typically in the later stages of a centre's lifetime (see Chapter 8). While this is not part of the DNRF's statutory mandate, it represents an important objective of public research, as also reflected, for example, in the Danish University Act.

Several centre leaders emphasise that the DNRF could take a more active role in bringing societal impact onto the agenda. It should be up to the DNRF Board to consider how the foundation can best support and incentivise centres to pursue the opportunities for societal impact that emerge from their research.

One natural focal point could be the midterm evaluation, which currently includes a section on “outreach” – i.e. the centres' engagement in dissemination activities beyond academia. Societal impact is a broader concept, encompassing projects and initiatives that help translate research into value for society. The midterm evaluation could therefore address not only activities already undertaken, but also the potential for societal impact to be pursued in the second phase.

Annual reports could also, where relevant, explore the topic in greater depth, providing the DNRF with a stronger platform to highlight the centres' contributions to addressing societal challenges.

DNRF should also consider whether, in this context, it could strengthen dialogue with the Innovation Fund Denmark (IFD) on how to strengthen the links between the instruments offered by the two organisations (see also chapter 9).

As with the recommendation above concerning private foundations, a structured dialogue on trends and perspectives in the research of the centres could help the IFD identify the potential of emerging research areas at an earlier stage. This, in turn, could facilitate a smoother transition to IFD-supported projects when opportunities arise.

A dialogue with IFD could also address funding gaps in the transition from inventions in basic research to commercialisation activities (and other projects generating societal value). Several interviewees emphasise that groundbreaking research may lead to radical innovation, but that the technologies are often less mature and the application areas more diffuse than in applied research projects (see Chapter 8). This could suggest a need for a discovery grant designed to take results from basic research and explore their potential for application in technologies, products, or societal solutions. In other words, a focused funding instrument positioned earlier in the value chain than the current InnoExplorer grants and Proof-of-Concept schemes at the universities.

### **Strong pipeline and balanced portfolio**

It is important for the DNRF's role and position that the CoE instrument appeals to all major scientific disciplines and the country's most talented researchers.

In this context, it is important that the long-term distribution of applications and grants aligns with the available talent pool and the areas of strength in Danish research.

Several university leaders see it as a paradox that the humanities and especially social sciences are underrepresented, as these are precisely the areas where alternatives to DNRF funding are weakest in terms of large, long-term grants for basic research (see Chapter 4 and Chapter 9).

According to the interviewed university leaders, the main reason is likely that these fields have less of a tradition for large research groups and major research grants (see Chapter 9).

It is mainly the universities' own responsibility to motivate more researchers in these fields to apply for DNRF funding. However, we recommend that the DNRF Board engage in a closer dialogue with the top management of the universities on how to secure more applications from underrepresented research areas.

Moreover, the evaluation concludes that a great deal of uncertainty exists in some research environments on what it takes to secure a CoE grant (see Chapter 9). While some departments have "cracked the code" and achieved a high success rate, uncertainty remains high in many other environments, particularly at smaller universities. Uncertainty is particularly pronounced regarding:

- The scientific track record required to become a centre leader.
- The needed level of originality and risk in the research theme.

The DNRF could help reduce this uncertainty by sharing information on the profiles of successful

centre leaders and applications. By presenting concrete examples or archetypes – highlighting variations in factors such as age, prior achievements, leadership experience, research ideas, and the centres' grounding in existing research – the foundation could support younger professors in planning a roadmap toward securing a DNRF grant.

### **Preserving the foundation's Legal and Endowment Structure**

The DNRF's strong position in the research funding landscape is closely linked to its organisation as an independent foundation with its own mission and independent board. This structure has created the basis for a unique dialogue and strong engagement with the supported centres, while also reinforcing the distinctive brand of the CoE instrument (see Chapter 9). At the same time, the model of state-provided capital injections ensures long-term financial security (see Chapter 4).

We therefore strongly recommend maintaining the DNRF's current legal form and funding model.

Finally, we recommend that the DNRF consider whether the conclusions and recommendations in this evaluation call for additional competences in the board and the secretariat.

To increase focus on societal impact, it seems relevant to strengthen the organisation with individuals who have expertise in both research and research-based innovation.

## 2. ABOUT THE EVALUATION

**This chapter outlines the purpose of the evaluation and provides details on the data sources utilised.**

### 2.1 Purpose and background

The overall purpose of the evaluation is to assess the extent to which the DNRF continues to fulfil its objective of strengthening Denmark's research capacity, as stipulated in the Act regulating the foundation<sup>1</sup>.

The DNRF was last evaluated in 2013<sup>2</sup>. The conclusions of the 2013 evaluation mirrored the results of similar evaluations of CoE programmes in other countries, namely that the CoE instrument is highly effective in:

- Producing research results of a high international standard.
- Promoting groundbreaking research in new scientific fields.
- Ensuring capacity building and developing new research environments of high international quality.
- Strengthening the internationalisation of research and attracting international researchers.
- Supporting career paths for talented researchers.

However, since the last evaluation significant changes have taken place in the research funding landscape, as well as in the political expectations of research outcomes and impact. These changes include:

- The growing role of private foundations, including in the funding of large centres and major research projects.
- Increased emphasis on the contribution of research to addressing societal challenges, including climate change, the UN Sustainable Development Goals, and the general need for knowledge-based innovation. In this context, more research funding is being earmarked for specific areas of application.

These developments create a need to evaluate the interaction between the DNRF's instruments and other programmes, as well as to assess whether the relevance and significance of the CoE instrument have changed since the previous evaluation. Furthermore, the changes underline the relevance of evaluating the DNRF's role in generating societal impact, although generating impact for society is not part of the DNRF's statutory purpose.

The evaluation focuses on the period after 2012, with particular emphasis on the CoE instrument, which has by far been the dominant instrument in DNRF's portfolio since the establishment of the foundation.

In order to assess the extent to which the DNRF meets its overall objective, the evaluation addresses the topics listed in box 2.1.

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<sup>1</sup> The Danish National Research Foundation Act, cf. consolidating act no. 367 of 10 April 2014

<sup>2</sup> Ministry of Higher Science and Education (2013) "Evaluation of the Danish National Research Foundation"

**Box 2.1. Evaluation topics**

|  |   |
|--|---|
| <p><b>A. The foundation's role and relevance in the national landscape</b></p> <ul style="list-style-type: none"> <li>• The DNRF's role and relevance within the Danish research funding landscape (both public and private funding) – in light of changes in the overall research funding system in recent years.</li> <li>• The appropriateness, timeliness and relevance of all funding instruments employed by the DNRF in light of the composition of the Danish and international landscape for research funding.</li> </ul> <p><b>B. Research impact</b></p> <ul style="list-style-type: none"> <li>• The quality and scientific impact of research output from activities funded by the DNRF.</li> <li>• The ability of the DNRF to enable groundbreaking research at the highest international level and contribute to the establishment of strong research environments in Denmark.</li> <li>• How the foundation contributes to the positioning of Danish research internationally.</li> <li>• How the hosting of DNRF-funded activities – especially CoEs – affect the research profiles and prioritisation of the host institutions – and how research areas are embedded in the host institutions or in Danish research after the DNRF-funding has ended.</li> <li>• The quality and relevance of talent development and research training in the context of activities funded by the DNRF.</li> </ul> | <p><b>C. Societal impact</b></p> <ul style="list-style-type: none"> <li>• The long-term importance and broader societal value creation of activities funded by the DNRF.</li> <li>• How the DNRF-funded activities support societal impact, innovation and spinouts, value creation in socially critical areas, as well as lasting effects and capacity building.</li> <li>• The extent of research generated intellectual property rights from the DNRF-funded activities used for commercial and other societal purposes.</li> </ul> <p><b>D. Funding principles and patterns</b></p> <ul style="list-style-type: none"> <li>• The appropriateness of DNRF procedures for soliciting and assessing applications and allocating grants, and mechanisms for continual evaluation of progress in activities funded by the DNRF.</li> <li>• The extent to which the DNRF enhances diversity in research, including disciplinary and gender diversity</li> <li>• The adequacy and impact of continuous interaction between the DNRF and the research environments receiving grants, specifically CoE and host institutions.</li> </ul> |
|--|---|

Source: DNRF (2025); "Terms of reference for evaluation of the Danish National Research Foundation 2025"

**2.2 Data sources and activities**

For the purposes of this evaluation, we have developed an evaluation design based on state-of-the-art methods and international guidelines for research evaluation, while emphasising that no fixed standards for research evaluation exist. Evaluation designs must be adapted to the purpose, the context, and the focus of the programmes<sup>3</sup>.

Recent literature on research evaluation, however, shows broad consensus on the importance of applying a mixed-methods approach, combining quantitative and qualitative data. In this way, the central questions in research evaluations are addressed by drawing on multiple data sources (methodological triangulation).

<sup>3</sup> See CoARA (2022): "Agreement on reforming research assessment" & RAND Europe (2013): "Measuring research – a guide to research evaluation frameworks and tools"

The evaluation is informed by a broad set of data sources (see appendixes for further details):

- Bibliometric analyses of academic output.
- Career analyses and mapping of grant acquisition among early-career researchers affiliated with the centres, based on multiple databases.
- A survey of centre leaders, addressing all dimensions outlined in Box 2.1.
- A survey of senior researchers, focusing primarily on individual research impact and the role of CoE in the research funding landscape.
- A survey of PhD students and postdocs, exploring the contribution of CoEs to talent development and career progression.
- Interviews with centre leaders, covering the full range of evaluation topics in Box 2.1.
- Follow-up interviews with PhD students and postdocs, providing qualitative insights to complement survey findings for this group.
- Case-study interviews with partner organisations, illustrating how centre research generates societal impact.
- Interviews with university leaders, with an emphasis on the DNRF's role in the funding landscape and on funding principles applied in the administration of CoEs.
- Interviews with external stakeholders, including private research funding foundations, to capture perspectives on synergies and gaps between actors and programmes in the research funding ecosystem.
- An interview with the Chairmanship of the DNRF Board.
- A self-evaluation report prepared by the DNRF.

- Data provided by DNRF, including, among other things, applications, evaluations of the individual centres, information on affiliated researchers, publication lists from the centres, contact details, etc.

## 2.3 Structure of the evaluation

The remainder of the evaluation report is structured as follows:

- Chapter 3 introduces the DNRF and its instruments. The chapter also includes analyses of how applications and grants are distributed across universities and scientific domains.
- Chapter 4 evaluates the role of the DNRF – and in particular the CoE instrument – within the research funding system.
- Chapter 5 analyses scientific results achieved in Danish CoEs benchmarked against CoEs in other Nordic countries as well as the ERC Advanced Grant programme. The chapter also highlights differences across centres.
- Chapter 6 assesses the impact of CoE grants on the host environments – both during and after DNRF funding.
- Chapter 7 maps the subsequent career trajectories of affiliated PhD students and postdocs and evaluates the extent to which affiliation with a CoE influences career opportunities both within and beyond academia.
- Chapter 8 examines the societal impact of the centres. It shows the share of CoEs that contribute to six different domains – ranging from business development to culture and social practices – and provides concrete examples of how centres create impact.
- Chapter 9 evaluates the DNRF's administration, including funding principles, ongoing monitoring practices, engagement with CoEs, and the foundation's external communication.

## 3. ABOUT THE DNRF

**This chapter introduces the Danish National Research Foundation (DNRF), including its mission, governance, and funding model. It also provides an overview of the current programmes and key data on the distribution of grants for the foundation's main instrument – the Centres of Excellence.**

### 3.1 About the foundation

The Danish National Research Foundation (DNRF) is an administratively and economically independent foundation established by the Danish Parliament in 1991. Its purpose is to strengthen the development of Danish research by supporting excellent basic science.

The main instrument is the Centres of Excellence scheme – long-term, flexible grants designed to foster breakthrough research in creative environments. Over time, the foundation has become a cornerstone of Danish research funding with a distinct identity and strategic positioning.

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#### Mission of the DNRF

The foundation supports excellent basic research across all scientific disciplines. Its ambition is to enable research that meets the highest international standards and contributes to the advancement of knowledge, science, and society in a Danish and international context.

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#### Funding of the DNRF

The foundation is financed through a state endowment, which has provided long-term financial independence and stability.

The capital base was initially DKK 2 billion and was expanded through two further injections from the state: DKK 3 billion in 2008 and another DKK 3 billion in 2015. The foundation operates based on these capital injections.

The DNRF distributes approximately 1.8% of the total public research funding in Denmark<sup>4</sup>. Over its lifetime, the foundation has supported Danish research institutions with more than DKK 10 billion, equivalent to an annual distribution of up to DKK 470 million. Despite its relatively modest share of public research funds, the foundation plays a strategic role in the Danish research ecosystem by focusing on excellence and long-term research impact (see Chapter 4).

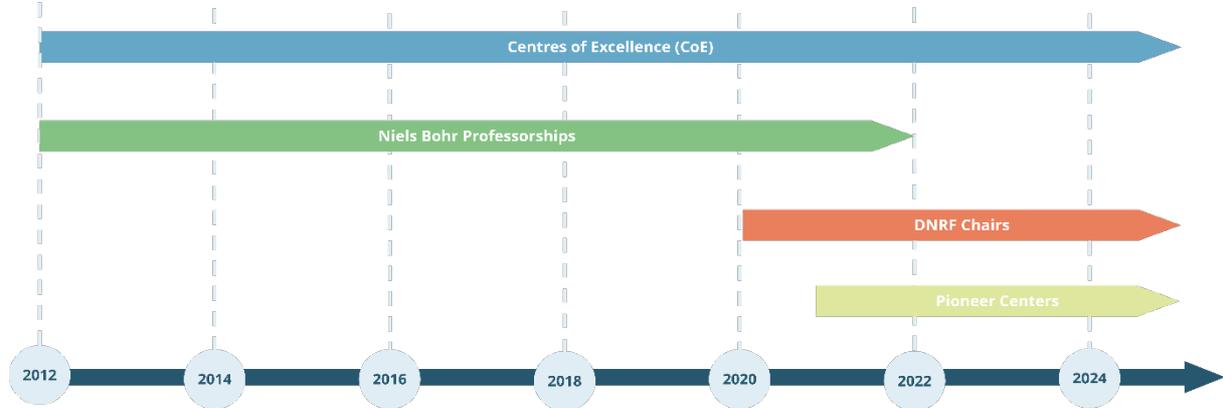
### 3.2 The DNRF programmes 2012-2025

Since 2012, the DNRF has launched two funding instruments beyond its core Centres of Excellence scheme. These instruments serve different purposes and target groups – from establishing transformative research in strategic areas to attracting international talent.

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<sup>4</sup> Statistics Denmark: Public research budget

Figure 3.1. Timeline of the DNRF's main funding instruments, 2012-25

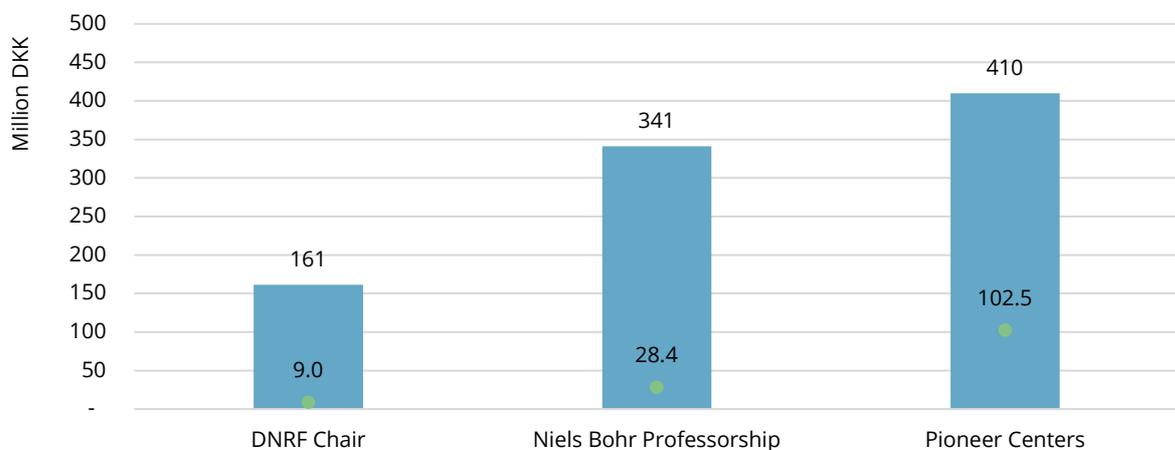


Source: DNRF (2025); "Self-assessment report"

**Pioneer Centres** were established in close collaboration with four major private foundations, Danish universities and the Ministry of Higher Education and Science. Their aim is to deliver transformative basic research in strategic societal areas, currently including AI, biomedicine, climate/land use, and Power-to-X. Each centre is co-founded and granted long-term support (13+ years). The initiative reflects a strategic turn toward collaborative large-scale initiatives with a focus on real-world challenges.

**The DNRF Chairs** were launched in 2020 with aim of supporting Danish universities in attracting outstanding researchers from abroad, including returning Danes. The programme offers up to DKK 10 million over three years to boost startup research activities. It covers all research fields, but due to a low and uneven application volume, the programme was discontinued after 2024. By February 2025, only 11 Chair Grants remained active.

Figure 3.2. DNRF grants for each programme (excluding CoE), total and average grant size, 2012-2025

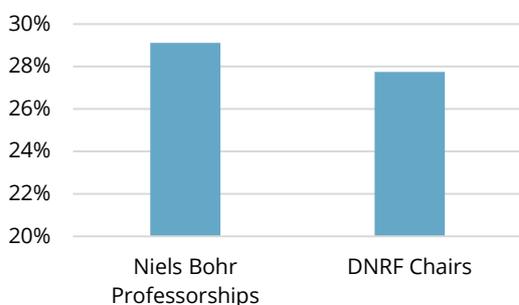


Source: Material from the Danish National Research Foundation

Note: Bars represent total DNRF grant volume for each programme in the period. Green dots indicate the average grant size per awarded project. The Pioneer Centres are co-financed by private foundations.

In addition, the period has entailed some **discontinued funding instruments**, the most prominent were the Niels Bohr professorships, which provided large-scale grants to recruit international researchers to Danish universities. In total, 21 professorships were awarded. As mentioned, the scheme was eventually phased out and replaced by the DNRF Chair Grants. Approximately one-fourth of the applications have been awarded grants in the two programmes. See figure below.

**Figure 3.3. Average success rate**



Source: Material from the Danish National Research Foundation

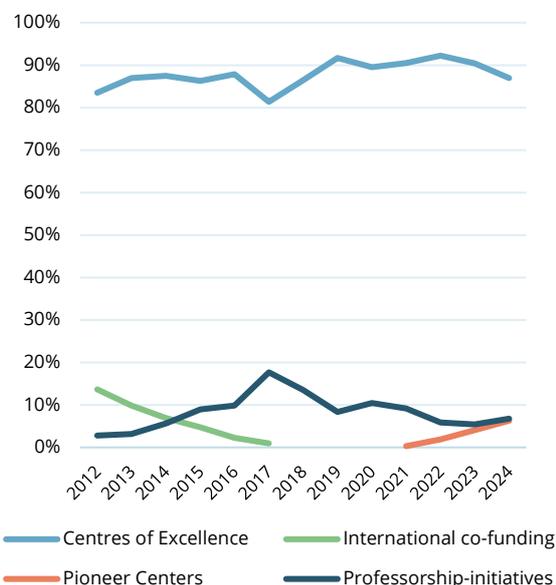
The foundation has also experimented with a series of bilateral cooperation agreements, including:

- A joint programme with the National Natural Science Foundation of China (2008–2017), which funded 10 Danish–Chinese research centres with the aim of fostering collaboration between leading researchers in the two countries.
- The NSF-GROW initiative with the US National Science Foundation (2009–2019), which supported PhD fellowships linked to Danish CoEs.
- A collaboration with the French National Centre for Scientific Research (2008–2014), designed to promote researcher mobility between France and Denmark.
- A targeted initiative with India (2012–2016), which co-funded three collaborative projects between Indian and Danish researchers.

These instruments have gradually been phased out as Danish research has become increasingly international in scope.

As figure 3.4 indicates, the Centre of Excellence scheme has by far been the most important instrument throughout the period in terms of amount of funding.

**Figure 3.4. Annual distribution of research activities, 2012-24**



Source: Material from Danish National Research Foundation

### 3.3 The Centre of Excellence Programme

#### 3.3.1 What is a Centre of Excellence?

The Centre of Excellence (CoE) is the DNRF’s primary funding instrument. The overall purpose is to support outstanding, curiosity-driven basic research by enabling a small number of excellent research environments to pursue long-term scientific agendas.

The CoE programme is designed to promote what the foundation refers to as frontline research – research that not only follows the international

frontier but aims to push beyond it. This involves a strong emphasis on scientific quality, originality, and willingness to take risks. Centres are expected to engage with major unsolved problems over a decade, and to do so with a high degree of autonomy and stability – elements that distinguish the programme from more conventional funding instruments.

### Box 3.1. Selection criteria for CoEs

**Scientific quality** is the primary criterion in the assessment of applications for new Centres of Excellence. Proposals must set out ideas for ambitious, innovative research with the potential to deliver genuinely groundbreaking results.

In its assessment, the foundation places particular emphasis on the following:

- **Ambition and originality** – the research idea must be both ambitious and original, with clear potential to achieve genuinely groundbreaking outcomes.
- **Leadership** – the centre leaders should be internationally recognised in their field, possess the necessary leadership skills, and have the time and capacity to direct a Centre of Excellence effectively.
- **Team composition** – the centre should bring together a group of co-applicants with high-level scientific expertise, capable of creating a creative and dynamic international research environment that will also provide optimal conditions for research training and for supporting early-career researchers.
- **Scope and structure** – the proposed centre's aims, structure and/or scale should enable research that could not readily be undertaken within other funding frameworks.

Grants are awarded in open competitions and typically span ten years (6+4-year model), with a mid-term evaluation serving both as reflection and

possible redirection. Since the first round in 1993/94, the DNRF has awarded 143 CoE grants across 12 application rounds, of which 44 centres remain active. The selection process involves international peer review, interviews, and a comprehensive assessment of excellence, ambition and leadership (see chapter 9).

Through the CoE programme, the DNRF aims to strengthen Danish research capacity at the highest international level, and to provide researchers with the conditions to pursue their most ambitious scientific ideas.

Since round 11 (2023), applicants to the CoE programme have been required to apply within one of two predefined budget frameworks: Up to DKK 6 million or up to DKK 10 million annually (equivalent to DKK 36 or 60 million over six years, incl. overhead). Previously, no fixed financial ceilings were in place, and centres could define their own budget needs.

Most CoE grants in the evaluation period fall within the range of DKK 57–66 million for the initial six-year period.

Since Round 1 in 1993/94, the average grant per centre for the entire 10-year period has increased from DKK 72.6 million to DKK 90.3 million in Round 12 and DKK 94.7 million in Round 11. This corresponds to an increase of 25–30%, while cumulative inflation over the same period has been around 75%. The average grant peaked in Round 10 (2019) at DKK 109.5 million<sup>56</sup>.

The funding from the DNRF is primarily used for salaries for temporarily hired staff (PhD students, postdocs, and a centre coordinator) and for data/databases, equipment, conferences, tests, travel, etc. The DNRF provides funds for the CoEs to hire an administrator or coordinator to assist and relieve the centre leader of some of the administrative and coordination burdens.

<sup>5</sup> In this round, a single very large grant of DKK 85 million was awarded the first six years.

<sup>6</sup> Source: Data from the DNRF. The calculations of average grant size in the latest rounds are based on the assumption that the average annual grant size do not change from first to second grant period.

The grant includes an overhead contribution to the host institution of 44%<sup>7</sup>.

### 3.3.2 Distribution across scientific areas and institutions

The portfolio of active Centres of Excellence reflects a wide disciplinary scope. While a majority of centres are anchored in the natural and health sciences, the programme also supports research environments in the humanities, social sciences, and technical sciences.

Table 3.1 shows the distribution of centre grants across scientific main areas for the past six rounds. It appears that around 70% of the centres fall within either the natural sciences or the health sciences.

The distribution largely mirrors Danish research in general, as these two areas account for about 60% of all full-time equivalent (FTE) academic staff years at public research institutions. However, the natural sciences are overrepresented, and the social sciences underrepresented, among the centres when compared to the overall distribution of research FTEs in Denmark. Furthermore, the table shows that the dominance of the natural sciences has been particularly pronounced in the past four rounds, where 23 out of 43 awarded applications (53%) have been rooted in the natural sciences.

It should be noted, however, that some centres are interdisciplinary, involving research groups from multiple scientific main areas.

**Table 3.1. Granted CoEs by scientific field, round 7-12**

|                             | Round 7<br>(2012) | Round 8<br>(2015) | Round 9<br>(2017) | Round 10<br>(2020) | Round 11<br>(2023) | Round 12<br>(2025) | Total     | Share of total |
|-----------------------------|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|-----------|----------------|
| Engineering and Technology  | 1                 | 4                 |                   | 1                  |                    | 1                  | 7         | 11%            |
| Humanities                  | 1                 | 1                 | 1                 | 1                  | 1                  | 2                  | 7         | 11%            |
| Medical and Health Sciences | 4                 | 5                 | 2                 | 1                  | 3                  | 3                  | 18        | 27%            |
| Natural Sciences            | 3                 | 2                 | 6                 | 7                  | 5                  | 5                  | 28        | 42%            |
| Social Sciences             | 2                 |                   | 1                 |                    | 2                  | 1                  | 6         | 9%             |
| <b>Total</b>                | <b>11</b>         | <b>12</b>         | <b>10</b>         | <b>10</b>          | <b>11</b>          | <b>12</b>          | <b>66</b> | <b>100%</b>    |

Source: Material from the Danish National Research Foundation

The CoE model is characterised by substantial and long-term funding enabling centres to build strong and resilient research environments (see Chapter 4). In addition to the grants provided by the foundation, many centres attract significant co-financing from host institutions and external partners.

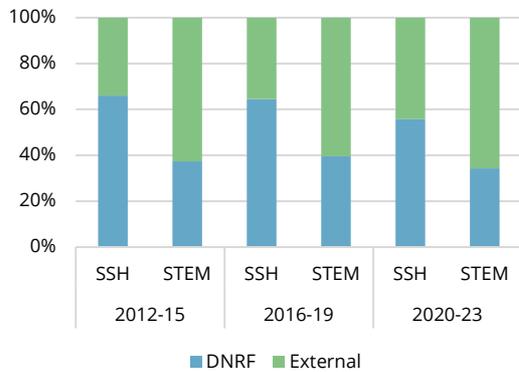
The external funding typically stems from a combination of private foundations – such as the Novo Nordisk Foundation, Villum Foundation, Carlsberg Foundation, and Lundbeck Foundation – as well as

public instruments including the The Independent Research Fund Denmark (DFF), the Innovation Fund Denmark (IFD) and EU-Funding.

The share of external funding varies across years and scientific disciplines, as shown in Figure 3.5. Not surprisingly, the external funding is higher within natural sciences, technical sciences and health sciences (STEM) than within humanities and social sciences (SSH).

<sup>7</sup> The overhead contribution of 44% applies to universities, while the corresponding rate for hospitals is 3.1%.

**Figure 3.5. Average funding split between the DNRF and external sources (SSH and STEM)**



Source: Material from the Danish National Research Foundation  
 Note: The figure shows the average funding distribution across CoEs within SSH and STEM fields combined.

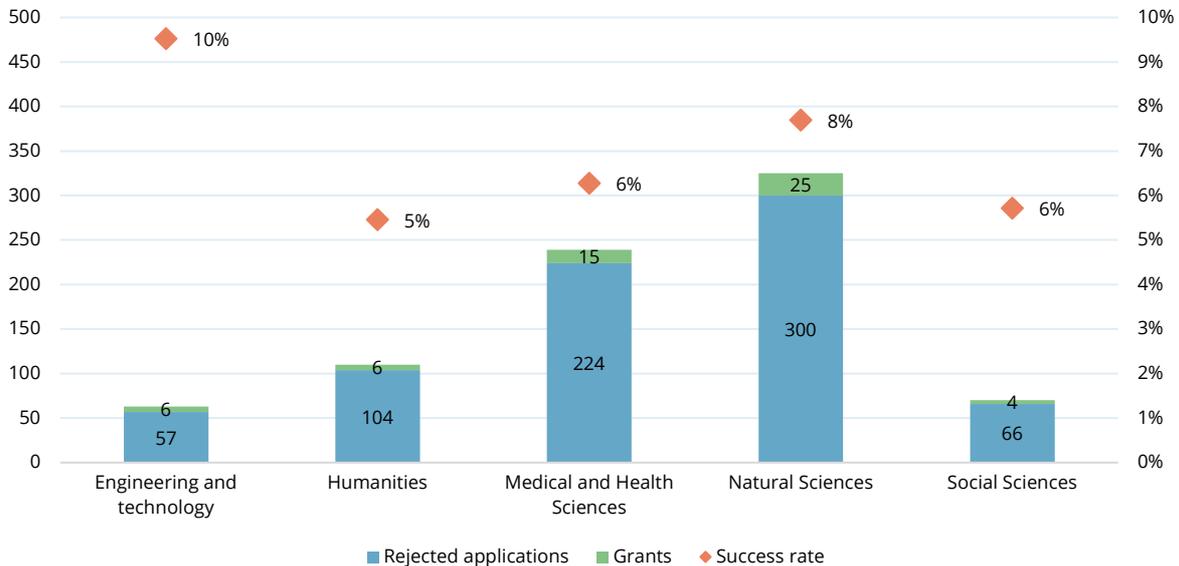
This distribution of centres across scientific areas is also reflected in the pattern of applications.

During round 8-12, 70% of the applications were rooted in natural sciences and health sciences, while social sciences accounted for less than 9% compared to a share of VIP-FTEs on almost 20% nationally.

As shown, the success rate has been highest within engineering and natural sciences – likely reflecting greater experience with applications for large grants and in the development and management of large research groups.

The lowest success rate is observed within the humanities, where only six out of 110 applications have been successful over the past five rounds.

**Figure 3.6: Distribution of applicants, grants and success rates across scientific areas (round 8-12)**

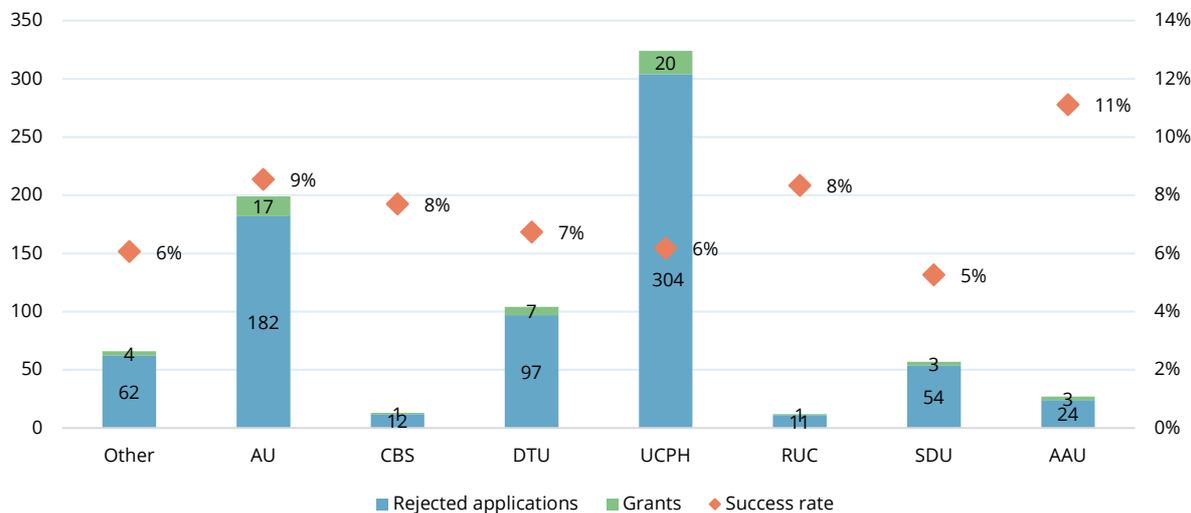


Source: Material from the Danish National Research Foundation

Figure 3.7 provides an overview of the distribution of applicants and grants across institutions during the same rounds.

As shown, the success rate varies between 5% (SDU) and 11% (AAU).

Figure 3.7: Distribution of applicants and grants on institutions (round 8-12 total)



Source: Material from the Danish National Research Foundation

### 3.4 Governance and management of the DNRF

The Danish National Research Foundation is governed by a board consisting of nine members, each with significant international research experience. The Minister for Higher Education and Science appoints the chair and one ordinary board member directly, while the remaining seven members are nominated by:

- The Independent Research Fund Denmark (3 members)
- The Danish Rectors’ Conference (1 member)
- The Director Generals’ Board of Applied Research Institutes (1 member)
- The Royal Danish Academy of Sciences and Letters (1 member)
- The Danish Academy of Technical Sciences (1 member)

The board holds full responsibility for the strategic direction of the foundation, including the design of funding instruments, evaluation criteria, and the selection of grants. It also oversees the foundation’s long-term financial strategy.

The foundation’s secretariat is based in Copenhagen and supports the board in the day-to-day administration. This includes grant management, coordination of evaluation processes, external communication, and the foundation’s ongoing dialogue with grant holders. The secretariat is organised to ensure close contact with grantees and to provide flexible administrative support tailored to the needs of applicants and institutions (see Chapter 9).

## 4. THE ROLE OF THE DNRF IN THE RESEARCH FUNDING SYSTEM

This chapter explores significant trends in the Danish research funding landscape and evaluates the role, timeliness and relevance of the DNRF and its funding instruments. The chapter includes an analysis of the additionality of the DNRF instruments and a discussion on how well CoEs are linked to other funding options in the research funding system.

### 4.1 Introduction

The Danish research funding landscape has undergone significant changes since the last evaluation of the DNRF took place in 2013.

When evaluating the role, timeliness and relevance of the DNRF and its funding instruments, two trends are important to highlight.

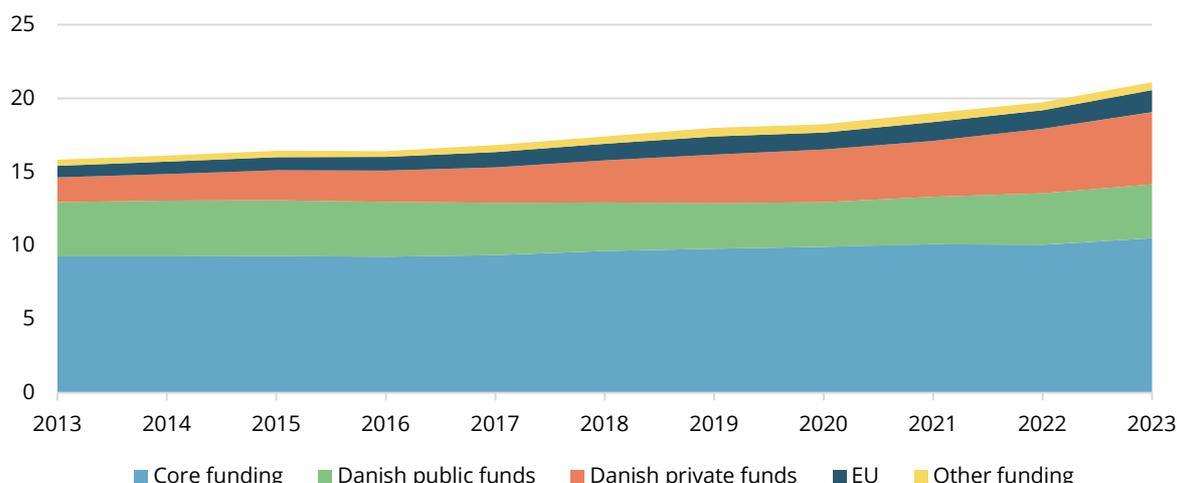
#### Significant increase in private funding

Between 2013 and 2023, private foundations nearly tripled their support for publicly performed research, increasing their share from 11% to 23%, while universities' core funding and public

competitive funds have remained stable. The development in universities' research revenues is displayed in Figure 4.1.

The figure shows that, in 2013, universities' research income comprised DKK 9.2 billion in core funding, DKK 3.7 billion from Danish public sources, DKK 1.7 billion from Danish private sources, and about DKK 1.2 billion from the EU and other sources. Ten years later, core funding totaled DKK 10.5 billion, public funding was unchanged at DKK 3.7 billion, private funding had risen to DKK 4.9 billion, and EU/other funding to DKK 2.0 billion.

**Figure 4.1. Development in universities' research revenues (billion DKK, current prices), broken down by sources**



Source: Universities Denmark, Statistical Database, Table A: Revenues

This growth has given private actors greater influence over research priorities – now also at low TRL levels, where particularly the Novo Nordisk Foundation has made large centre-based investments.

A decade ago, large centre-based investments were unique to the DNRF. The CoE is still among the largest research grants awarded. But the size and focus on basic research are no longer entirely unique to the DNRF.

Private funding has not only changed the composition of funding sources, it has also introduced new strategic logics and long-term commitments into the landscape. The Novo Nordisk Foundation stands out among private foundations, notably through investments in flagship centres that enjoy substantial autonomy and sustained funding horizons. Examples include the long-running Steno Diabetes Centre, CORC (focused on CO<sub>2</sub> storage and utilization), reNEW (stem-cell research), the Copenhagen Centre for Protein Research, and DTU Biosustain. These investments underscore a growing philanthropic presence in areas traditionally supported by public basic research funding.

Moreover, private funders' ability to move quickly, invest at scale, and support institutional capacity has made them key system actors, particularly in shaping new research fields and infrastructures. An example is Denmark's first AI supercomputer, named "Gefion" and funded by a public-private partnership between the Novo Nordisk Foundation and the Export and Investment Fund of Denmark (EIFO).

### **Increased earmarked public funding**

Another important trend to notice is the increased share of public research funding being politically prioritized.

Since 2013, Denmark has published a series of national research strategies aimed at aligning research investments with societal challenges and areas of strategic importance. The establishment

of the Innovation Fund Denmark (IFD) in 2014 marked a shift toward more coordinated and politically prioritized funding. This was followed by the Research 2025 catalogue in 2017, which identified promising research areas to guide strategic allocations from the research reserve.<sup>8</sup> In recent years, dedicated national strategies in fields such as quantum technology, artificial intelligence, and space have further shaped the research agenda.

These strategies have had a significant impact on the Danish research funding landscape by increasing the proportion of earmarked funds and reinforcing a mission-oriented approach. As a result, a growing share of public research funding is now negotiated and prioritised politically, with the share of funds allocated through the research reserve rising from 3.8% in 2017 to 20% in 2024.<sup>9</sup> While this has strengthened focus and coordination, it has also raised concerns about reduced room for bottom-up, investigator-driven research.

In Denmark, earmarked public research funding has historically been directed towards areas of strategic and political priority. Major allocations have included large-scale programmes in green transition and energy research (e.g. renewable energy, energy efficiency, and climate technologies), health and life sciences (such as cancer research, biotechnology, and pandemic preparedness), and digitalisation and technological innovation (including artificial intelligence, quantum technology, and cybersecurity). Additional earmarked funds have supported Arctic and maritime research, reflecting Denmark's geopolitical responsibilities, as well as social sciences and humanities initiatives linked to welfare, education, and integration policy.

A similar pattern can be detected in EU framework programmes that have moved toward more thematic and mission-oriented funding. The share of "free research" in EU programmes fell from 32% in Horizon 2020 to 26% in Horizon Europe.<sup>10</sup>

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<sup>8</sup> Danish Agency for Higher Education and Science (2017): "FORSK2025 - løfterige forskningsområder frem mod 2025"

<sup>9</sup> DEA (2024): "Forskningsreservens størrelse og struktur over tid"

<sup>10</sup> Vallgård et al. (2021): "Unge forskere: Flere øremærkede forskningsmidler truer fri forskning"

Against the backdrop of these two trends in the Danish research funding landscape, the remainder of the chapter evaluates the role, timeliness, and relevance of the DNRF and its funding instruments.

Section 4.2 compares the CoE programme with other major research grants available to researchers in Denmark. Section 4.3 examines how the CoE programme links to other research funding programmes, as these connections determine its leverage and long-term sustainability. Finally, Section 4.4 discusses the timeliness and relevance of other DNRF instruments — namely the Pioneer Centres and the DNRF Chairs.

## 4.2 Comparing the CoE grant with other large research grants

### Grant size, duration and focus

Denmark's research funding landscape combines nationally anchored instruments with EU-level excellence grants. In Figure 4.2 (next page), six major research grants are compared on size, duration and scientific focus.

The DNRF's Centres of Excellence (CoE) programme has historically been Denmark's largest and longest-horizon research grant. With an initial six-year period and the option of a four-year extension following a mid-term review, it remains the longest-term instrument. While most CoE awards fall in the range of DKK 57–66 million for the initial six years, other programmes now surpass the CoE in terms of annual funding — partly because the average grant size today is broadly unchanged from the first rounds in the 1990s, even though inflation has nearly doubled price

levels over time. Nevertheless, the CoE remains a flagship vehicle for long-term, curiosity-driven research across all fields.

The EU's European Research Council (ERC) complements the DNRF with bottom-up frontier funding in any discipline, awarded solely on scientific excellence. ERC Advanced Grants support established PIs for up to five years with up to EUR 2.5 million/DKK 18 million (higher if relocating to Europe) and ERC Synergy Grants back small teams for up to six years with budgets up to EUR 10 million/DKK 75 million.

Strategic, mission-oriented funding is provided by the Novo Nordisk Foundation (NNF) Challenge Programme, which selects annual themes addressing major societal and planetary challenges. Grants support natural sciences, medical sciences, and engineering with up to DKK 75 million per six-year project. In contrast to the DNRF, the NNF has adjusted the size of its Challenge Programme grants from DKK 60 million to DKK 75 million in response to inflation.

The Carlsberg Foundation's Semper Ardens Advance provides five-year grants to a single applicant or as a team of maximum four PIs. The total amount applied for must be within a budget of DKK 15-25 million and the grant is available to researchers within three scientific fields.

Finally, the VILLUM FONDEN's Villum Investigator programme targets outstanding experienced researchers in technical and natural sciences with six-year grants. Applicants already based in Denmark can seek up to DKK 30 million and leading researchers relocating to Denmark may apply for up to DKK 40 million.

Figure 4.2. Major research grants available to researchers in Denmark

|   |                            | Grant size (DKK)<br> | Grant duration<br> | Scientific focus<br> |
|---|----------------------------|---|--|---|
|  | DNRF Centers of Excellence | 60+40 million   | 6+4 years  | All fields  |
|  | ERC Advanced               | 18-26 million   | 5 years  | All fields  |
|   | ERC Synergy                | 75 million  | 6 years  | All fields  |
|  | Challenge Programme        | 75 million  | 6 years  | Natural sciences, medical sciences and engineering  |
|  | Semper Ardens Advance      | 15-25 million   | 5 years  | Natural sciences, humanities and social sciences  |
|  | Villum Investigator        | 30-40 million   | 6 years  | Natural sciences, medical sciences and engineering  |

Source: Foundations' websites

Note: From the 11th application round, the DNRF board decided to signal the possibility of applying for a CoE grant of DKK 36+24 million as an alternative to the traditional DKK 60+40 million.

All six instruments provide multi-year, excellence-based funding and expect international-level peer review and ambition. They differ chiefly in:

- **Grant size:** Largest single-award ceilings are the DNRF CoEs (if centres are awarded the full 6+4 years) followed by ERC Synergy and NNF Challenge (both up to DKK 75 million for 6 years).
- **Grant duration:** Most run 5–6 years. DNRF CoEs are the outlier with up to 10 years.
- **Scientific focus:** DNRF CoEs, ERC grants, and Carlsberg Accomplish are bottom-up across all fields. NNF Challenge is theme-driven within selected areas and Villum Investigator is bottom-up but has field boundaries.
- **Form and team setup:** ERC Advanced funds a single PI, Synergy funds teams, CoEs fund centres, NNF Challenge funds consortia, Carlsberg Accomplish and Villum Investigator fund individual PIs (often with groups).

The CoEs stand out from other large research grants with regard to its long horizon and all-inclusive scientific focus. In the social sciences and humanities there are not many alternative funding options available.

#### A capacity-building research grant

The CoEs operate as a capacity-building instrument that enables new research environments to be established or existing research groups to pursue completely new technologies and research hypotheses.

Interviews with centre leaders emphasise that the programme's extended duration and flexible budgeting de-risk exploration and allow strategic pivots when initial avenues underperform. As such, many centre leaders view the instrument as a framework grant.

For many centres, the path to research success (see Chapter 5) has involved pursuing new and uncertain experimental directions with a significant risk of failure. It has therefore been crucial to have 4–5 years of funding for curiosity-driven research

and the opportunity to explore ideas that emerged along the way. Such opportunities are not available to the same extent in private foundation programmes, which are of shorter duration or more tightly bound to specific research objectives defined in the calls.

Because selection is idea-driven, centre leader interviews report that teams can form across departments, institutions, and fields to match the scientific problem, moving from ad hoc collaboration to a coherent environment with joint appointments, shared seminar ecosystems, common data/IT backbones, and visiting scholar schemes.

The grant also provides the connective infrastructure that underpins durability. Interviews with heads of department and centre leaders stress the importance of appointing a dedicated coordinator and maintaining administration to professionalise operations, standardise recruitment and communication, and align the centre with host-institution strategies, space, and overhead arrangements. A CoE builds or adds to existing laboratories and facilities, major datasets, software, and analytic methods. Centre leader interviews indicate that these assets typically outlast the grant itself.

Over time, cohorts of researchers mature, spinout groups form, and follow-on awards (e.g., ERC, Vilium, DFF, NNF) sustain momentum so that, at grant end, the environment often persists as a recognised section, laboratory, or cross-faculty hub.

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*"We have used the grant to conduct research in an entirely new field and technology. We have gone from nothing to establishing unique infrastructure, producing strong publications, and building valuable collaborations with both universities and industry. Many new ideas and perspectives have been generated, giving rise to new research groups that have subsequently secured their own funding."*

**Anja Boisen,**  
**Professor and Centre Leader, IDUN**

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### **A prestigious sign of excellence**

Interviews with Heads of Department consistently characterise the CoE as Denmark's most prestigious research grant and a recognised "currency" across disciplines because awards are made on scientific excellence. They also stress that applicants compete across all scientific fields, which signals quality system-wide and strengthens the badge value of the grant.

Centre leader interviews echo that the CoE brand elevates visibility and prestige – especially in Denmark - facilitating recruitment and collaboration, while noting that ERC Advanced can be more visible internationally.

In practical terms, heads of department interviews report that CoEs often influence strategic prioritisation within host institutions and can be leveraged to secure institutional resources. An example put forward by the head of a social science department is that the CoE label has eased access to supercomputer facilities. Such facilities in high demand tend to be allocated to natural and life sciences. But a CoE is recognised as equally excellent across scientific fields.

Both centre leaders and heads of department observe that receiving a CoE markedly raises national and international profile and is widely regarded as a hallmark of excellence reinforcing the programme's role as a system-level sign of quality.

### **CoE provides clear additionality**

Taken together, interviews with centre leaders and heads of department indicate that CoE provides clear additionality relative to other funding instruments. The instrument is explicitly oriented to frontier, curiosity-driven research, with a long horizon and flexibility that enables environment-building in ways shorter, themed or mission-oriented schemes generally do not.

The survey of centre leaders supports these interview findings. In Figure 4.3, a majority of centre leaders disagree that there is "considerable overlap" between CoE and other national programmes (69%), EU programmes (66%), or private

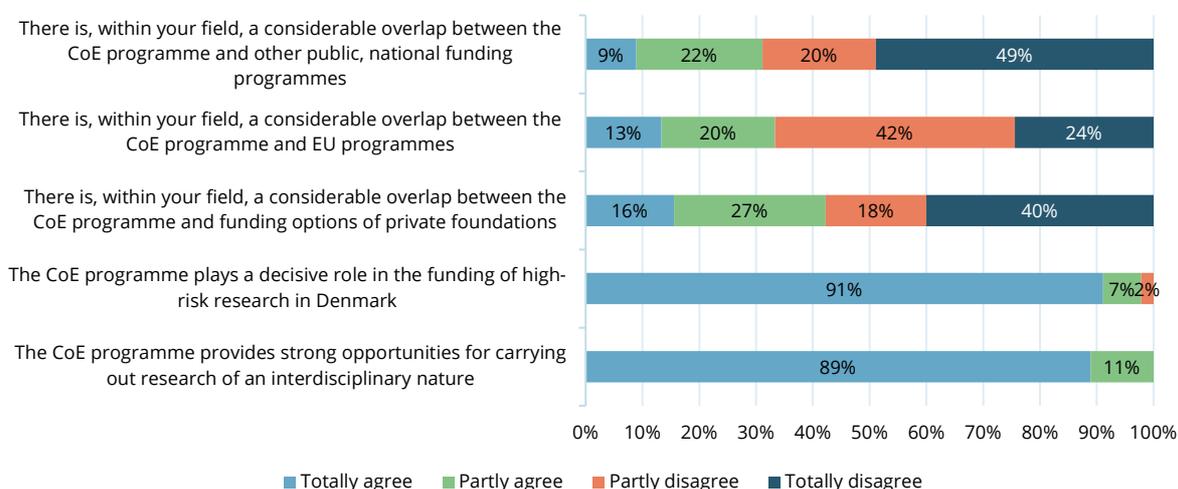
foundation options (58%). 91% totally agree the programme plays a decisive role in financing high-risk research, and all respondents assess that CoE provides strong opportunities for interdisciplinary work (89% totally agree and 11% partly agree).

This distinctive role is also illustrated in interviews, where proposals considered “too high risk” for other elite schemes have been able to progress within the CoE.

In interviews, several centre leaders stress that CoE is the only programme that truly supports free research and allows a research environment to be built, while working in complement with later, more targeted grants once the platform exists.

The CoE’s non-thematic remit and emphasis on basic research distinguish it from increasingly thematised EU schemes and from private foundations’ mission-driven calls.

**Figure 4.3. CoEs role and position in the research funding landscape**



Source: Survey of centre leaders  
Note: N=45.

In the survey, centre leaders were asked to indicate what they believe would have happened if their application had been rejected by the DNRF. In that question, centre leaders could choose among four options, ranging from “we would probably not have initiated the supported research” (high additionality) to “a similar project would have been carried out with alternative funding” (low additionality). The results across scientific fields are shown in Figure 4.4.

The figure shows that a strong additionality of the CoE instrument is fairly consistent across disciplines.

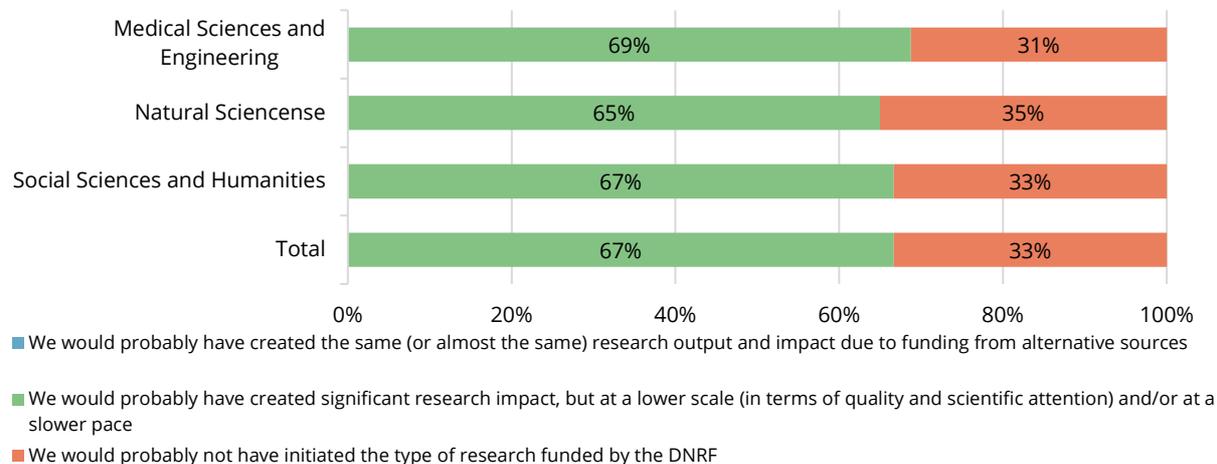
Across scientific fields, two-thirds of the centre leaders report they would have produced significant research impact but at a lower scale and/or

slower pace without CoE funding, while around one-third state they would not have initiated the CoE-funded line of research at all.

Notably, no respondents report they would have achieved the same output and impact from alternative sources.

The pattern is consistent across disciplines, with only minor variation. This is interesting as the natural sciences, medical sciences and engineering have more funding options available from private foundations than the social sciences and humanities. Nevertheless, the CoE grant shows strong additionality in all fields confirming the picture of a unique instrument capable of establishing novel research environments.

**Figure 4.4. Additionality of the CoE programme**



Source: Survey of centre leaders  
 Note: N=45.

### 4.3 Links to other programmes

An evaluation of the CoE instrument should also examine how it connects to other research funding programmes, as these linkages are central to its leverage and long-term sustainability.

#### Systematic gearing

The evaluation shows that CoE acts as a platform that systematically gears additional awards – often at least on a 1:1 basis, and in several cases substantially more (see also Figure 3.5 in the previous chapter, which illustrates the split between DNRF funding and external funding of CoEs).

Interviews with centre leaders describe the CoE as deliberately structured to attract additional funding: the centre framework provides a visible, long-horizon platform that enables coordinated grant-seeking.

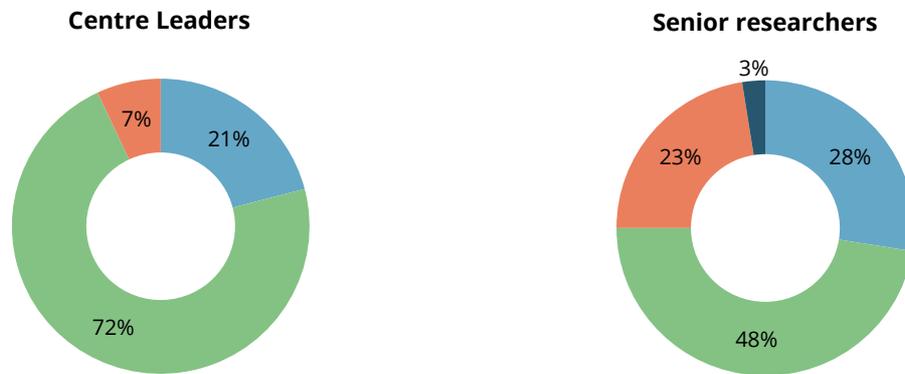
Centre leader interviews also point to the ability of CoEs to attract international fellows, who over time secure individual grants – such as Sapere Aude, ERC Starting Grants, and programmes

supplied by private research foundations – and become additional ‘application engines’ for the environment.

Interviews with heads of department highlight organisational features that support this gearing: administration anchored at the host institution (financed via overheads) and the reuse of centre processes and staff across successive centres, which help to professionalise application pipelines and grant management.

In the surveys, centre leaders and senior researchers were asked to assess links to other programmes. Overall, the results (Figure 4.5) support the points above: only 7% of centre leaders report a genuine funding gap for pursuing follow-up research ideas. Among senior researchers, the share is higher, perhaps reflecting that intense competition for research funding is felt more keenly at the individual level. Respondents generally consider opportunities to secure funding for specific follow-up projects to be good, whereas fewer find it feasible to continue centre-level activities in their entirety through follow-up grants.

**Figure 4.5. Links to other funding options**



- There are good opportunities to continue the research and further develop the environment (supported by the DNRF-grant) through follow-up funding from other programmes
- Individual researchers have good opportunities to secure funding for follow-up research, but it is difficult to maintain or further develop a cohesive research environment
- A funding gap between CoE grants and other programmes makes it challenging to sustain the centre's research activities or secure follow-up funding
- Not relevant

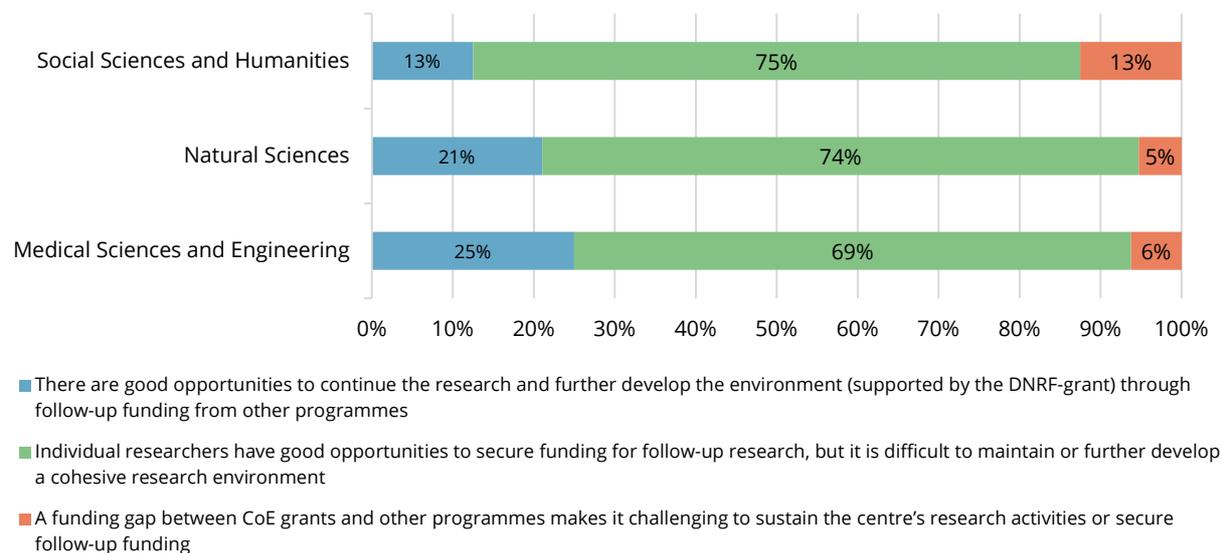
Source: Survey of centre leaders and senior researchers

Note: N=43 Centre leaders & N=80 Senior researchers. Responses marked as "Too early to say" or "Do not know/remember" are excluded from the figure (see appendix 1).

Figure 4.6 shows responses to the same survey question by scientific field. The share reporting viable environment-level continuation is lowest in the social sciences and humanities (13%) and higher in the medical sciences and engineering

(25%) and the natural sciences (21%). By contrast, explicit funding gaps are most common in the social sciences and humanities (13%) and less frequent in the natural sciences (5%) and in the medical sciences and engineering (6%).

**Figure 4.6. The links to other funding options – by scientific domains**



Source: Survey of centre leaders  
 Note: N=45.

Taken together, the interviews and survey suggest that CoEs are well linked to the wider portfolio for individual progression and additional funding, but that post-grant environment sustainability and talent retention can be difficult - particularly in the social sciences and humanities.

**Most environments continue after grant end**

Interviews with heads of department and centre leaders emphasise that the need, relevance and appetite to maintain a CoE environment at grant end vary markedly. Heads of department note that while many centres build an identity and capacity that continue long after the grant ends, others are exhausted after ten years and should naturally wind down.

Examples from the interviews include the Centre on Autobiographical Memory Research (CON AMORE), founded as a CoE in 2010 at Aarhus University’s Department of Psychology and Behavioural Sciences. The centre leader has successfully attracted follow-up grants after the CoE ended in 2020, and the department has agreed to cover

secretarial support for the centre leader and continue to provide facilities for the centre to be physically co-located.

An example of a CoE that pivoted to new but related themes is the Centre for Financial Frictions (FRIC) at CBS, established in 2012. In 2023, CBS was awarded a successor CoE led by one of the senior researchers from the former centre.

There are also examples of CoEs that were closed owing to collaboration difficulties, and cases where environments became fragile when a lead PI moved to another institution.

Overall, however, most environments continue after the grant ends. As indicated in Figure 4.5, continued research within these environments is often supported by individual grants, enabling senior researchers to pursue new research angles or application tracks originating from the CoE.

**Continued capacity building after the expiry of a CoE grant**

Several centre leaders highlight both the need and the potential for continued investment in capacity

building – even after the conclusion of a CoE grant. This is particularly relevant in new technological fields such as quantum technology and nanotechnology for medical applications. As illustrated in Figures 4.5 and 4.6, follow-up funding opportunities are most often linked to applications for individual projects, while options for sustained capacity building and the retention of strong core environments remain more limited.

Moreover, follow-on grants are frequently tied to the strategies of private foundations. For many centres, this poses no challenge, as the objectives and priorities of these foundations often align well with pursuing application-oriented perspectives. Yet, there are also centres for which the termination of a D NRF grant risks the loss of unique research capacity or constrains its further development.

Against this backdrop, there appears to be considerable potential for fostering stronger synergies between major public and private research investments. This is especially relevant in emerging research fields that have not yet gained significant traction in national research strategies or in perceptions of Denmark's areas of strength.

#### **Different strategies for talent retention**

Interviews with heads of department show wide variation in ambitions and strategies for retaining early-career researchers recruited to CoEs.

Heads of department welcome the D NRF's removal of requirements for embedded posts, noting this reduces lock-in and creates more freedom to recruit and operate after grant end. Some institutions keep permanent hiring decisions independent of CoE activities, while elsewhere, CoE flexibility is used to recruit quickly and stabilise promising talent.

In some departments, a local policy of not hiring their own PhD graduates limits internal retention. In most cases, however, the CoE functions as a structured talent pipeline for the department and

many early-career researchers subsequently stay to found their own research groups. In one case (stemming from the Copenhagen Centre for Glycomics), five former centre researchers now lead their own groups in an expanded environment of approximately 50 senior researchers.

Heads of department underline that centre leaders differ in how actively they “lift” younger colleagues. Nonetheless, CoEs often function as talent factories where early-career researchers progress to either academic awards or industry placements.

Chapter 7 examines the career development of affiliated early-career researchers in more detail.

## **4.4 Timeliness and relevance of other D NRF instruments**

Today, the D NRF operates two additional funding instruments alongside its core CoE scheme – the Pioneer Centres and the D NRF Chairs (see Chapter 3 for descriptions). Below, the timeliness and relevance of each instrument are discussed in light of the changes in the Danish research funding landscape outlined at the start of this chapter.

### **Pioneer Centres**

The origins of the Pioneer Centres lie in the Government's 2017 strategy for research and innovation<sup>11</sup>. With the ambition of lifting the pinnacle of Danish research to Nobel Prize level, the Government commissioned the D NRF to form a partnership with private foundations to improve synergy in the funding landscape and to establish an ambitious funding framework with a long time horizon that would enable research results capable of competing with the very best internationally.

While the CoE scheme focuses exclusively on scientific excellence in basic research, the Pioneer Centres aim to bridge basic research with application-oriented efforts.

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<sup>11</sup> Regeringen (2017): “Danmark klar til fremtiden - Regeringens mål for dansk forskning og innovation”

Four Pioneer Centres have been established in close collaboration between the Ministry of Higher Education and Science, the DNRF, and Denmark's major private research-funding foundations. The participating foundations decided that the initiative would focus on artificial intelligence and climate/energy and allocated a total budget of DKK 1.15 billion to support the four Pioneer Centres.

The Pioneer Centres are granted considerable freedom in their research, financial continuity, and time horizon. They are funded for at least 13 years, with no stop/go evaluation. A possible five-year extension is described in the implementation plan for Pioneer Centres but would require the involved foundations to allocate additional funding.

Interviews with two Pioneer Centre leaders indicate that the large upfront grant – and particularly the 13-year timeline without a stop/go evaluation – enables the centres to attract the world's leading researchers. Such researchers often require positions guaranteed beyond six years and startup packages including PhD students and postdoctoral researchers. Furthermore, whereas a CoE grant is usually budgeted with only a small uncommitted buffer, the Pioneer Centre grant is large enough to allow a substantial reserve to be held for special opportunities that may arise – another feature that is attractive to top talent.

However, many of the features that positively characterise Pioneer Centres are also core features of the CoE scheme – namely extensive flexibility, interdisciplinarity, and the DNRF's strong commitment to, and high degree of trust in, the centre.

In interviews, all participating foundations agreed that the Pioneer Centre initiative has strengthened collaboration among funders, and most expressed openness to further co-funded initiatives.

However, several representatives noted that a fully inclusive model should not be a requirement for future calls, as the coordination and administrative burden proved too demanding. With a full-cost model now established – combining elements

of public and private foundations' funding models – bilateral or trilateral partnerships are expected to be easier to pursue if more Pioneer Centres are decided on in the future. It is, however, too early to fully evaluate the additionality of Pioneer Centres relative to CoEs, which, as mentioned above, often attract additional funding.

### **The DNRF Chairs**

Launched in 2020, the DNRF Chairs programme replaced the Niels Bohr Professorships as an instrument to support universities in attracting outstanding researchers from abroad. While the DNRF Chairs were open to all research fields, a lower-than-expected number of applications led the DNRF Board to decide not to continue the initiative beyond its planned five-year period.

In interviews, stakeholders across the research funding landscape expressed support for the decision. They noted that similar funding opportunities already exist for research institutions, reducing the need for the DNRF Chairs. The most relevant alternatives cited were the Villum Investigator programme and the Novo Nordisk Foundation Start Package Grants. However, these instruments are not available to the social sciences and humanities. Nevertheless, an analysis of awarded DNRF Chairs shows that only 17% of the total budget was awarded to chairs in the social sciences and humanities, suggesting that the need for such an instrument is limited.

## **4.5 Conclusion**

Despite the growing scale and influence of private foundations, the DNRF continues to play a highly relevant, central, and distinctive role in Denmark's research funding system. Its bottom-up selection on scientific excellence, long time horizons, and flexibility provide clear additionality: the DNRF anchors new research environments, catalyses high-risk discovery, and gears substantial external funding (often on at least a 1:1 basis), while serving as a system-level benchmark for quality across fields.

Within this role, the Centres of Excellence should remain the foundation's core instrument – and, in effect, its DNA. The programme's defining features – curiosity-driven scope, interdisciplinarity, long-term and flexible support, and professionalised centre organisation – are precisely what enable durable capacity building and world-class results. Maintaining and sharpening the CoE model, while ensuring complementarity with other national and private schemes, is therefore the most effective way for the DNRF to sustain its unique contribution to the research ecosystem.

The Pioneer Centres may serve as a relevant supplement, but it is still too early to assess the effects and additionality of this instrument. Finally, the interviews indicate that the need for additional schemes aiming at attracting international professors is limited.

Taken together, the interviews and survey responses suggest that while CoEs are generally well connected to broader funding opportunities for individual career progression and additional projects, ensuring sustainability of the research environment and retaining talent after a grant expires can be challenging — particularly in the social sciences and humanities, as well as in emerging technological fields.

Follow-on grants are often tied to the strategies of private foundations. While this alignment poses no challenge for many centres, there are also cases where the conclusion of a DNRF grant risks the loss of unique research capacity or hampers its further development.

In this context, there is significant potential to strengthen synergies between major public and private research investments.

## 5. SCIENTIFIC IMPACT

**This chapter examines the scientific output and impact of the research conducted in the CoEs since 2012. It does so by comparing the research output with relevant reference groups. The chapter also explores the extent to which research in the CoEs leads to scientific breakthroughs. Finally, it discusses whether and how the CoE instrument plays a vital role in generating scientific excellence.**

### 5.1 Introduction

This chapter evaluates the academic performance of the CoEs, and the role of the grants in generating academic output and excellence in the supported research environments.

To ensure that the conclusions are well-founded and balanced, we draw on multiple data sources:

- Bibliometric analyses comparing the academic performance of publications stemming from the research in the CoEs with three reference groups (see box 5.1).
- Data from surveys targeting centre leaders and affiliated researchers, respectively.
- Interviews with centre leaders and department heads/directors from Danish universities.

Individually, these sources do not provide a complete picture of the effects of the DNRF grants but together they offer a robust basis for evaluating the impact of research programmes<sup>12</sup>.

The bibliometric analyses are based on publication data from CoEs active during the period 2012–23 (and thus established in application rounds 3–11). The classification of scientific fields follows the structure used in the bibliometric database Scopus. Consequently, the scientific fields applied in this chapter are not identical to those used in

Chapter 3, which are based on DNRF's own classification of research areas.

#### Box 5.1. Reference groups

To assess the scientific impact of the DNRF CoEs, three reference groups have been constructed to serve as benchmarks:

- All Danish scientific publications
- Other Nordic Centres of Excellence
- ERC Advanced Grant project publications

The first group includes all Danish publications in the relevant period and provides a baseline for comparing DNRF-funded research with the overall Danish research output.

The second group comprises publications from CoEs in Finland, Sweden, and Norway, and enables benchmarking against similar programmes.

The third group consists of publications by recipients of ERC Advanced Grants – an elite segment of European researchers selected through a highly competitive process. For comparison, we have constructed a group of publications from ERC Advanced Grant projects that resemble the DNRF articles in terms of publication year, scientific field, and type of publication. This group makes it possible to benchmark the DNRF research against the highest-performing segment of European science.

<sup>12</sup> In line with established good practice in research evaluation, we assess scientific impact using a mixed-method approach, see, for example Palinkas et al., (2019): "Innovations in Mixed Methods Evaluation" & Abudu et al. (2024): "Improving the reporting of research impact assessment: a systematic review of biomedical funder research impact assessments"

## 5.2 Academic production

An important ambition of the DNRF is to foster an increase in the scientific output of the participating researchers. The first step in assessing this ambition is to examine the academic output of the CoEs. In practice, however, this is difficult to measure precisely, as scientific articles may often result from research supported by multiple grants. To address this, the analysis draws on publication lists submitted by each centre to the DNRF. These lists reflect the judgement of the CoE leaders regarding which articles can reasonably be attributed to the centre. It should be noted that this approach does not remove potential overlaps with publications reported under other grants, but it ensures that the publications included represent what the centres themselves consider to be their core output.

Table 5.1 provides an overview of the total academic output generated by the Centres of Excellence in the period 2012-23. In total, more than 27,000 scholarly contributions were registered during the period.

**Table 5.1. Academic production in CoEs, 2012-23**

| Type   | Output        |
|--|---------------|
| <i>Scholarly outputs with DOI, e.g. journal articles, review papers, and conference papers</i> | 18,719        |
| <i>Journal articles without DOI</i>  | 2,055         |
| <i>Conference proceedings, abstracts and papers</i>  | 1,952         |
| <i>Book chapters</i>   | 1,267         |
| <i>PhD theses</i>  | 1,060         |
| <i>Other</i>   | 943           |
| <i>Master &amp; Bachelor theses</i>  | 460           |
| <i>Books and monographs</i>  | 185           |
| <i>Working papers</i>  | 151           |
| <i>Edited volumes (books and journals)</i>   | 93            |
| <i>Reviews</i>   | 69            |
| <i>Patents</i>   | 52            |
| <b>Total</b>   | <b>27,006</b> |

Source: Material from the Danish National Research Foundation

The largest academic outputs consist of scholarly publications with a DOI (Digital Object Identifier) – a category that includes peer-reviewed journal articles, review papers, and conference papers published through formal academic channels. These publications amount to nearly 19,000 contributions.

In addition, the centres have produced a wide range of academic outputs without a DOI, including journal articles, conference contributions, as well as book chapters, edited volumes, and monographs.

Such publication formats are particularly common within the humanities and social sciences, where books and book chapters often serve as primary channels of scholarly communication.

The table also reports a substantial number of PhD dissertations, master’s theses, and bachelor’s theses produced within the CoEs.

This highlights the important role of the centres in research training and higher education (see Chapter 6-7).

### Bibliometric analysis of academic production

The following section examines the scientific output of the CoE’s using bibliometric indicators.

Bibliometrics is a widely applied method for assessing research output and impact based on quantitative data on publications and citations.

The analysis is based on data from Scopus, which provides the broadest coverage of Danish research publications among international bibliometric databases<sup>13</sup>.

In interpreting the bibliometric analyses, it is important to be aware that they only include articles with a DOI published in journals indexed in Scopus. This means that publication formats less

<sup>13</sup> Ministry of Higher Education and Science (2018): “Forskningsbarometer 2018”

frequently covered by the database – such as books and book chapters – are excluded.

Scopus has particularly strong coverage in the health sciences, technical sciences, and natural sciences, where approximately 90% of Danish university research is indexed. Coverage is also relatively high in the social sciences and in interdisciplinary research, while it is more limited in the humanities, where just over half of research publications are typically included.

Out of 18,719 scholarly outputs with a DOI, 14,661 were identified in Scopus.

### Annual production of the CoEs

Figure 5.1 provides an overview of the total scholarly output from the CoEs since 2012 and

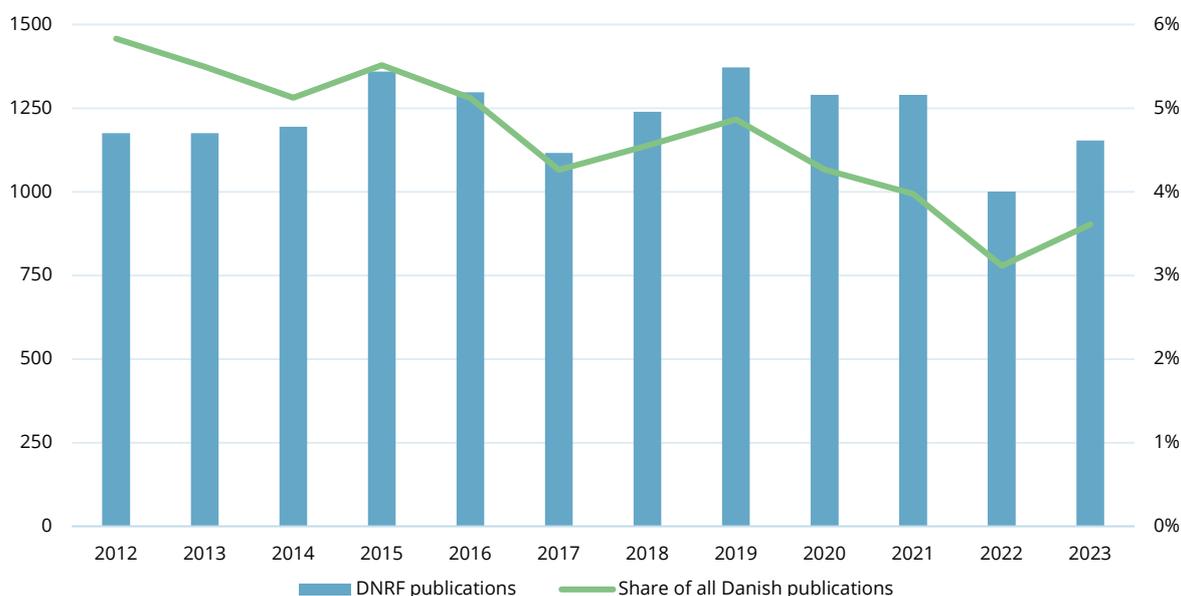
highlights the centres’ share of overall academic production in Denmark.

The total number of articles varies from year to year, peaking in 2019 at nearly 1,400 publications. The annual average is approximately 1,220 publications, corresponding to 4.5% of total Danish research output during the period (covered by Scopus).

The figure also reveals a decline in the DNRF articles’ share of total academic production in Denmark, from nearly 6% in 2012 to just under 4% in 2023.

The development reflects the DNRF’s diminishing share of research funding in Denmark (see Chapter 4).

**Figure 5.1: Annual number of DNRF articles and their share of total Danish scientific output, 2012–23**



Source: Scopus and data from CORDIS, the DNRF and other Nordic Research Foundations  
 Note: Scientific publications include articles, reviews and conference papers with a DOI.

### Significant differences in the number of articles published across scientific fields

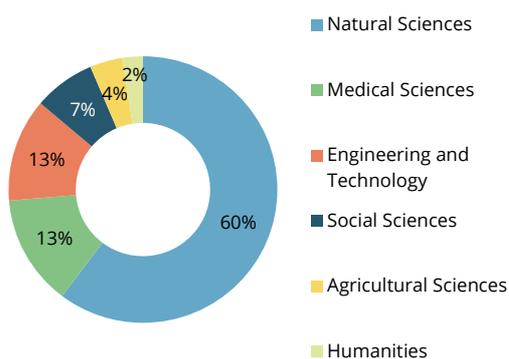
As shown in Figure 5.2, 60% of the DNRF articles are published within the Natural Sciences. Medical Sciences and Engineering and Technology follow, each accounting for 13% of the total.

The relatively low share of articles within the Social Sciences and Humanities should be seen in light of two factors. First, the DNRF has funded comparatively few CoEs in these fields.

Second, bibliometric databases provide more limited coverage of research within the Social

Sciences and Humanities. Consequently, the lower publication share does not necessarily reflect lower levels of research activity within centres in these areas.

**Figure 5.2. The DNRF articles by scientific fields, 2012-23**



Source: Scopus and data from CORDIS, the DNRF and other Nordic Research Foundations  
 Note: Scientific publications include articles, reviews and conference papers. Articles are classified into scientific fields by Scopus.

The table below provides a more detailed picture of the DNRF articles, broken down by scientific subfields. It shows the share of total Danish article production accounted for by the DNRF articles within each subfield.

**Table 5.2. DNRF articles by subfields and their share of Denmark’s total output, 2012-23**

|  | No. of articles | Share of Danish articles |
|--|-----------------|--------------------------|
| <b>Natural Sciences</b>                  |                 |                          |
| Physical sciences                        | 5,304           | 15.9%                    |
| Biological sciences                      | 3,688           | 5.3%                     |
| Earth and related environmental sciences | 3,485           | 7.2%                     |
| Chemical sciences                        | 222             | 6.8%                     |
| Computer and information sciences        | 739             | 2.0%                     |
| Mathematics                              | 1,275           | 7.0%                     |
| <b>Engineering and Technology</b>        |                 |                          |
| Materials engineering                    | 1,474           | 7.6%                     |
| Electrical engineering                   | 593             | 2.6%                     |

|  |       |      |
|--|-------|------|
| Chemical engineering                                 | 410   | 2.3% |
| Mechanical Engineering                               | 320   | 2.5% |
| <b>Medical and Health Sciences</b>                   |       |      |
| Basic medicine                                       | 1,606 | 2.7% |
| Clinical medicine                                    | 1,335 | 1.5% |
| Health sciences                                      | 167   | 0.7% |
| Medical biotechnology                                | 138   | 3.5% |
| <b>Social Sciences</b>                               |       |      |
| Economics and business                               | 635   | 4.7% |
| Psychology and cognitive sciences                    | 470   | 4.3% |
| Political Sciences                                   | 188   | 1.6% |
| Law  | 150   | 2.3% |
| <b>Humanities</b>                                    |       |      |
| History and archaeology                              | 221   | 7.5% |
| Languages and literature                             | 77    | 2.7% |
| Philosophy, ethics and religion                      | 67    | 2.9% |
| Arts (arts, history of arts, performing arts, music) | 42    | 3.7% |
| <b>Agricultural Sciences</b>                         |       |      |
| Agriculture, forestry, and fish-ery                  | 540   | 4.0% |
| Animal and dairy science                             | 187   | 1.8% |

Source: IRIS Group based on data from Scopus  
 Note: Scientific publications include articles, reviews and conference papers with a DOI. A single article may be attributed to multiple scientific fields. Articles are classified in scientific fields by Scopus.

The table indicates that the DNRF grants play a particularly important role in Danish research within several areas of the natural sciences – especially in the Physical Sciences.

More than 5,000 DNRF articles have been published in this subfield, accounting for nearly 16% of all Danish articles. The DNRF also plays a significant role in a number of other subfields, including Materials Engineering and History and Archaeology, where the DNRF articles represent more than 7% of total Danish research production in both areas.

**Strong international collaboration**

Another important objective of the DNRF is to promote internationalisation of Danish research. One

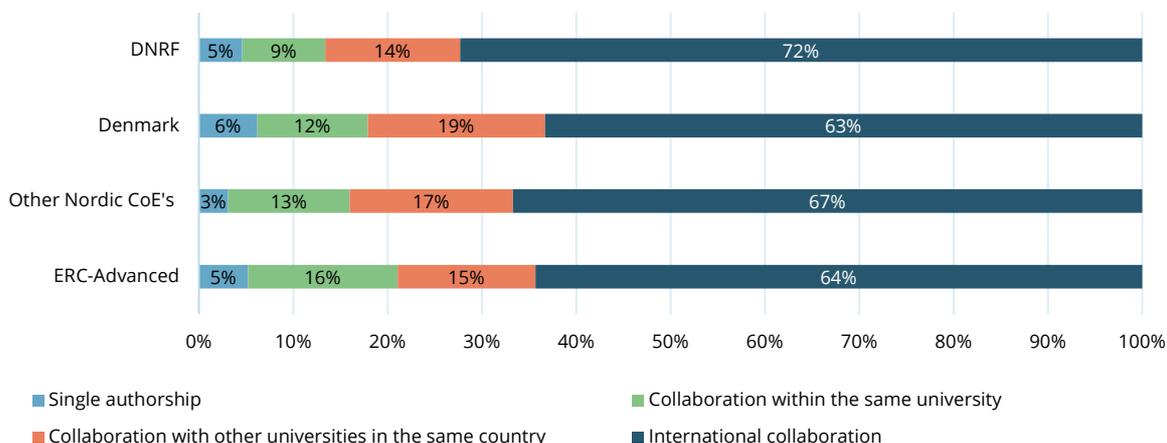
way to assess this is by examining the share of scientific articles co-authored with researchers employed at foreign research institutions.

More than 70% of the DNRF articles are published in collaboration with researchers employed at foreign research institutions, as shown in Figure 5.3.

This is a higher share than in the benchmark units and demonstrates that researchers at the CoEs are strongly internationally oriented, collaborating with a wide range of partners worldwide.

Only a very small proportion (5%) of DNRF articles are single-authored – a pattern observed across all comparison units. This reflects the highly collaborative nature of contemporary research.

**Figure 5.3. Share of articles co-authored with researchers from other universities in Denmark and abroad, 2012-23**



Source: Scopus and data from CORDIS, the DNRF and other Nordic Research Foundations  
 Note: Scientific publications include articles, reviews and conference papers with a DOI.

### Significant increase in open access articles

Open Access (OA) is a key priority in Danish research policy, and both the DNRF and the Danish Ministry of Higher Education and Science are actively engaged in promoting broader access to new knowledge<sup>14</sup>.

Easier access to publicly funded research is seen as essential to ensuring that both the research community and society at large can benefit from the latest scientific advances.

As shown in the figure below, more than 80% of DNRF articles were openly accessible in 2023. From 2012 to 2023, the share of the DNRF articles

published in non-accessible journals declined significantly. Compared to the Danish average of around 75% in 2023, the DNRF articles have a slightly higher level of Open Access<sup>15</sup>.

There has been a clear increase in the share of Gold OA, where the final version of the article is freely available on the publisher’s website. At the same time, the share of Green OA – where a version of the article is deposited in a publicly accessible repository – has remained relatively stable.

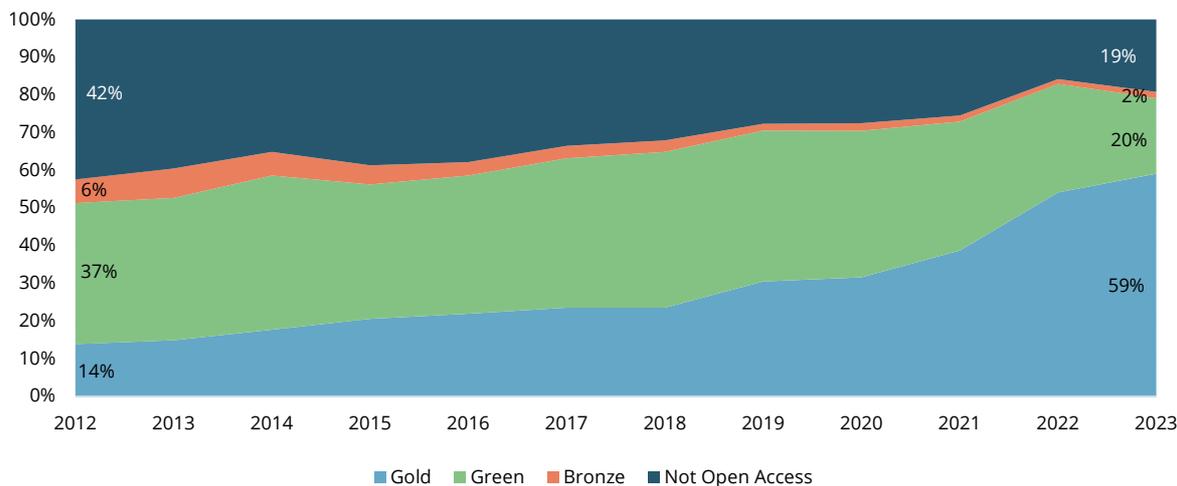
Bronze OA, covering articles freely available on the publisher’s website but without a clear open license, only accounts for a small share.

<sup>14</sup> Ministry of Higher Education and Science (2018): “Denmark’s National Strategy for Open Access”

<sup>15</sup> Ministry of Higher Education and Science (2018): “Evaluering af Danmarks Nationale Strategi for Open Access”

This indicates that researchers at the CoEs contribute strongly to making research openly available – in line with national policy ambitions.

**Figure 5.4. Development in the share of DNRF articles published in Open Access journals, 2012-23**



Source: IRIS Group based on data from Scopus

Note: Scientific publications include articles, reviews and conference papers with a DOI.

### CoEs strengthen researchers' ability to publish scientific articles

In the survey, we ask the centre leaders to assess the extent to which the DNRF grant has strengthened their local research environment's capacity to produce scientific articles and publish in recognised journals.

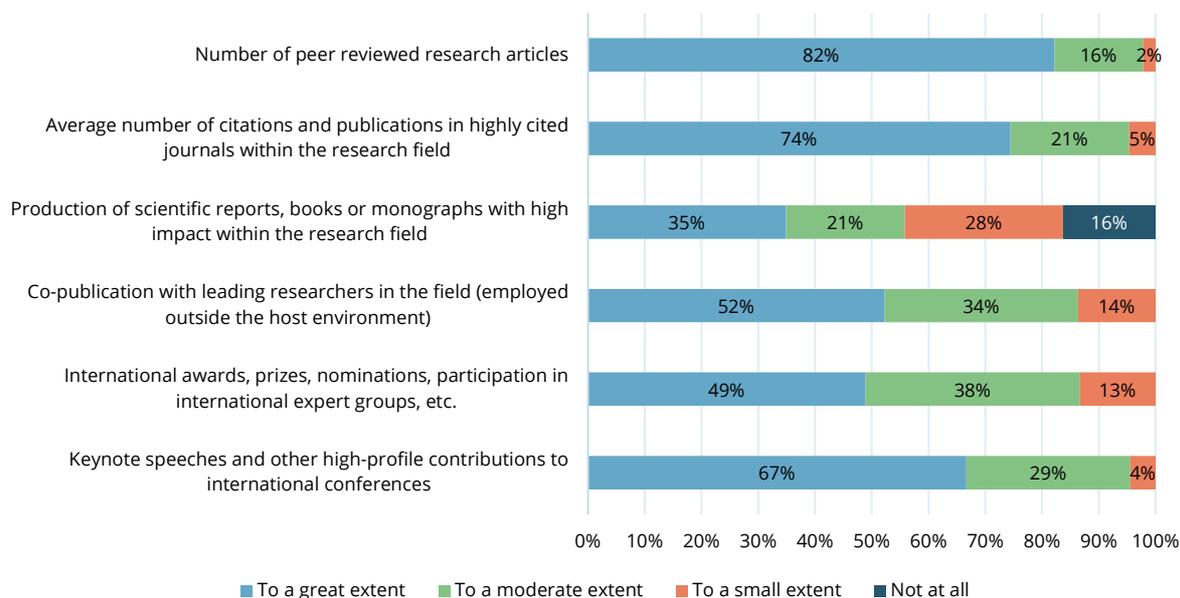
Overall, the responses indicate that the CoE grants have had a highly positive effect on the scientific output of the host environment (see Figure 5.5). More than 80% of centre leaders consider that the grant has, to a great extent, supported the production of scientific articles.

Similarly, 74% report that the CoE has had a strong, positive impact on their ability to publish in prestigious journals.

The CoEs also contribute positively to the internationalisation of Danish research. More than half of centre leaders assess that the grant has strengthened collaboration with leading researchers outside their local environment – supporting the picture in Figure 5.3 above.

In addition, the CoE grants appear to have enhanced participation in international expert groups and increased the receipt of international prizes.

**Figure 5.5. Centre leaders' assessment of whether CoE grants have had a positive impact on research output at the host institution**



Source: Survey of centre leaders

Note: N=45.

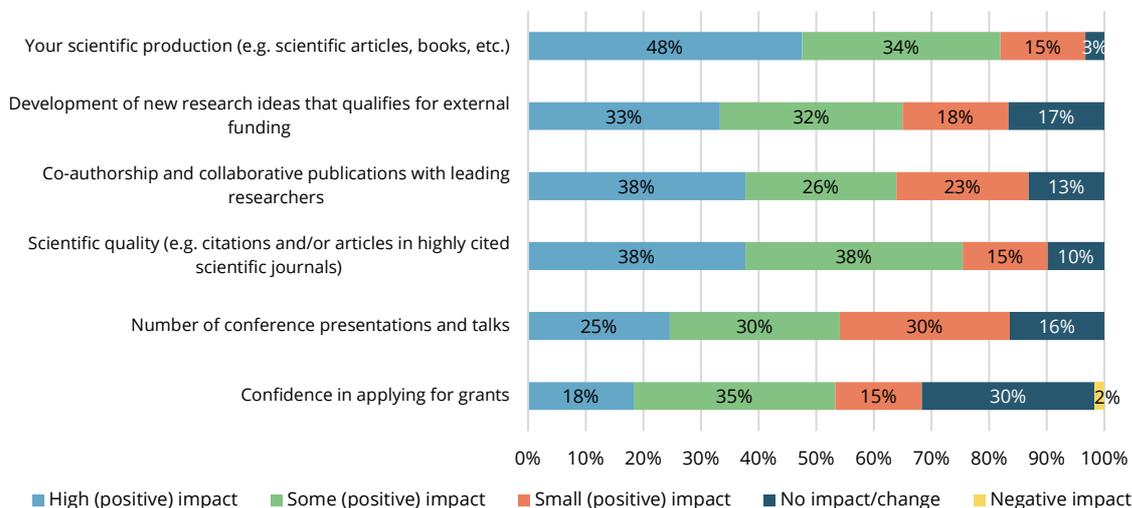
To assess the significance of the CoE grant for the broader group of researchers affiliated with the centres, we also asked the senior researchers to what extent their affiliation with a CoE has influenced their academic output.

The results indicate that the CoEs play an important role in strengthening the academic performance at the level of individual researchers. Nearly half of the senior researchers report that their affiliation has had a highly positive impact on their scientific production (e.g. articles, books).

A slightly smaller share state that the CoE has had a highly positive impact on both their collaboration with leading researchers and the scientific quality of their research.

Finally, the CoEs also play an important role in supporting the generation of new research ideas eligible for external funding among senior researchers. At the same time, more than half report increased confidence in applying for research grants.

**Figure 5.6. Senior researchers' assessment of whether CoE-participation has had an impact on their academic output**



Source: Survey of senior researchers affiliated with the CoEs

Note: N= 60-61. The figure includes only respondents who indicated that their primary research focus had been within the centre for several years, in response to a question about their affiliation with the centre.

### CoEs' impact on research environments within the social sciences and humanities

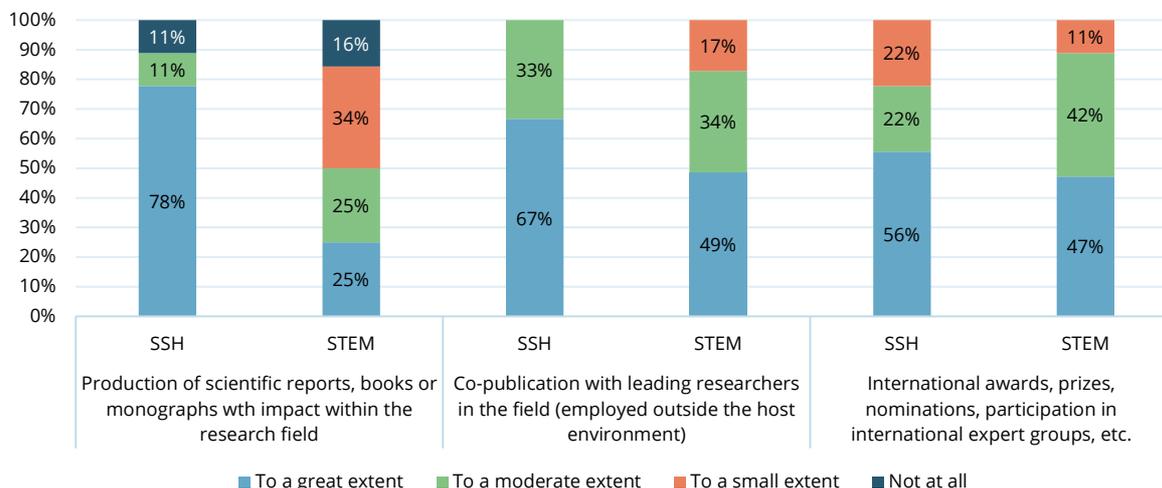
As described above, research articles within the Humanities and Social Sciences (SSH) are relatively poorly covered in bibliometric databases.

Bibliometric analyses primarily rely on indexed journal articles, while books, monographs and book chapters remain crucial publication channels within especially humanities. These forms of output are only partly covered in international bibliometric databases, and SSH research is also more frequently published in national languages.

Consequently, conventional bibliometric indicators provide only a partial picture of the actual impact of SSH research. This is also reflected in the distribution of DNRF articles across fields, where SSH accounts for only 9% of the total (see Figure 5.2).

Given these limitations, survey responses from centre leaders provide an important supplementary perspective. Figure 5.7 illustrates to what extent centre leaders assess that the CoE grant has strengthened research output, highlighting differences between SSH and STEM fields.

**Figure 5.7: Centre leaders' assessment of whether CoE grants have had a positive impact on research output at the host institution – by scientific field**



Source: Survey of centre leaders  
 Note: N=9 SSH & N=36 STEM.

Nearly 80% of SSH centre leaders report that the grant has, to a great extent, impacted the production of scientific reports, books or monographs, compared to one quarter among STEM leaders. This reflects the clear differences in publication traditions across scientific fields.

Co-publication with leading researchers employed outside the host environment is another area where SSH centre leaders highlight the positive effect of the CoE grants. Two-thirds of SSH leaders report a great impact in this regard, compared with around half of STEM leaders.

Finally, respondents were also asked about recognition through international awards, prizes, nominations, and participation in international expert groups. Reported impact is more moderate in both SSH and STEM, although close to half of SSH leaders still indicate that the grant has had a significant effect.

Taken together, these findings suggest that the CoEs have substantially strengthened the ability of SSH research environments to produce academic

output and to engage in international collaboration, while also underlining differences in how research impact manifests across disciplines. This point is important to consider when interpreting the subsequent bibliometric analysis.

### 5.3 Scientific impact

This section examines the scientific impact of articles published by researchers during their affiliation with CoEs. By “scientific impact,” we refer to the influence of these articles on the advancement and development of science.

Scientific impact can be measured, to some extent, by counting citations of articles by other researchers. An article that is frequently cited can be considered to have a high degree of scientific impact<sup>16</sup>.

However, when interpreting the results of bibliometric analyses, it is important to bear in mind some limitations. Bibliometric data provide only a partial picture of research quality.

<sup>16</sup> Hicks et al. (2015): “Bibliometrics: The Leiden Manifesto for research metrics”

Citation counts can be influenced by many different factors – including visibility, collaboration patterns, and even controversy – and do not always reflect the scientific merit or originality of the work<sup>17</sup>. Because research impact is multifaceted and cannot be fully captured through citation data alone, the bibliometric analysis is complemented by qualitative insights from both interviews and survey responses.

### The DNRF articles are highly cited

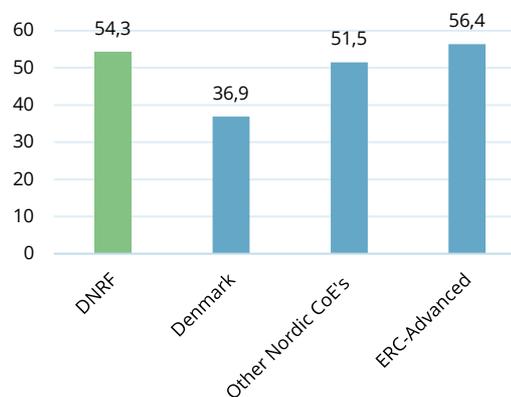
The figure below shows the average number of citations per scientific article for the CoEs and the three reference groups.

DNRF articles published in the period 2012–23 have received just over 54 citations per article on average. This is substantially higher than the average for all Danish articles, which is just under 37 citations per article.

The relatively high number of citations received by DNRF articles can be interpreted as an indication of their relevance to the development of their respective scientific fields – and thus their broader scientific impact.

DNRF articles are cited slightly more often than those published by other Nordic Centres of Excellence and slightly less than articles by ERC Advanced Grant holders. The difference in citation counts between the two comparison groups is, however, small.

**Figure 5.8. Average no. of citations per publication, 2012-23**



*Source: Scopus and data from CORDIS, the DNRF and other Nordic Research Foundations*  
*Note: Scientific publications include articles, reviews and conference papers with a DOI.*

The absolute number of citations per publication should be interpreted with caution, as citations accumulate gradually as articles circulate in the research community. Articles published in the latter part of the period have therefore had less time to attract citations. Moreover, citation patterns differ across scientific areas.

A widely recognised approach to assessing and comparing scientific impact is to use the Field-Weighted Citation Impact (FWCI), which accounts for differences across fields, years of publication, and document types.

The FWCI measures the number of citations a publication has received compared to the average number of citations for similar publications in the same field.

In other words, it reflects the ratio of actual citations to the expected global average for publications of the same type, subject area, and publication year. A score above 1 indicates that a

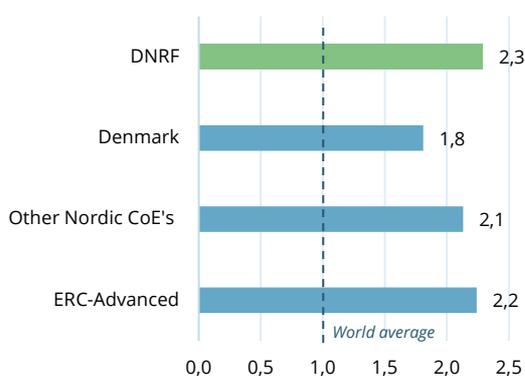
<sup>17</sup> See, for example, Reed et al. (2021): “Evaluating impact from research: A methodological framework” & CoARA (2022): “Agreement on reforming research assessment”

publication receives more citations than the global average for comparable publications.

The FWCI for DNRF articles is 2.3, showing that they are, on average, cited more than twice as often as comparable publications.

This is marginally above the FWCI of all other reference groups – including ERC Advanced Grants – indicating the high scientific impact of DNRF articles.

**Figure 5.9. Field-weighted citation impact, 2012-23**



Source: Scopus and data from CORDIS, the DNRF and other Nordic Research Foundations

Note: Scientific publications include articles, reviews and conference papers with a DOI.

The results are in line with the conclusions from the previous evaluation of the scientific impact of the CoEs conducted in 2013.

Figure 5.9 shows that the DNRF-supported articles are cited approximately 30% more frequently than Danish articles overall, broadly in line with the findings of the previous evaluation<sup>18</sup>. This suggests that research conducted at the CoEs consistently demonstrates a high level of scientific quality.

### High share of DNRF articles among the most cited worldwide

A complementary approach to assessing the impact of scientific publications is to measure the share of articles that rank among the most cited worldwide. This indicator captures the proportion of articles within the top 10%, 5% and 1% most cited globally.

As the indicator focuses on shares rather than averages, the indicator is less sensitive to individual highly cited publications than metrics based on average citation counts.

As shown in Figure 5.10, just over 26% of all the DNRF articles are among the 10% most cited publications within their respective fields. In comparison, the share for all Danish articles is 19%.

The DNRF articles clearly outperform the overall Danish level and to some extent the other Nordic CoEs. The share of articles among the top 10% most cited is, however, slightly higher for ERC Advanced articles.

At the very top tier – the 1% most cited articles globally – 3.9% of DNRF articles fall into this category. Here too, DNRF articles are well above the national benchmark and on par with both the other Nordic CoEs and ERC Advanced Grants.

The fact that DNRF articles perform at the same level as ERC Advanced is a strong indicator of scientific excellence, as ERC Advanced is a highly prestigious grant awarded to Europe's leading researchers.

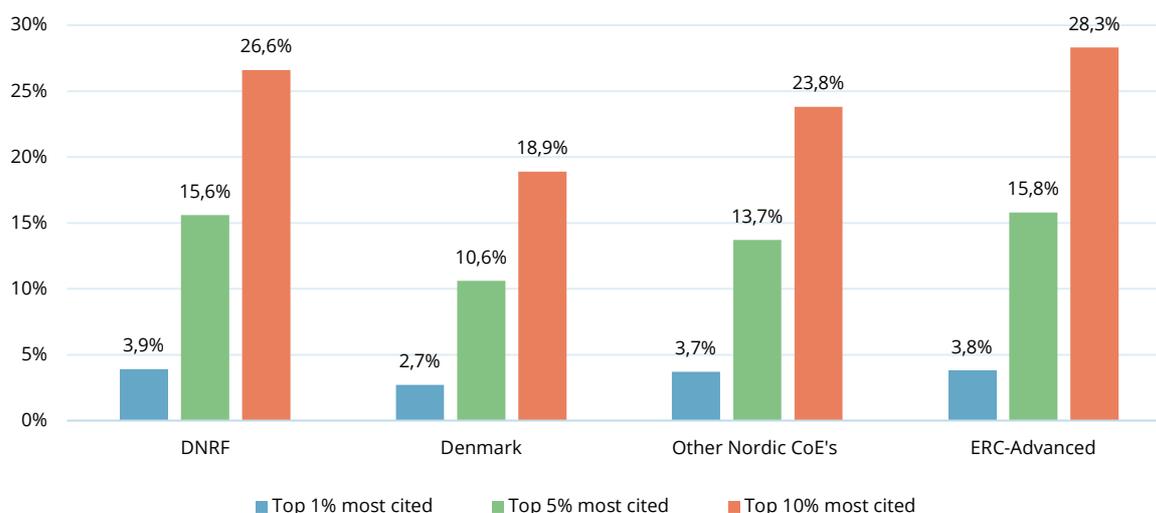
The comparison with ERC Advanced Grants should also take into account the differences in objectives. CoEs represent long-term investments with considerable emphasis on building research capacity and educating new generations of researchers.

<sup>18</sup> Schneider & Costas (2013): "Bibliometric analyses of publications from Centres of Excellence funded by the Danish National Research Foundation"

ERC Advanced is a more focused project format with the primary aim of conducting research. This means that the grant holder is typically involved in a larger share of the publications, while relatively fewer articles are authored by early-career

researchers. Accordingly, ERC Advanced articles can be expected to attract more citations on average, partly explaining why they perform slightly better than the DNRF articles in terms of the share among the top 10% most cited.

**Figure 5.10. Share of publications among the top 1%, 5%, and 10% most cited, 2012-23**



Source: Scopus and data from CORDIS, the DNRF and other Nordic Research Foundations  
 Note: Scientific publications include articles, reviews and conference papers with a DOI.

**DNRF articles are frequently published in prestigious journals**

The final approach to quantitatively assessing the impact of research is to examine the proportion of publications appearing in top-tier journals.

Publications in these journals also tend to attract more citations and can therefore, to some extent, be regarded as reflecting high research quality.

The table below shows the share of DNRF articles published in journals that rank among the top 10%, 5% and 1% most cited globally within their respective fields. The results are presented for two sub-periods and for the full period.

Just over 34% of all DNRF articles have been published in top 10% journals, compared to 29% of all Danish articles in 2012-23.

There are minor variations between the two sub-periods – for example, the share of articles

published in top 10% journals is slightly higher in 2012-17.

Overall, however, the picture is consistent, with a relatively high share of DNRF articles published in prestigious journals, well above the Danish average, and above other Nordic CoEs within the most cited journals.

As with the share of highly cited publications, ERC Advanced Grant holders perform slightly better than DNRF in terms of publishing in top-tier journals.

Nearly 5% of DNRF articles have been published in top 1% journals – a category that includes highly prestigious outlets such as Nature, Science and The Lancet. This share is significantly higher than the national average and above similar programmes in other Nordics, although ERC Advanced outperforms DNRF in this regard.

**Table 5.3. Share of publications published in the top 1%, 5%, and 10% most cited journals, 2012-23**

|                          | 2012-17 |       |        | 2018-23 |       |        | 2012-23 (total) |       |        |
|--------------------------|---------|-------|--------|---------|-------|--------|-----------------|-------|--------|
|                          | Top 1   | Top 5 | Top 10 | Top 1   | Top 5 | Top 10 | Top 1           | Top 5 | Top 10 |
| <i>The DNRF</i>          | 4.4%    | 18.1% | 37.3%  | 5.1%    | 20.7% | 30.9%  | 4.7%            | 19.4% | 34.1%  |
| <i>Denmark</i>           | 2.5%    | 13.8% | 28.0%  | 3.1%    | 16.1% | 29.8%  | 2.9%            | 15.1% | 29.1%  |
| <i>Other Nordic CoEs</i> | 3.9%    | 19.6% | 36.9%  | 4.1%    | 18.0% | 29.9%  | 4.0%            | 18.9% | 34.2%  |
| <i>ERC Advanced</i>      | 6.2%    | 22.1% | 38.8%  | 6.7%    | 24.1% | 34.5%  | 6.4%            | 23.1% | 36.5%  |

Source: Scopus and data from CORDIS, the DNRF and other Nordic Research Foundations  
 Note: Scientific publications include articles, reviews and conference papers with a DOI. The classification of high-impact journals is based on SNIP (Source Normalised Impact per Paper).

**Overall high scientific impact from the CoEs**

In summary, the analyses point to a high scientific impact of the DNRF-funded research.

Articles published by researchers at the CoEs receive significantly more citations and are published more frequently in prestigious journals compared to Danish research as a whole.

The scientific impact also exceeds that of other Nordic CoEs and is, in many respects, on par with ERC Advanced Grant holders.

These findings are in line with the conclusions from previous evaluations, which likewise documented a high scientific impact, showing that the CoEs contributed strongly to the visibility and impact of Danish research<sup>19</sup>.

The following section takes a closer look at the role of the CoEs in fostering high-risk research and in creating the conditions for major scientific advances.

**5.4 High-risk research and scientific breakthroughs**

As described in Chapter 3, a core objective of the CoE programme is to support high-risk research that pushes the boundaries of international

science and provide a foundation for scientific breakthroughs.

Scientific breakthroughs can be defined as research that is both original and pioneering, generating new scientific insights and laying the groundwork for future developments in research.

Scientific breakthrough research is inherently difficult to define, measure and detect. The very notion of what constitutes a scientific breakthrough is open to interpretation, and no universally accepted definition exists<sup>20</sup>.

In the evaluation, we have defined scientific breakthroughs as follows:

*Original and groundbreaking results that break with existing research and give rise to follow-up studies that further qualify and develop the theories and findings from the original articles – or draw on them in other research projects.*

Scientific breakthroughs are thus understood as major advances that attract significant international attention and form the basis for a large number of subsequent research projects.

Such follow-up research may involve further qualifying the theories developed in the breakthrough project or using the results to achieve advances in

<sup>19</sup> Ministry of Higher Science and Education (2013): "Evaluation of the Danish National Research Foundation"  
<sup>20</sup> Wang et al. (2022): "Quantifying scientific breakthroughs by a novel disruption indicator based on knowledge entities"

other areas. Achieving such breakthroughs typically requires research that is both innovative and entails a high degree of risk, as entirely new insights rarely emerge from incremental approaches.

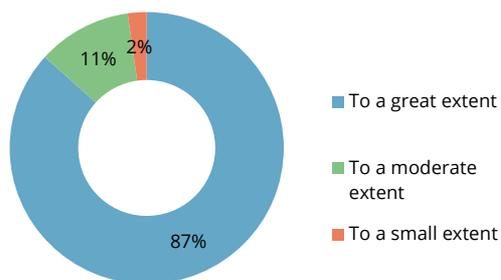
In the following section, we therefore examine the extent to which the research conducted at the CoEs can be characterised as high-risk research and conducive to scientific breakthroughs.

### Researchers view CoEs as an environment for high-risk, exploratory science

A first step is to evaluate whether the CoE grants foster high-risk research – that is, the exploration of entirely new research questions and hypotheses with a significant risk of failure, but with the potential to yield novel scientific insights.

In the survey, centre leaders were asked to assess the extent to which the CoE has engaged in such research.

**Figure 5.11. Centre leaders' assessment of whether the CoE grant has led to high-risk research**

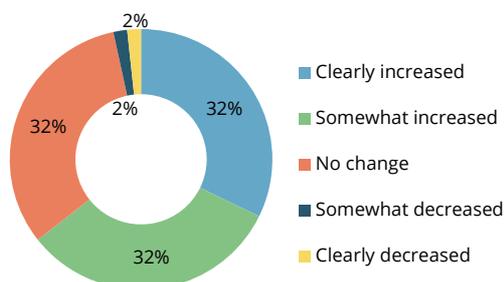


*Source: Survey of centre leaders*  
 Note: N=45. High-risk research is defined as research that explores bold, untested ideas or approaches with a significant chance of failure, but with the potential to lead to major scientific or technical breakthroughs if successful.

The responses indicate that almost all centre leaders assess that at least part of the research can be characterised as high-risk research.

In addition to the responses from CoE leaders, we also asked senior researchers affiliated with the CoEs whether their affiliation had led them to engage in more high-risk research, cf. Figure 5.12.

**Figure 5.12. Senior researchers' assessment of whether the CoE grant has increased their involvement in high-risk research**



*Source: Survey of senior researchers affiliated with the CoEs*  
 Note: N=59. The figure includes only respondents who indicated that their primary research focus had been within the centre for several years, in response to a question about their affiliation with the centre.

A more nuanced perspective emerges among senior researchers concerning the extent of high-risk research within the centres. Slightly more than 60% report an increased engagement in high-risk projects, and approximately one-third describe a significant rise in their involvement.

Conversely, one-third do not consider themselves to have undertaken more high-risk research during their time at the centre, and a very small share (4%) even report a decrease. These differences may reflect that senior researchers are integrated into the centres in varying ways and over different periods of time.

Some pursue their own research agenda largely independent of the centre's core activities, while others are more directly involved in the centre's main research projects.

The interviews with centre leaders further support the picture that the vast majority of CoE grants are associated with high-risk research. A clear majority

of the centre leaders emphasise that the research pursued uncertain and experimental avenues that had not previously been a focus in the international research community.

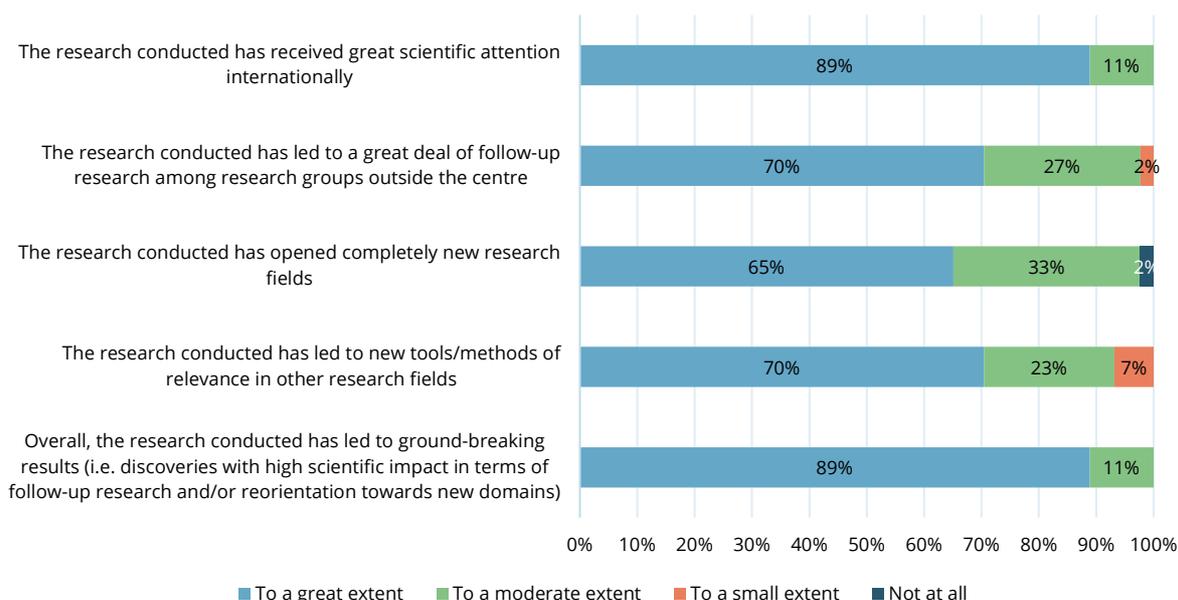
One explanation for the senior researchers' interpretation may also be that some join the centres after they have been running for some time, and that the perception of high-risk research is likely strongest during the early years, until the centres have had the opportunity to verify hypotheses and establish functioning interdisciplinary setups.

### Research activities leading to groundbreaking results

Based on the above definition of scientific breakthroughs, the survey of centre leaders included a series of questions aimed at assessing whether parts of their research have resulted in scientific breakthroughs (see Figure 5.13).

The final two questions, in particular, provide an indication of whether the research leaders perceive the research as containing elements of a scientific breakthrough. Overall, nearly all CoE leaders consider that the research conducted at their centre includes such elements.

Figure 5.13. Centre leaders' agreement with statements on scientific breakthroughs



Source: Survey of centre leaders

Note: N=43-45. Responses marked as "Too early to say" and "Do not know/remember" are excluded from the figure (see appendix 1).

Close to 90% report that the research to a great extent has received international scientific attention, while 70% state that it has led to significant follow-up research among groups outside the centre.

Around two-thirds indicate that the research to a great extent has opened up new fields of study, and a slightly higher share report that it has led to

the development of new tools or methods relevant to other research areas.

Taken together, close to 90% of CoE leaders assess that the research has produced groundbreaking results – a pattern that is consistent across all major scientific fields.

For comparison, 32% of research leaders from DFF-funded projects<sup>21</sup> in a 2019 evaluation fully agreed that their projects had led to scientific breakthroughs (using the same definition). The high proportion for CoEs should, however, be seen in light of the fact that CoE grants provide framework funding for multiple research projects. In this evaluation, we interviewed 17 centre leaders, nearly all of whom were able to describe research outcomes that could be considered groundbreaking.

The box below provides some examples of groundbreaking research results based on the interviews with centre leaders.

### Box 5.2. Examples of scientific breakthroughs

**The Centre for Glycomics** was the first to map sugar molecules, their positions on proteins, and their role in disease development. The centre has pioneered genetic approaches and technological platforms that advance the study of glycans and their functions and pave the way for custom-designed new glycoprotein therapeutics.

**iCourts** was the first research environment to study the growing importance of international courts, systematically mapping their legal frameworks, structures, and rulings. The centre developed a conceptual understanding of how authority is established in international courts, as well as the sociological dynamics linked to both recognition of and resistance to the courts. It also represented a methodological breakthrough in legal research by combining normative and sociological approaches with big data computational methods.

**The Cosmic Dawn Centre** has been a pioneer in mapping the early stages of the universe, becoming the first centre to obtain large amounts of data from the James Webb Telescope. This led to a series of groundbreaking articles in *Nature* and *Science*, demonstrating that the early universe contained far more galaxies and black holes than previously assumed, presenting a challenge to the cosmological model.

**Centre for Music in the Brain** has developed a groundbreaking theory of brain function in relation to

music, verified through mathematical modelling and experiments on how the brain responds to music. The research concludes that the brain is designed to predict the future and reacts to inputs that violate its expectations. These findings were published in a landmark article in *Nature* in 2022 and have had significant international impact within neuroscience.

**UrbNet** has combined archaeological and natural science research to study societal changes and adaptations to crises from the Hellenistic period through the Middle Ages. The centre has shown how historical urban communities adapted to natural disasters and climate changes. Reflecting the high international interest, UrbNet founded the *Journal of Urban Archaeology* and a book series, *Urban Archaeological Pasts* (Cambridge University Press). In just a few years, the journal has become one of the most respected in the field of urban archaeology.

A common feature of the five centres in the box is that they serve as global research hubs. They host numerous seminars, attract many visiting researchers, and house unique datasets of global significance that are utilised by scientists worldwide.

### Identifying scientific breakthrough papers using bibliometrics

In addition to survey and interview data, we have sought to identify potential breakthroughs through bibliometric analysis. The purpose is to examine whether signs of breakthrough research can be detected in publication and citation patterns, and to explore whether bibliometric indicators can capture path-breaking contributions in new research fields supported by the DNRF.

There is no generally accepted approach to identifying scientific breakthroughs, and the topic has received only limited attention in the bibliometric literature.

<sup>21</sup> Independent Research Fund Denmark

Previous studies have typically defined breakthrough research as publications with *exceptionally* high citation counts.

This approach was also used in the previous evaluation of the CoE programme to identify potential breakthrough papers<sup>22</sup>.

In the current evaluation, we have followed the same approach, considering citation counts to be the most reliable available indicator for identifying particularly influential articles that may be regarded as breakthroughs.

To identify potential breakthrough articles, we rely on *research topics* from the Scopus database. A research topic refers to a narrow scientific field composed of articles addressing a shared subject and closely connected through citation patterns.

The Scopus database contains more than 94,000 unique research topics – for example, “*Nanoparticle; Graphene; Surface-Enhanced Raman Spectroscopy*”.

Each article is assigned to only one research topic, which makes it possible to assess its contribution and scientific impact within a clearly defined research context.

This detailed and specialised topic structure allows for analysis of research contributions within narrowly defined academic fields.

We consider the most cited article within a given topic to be a potential breakthrough, as it has received exceptional attention and influence among researchers working on the same subject.

For a DNRF article to be classified as a breakthrough, it must be among the most highly cited publications within its specific research topic. The method used to identify such publications is described in more detail in the box below.

### Box 5.3. Identification of breakthrough papers

The analysis takes as its starting point the top 5% most cited DNRF articles (768 in total). For each of these, we identified the unique research topic to which the article belongs. Altogether, the 768 articles were published across 383 unique research topics.

Research topics are defined as tightly connected groups of articles focusing on the same subject and linked through citation patterns, for example “Galaxy Evolution; Intergalactic Medium; Reionization”.

We then excluded articles belonging to research topics that were not themselves among the top 10% most cited topics globally.

This step reflects the assumption that scientific breakthroughs are most likely to emerge within highly influential areas of research that have received substantial international attention. Out of the 383 research topics, 267 were within the global top 10%.

For each of these 267 topics, we identified the DNRF articles that were either the most- or the second-most cited publications within the topic during the period 2012–23.

This was done to assess whether the DNRF articles had played a central role within their respective research areas. The underlying assumption is that the most highly cited articles within a field are those most likely to contain innovative and groundbreaking results. In total, 42 DNRF articles met this criterion.

Of these, six had more than 100 authors. Given the large number of contributors, it is uncertain whether the DNRF-affiliated researchers played a significant role in these particular articles.

We therefore examined whether a CoE-affiliated researcher was listed as either first or last author, but as this was not the case, the six articles were excluded.

Based on this approach, we identified 34 DNRF articles as potential scientific breakthrough articles.

<sup>22</sup> Schneider & Costas (2013). “Bibliometric analyses of publications from Centres of Excellence funded by the Danish National Research Foundation”

### Important limitations in assessing scientific breakthroughs

There are important limitations to consider when interpreting potential breakthroughs identified through bibliometric analysis.

Scientific research is fundamentally cumulative and iterative. Major advances are typically developed and refined over time and rarely take the form of a single publication.

Rather than being confined to one publication, breakthroughs often emerge through a series of related studies and articles, as researchers gradually deepen their understanding and explore new applications of their findings.

An illustrative example of this is the case of Danish chemist Morten Meldal – recipient of the 2022 Nobel Prize in Chemistry. His contributions to the development of click chemistry unfolded across multiple studies and conceptual advances.

According to the Nobel Committee, the impact of his work was not based on one specific publication, but on the formulation of a broader conceptual framework that catalysed widespread innovation across chemistry and related fields<sup>23</sup>.

Similarly, a study based on official Nobel Prize documentation found that, on average, 9.6 publications are cited as contributing to the prize-winning discovery<sup>24</sup>.

This reflects the fact that breakthrough research is seldom traceable to a single paper, but instead to a coherent body of work published over several years.

Moreover, it is important to note that some research topics in Scopus span multiple subfields and niches within global research. Consequently, research deemed a breakthrough by centre leaders, and their peers, may not always be captured

as such in the bibliometric analysis, due to competition from other subfields.

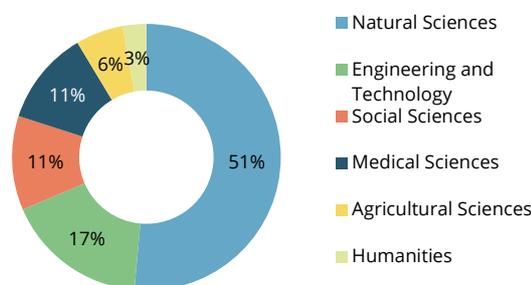
### 34 potential scientific breakthrough articles by DNRF researchers

Based on the method described in the box above, we identified 34 potential scientific breakthrough articles. The 34 breakthrough articles cover all six main scientific fields, as shown below.

The distribution of breakthrough articles across scientific fields closely mirrors that of all DNRF publications (Figure 5.2), with just over half belonging to the Natural Sciences.

This is followed by articles within Engineering and Technology, which account for 17% of the breakthrough articles. Medical Sciences and Social Sciences each represent 11%.

**Figure 5.14. DNRF breakthrough articles by scientific fields**



Source: IRIS Group based on data from Scopus.

Note: Scientific publications include articles, reviews and conference papers with a DOI. Articles are classified into scientific fields by Scopus.

To gain a deeper understanding of the scientific breadth of the breakthrough articles, the figure below displays a word cloud constructed from key phrases identified in the articles.

The figure provides a visual impression of the central keywords, ranging from highly specialised technical terms to broader themes that cut across

<sup>23</sup> The Nobel Committee for Chemistry: "Click Chemistry and Bioorthogonal chemistry"

<sup>24</sup> Bjørk, R. (2019): "The age at which Noble Prize research is conducted"



spread across 23 CoEs, with a maximum of four linked to a single centre.

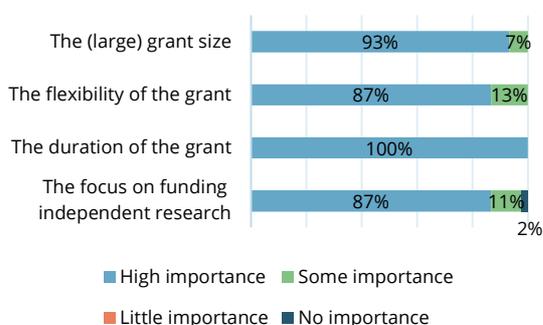
This broader distribution across scientific fields likely reflects methodological differences, as the present analysis is based on research topics rather than the more restrictive citation-based methods applied previously.

### 5.5 The role of the CoE grant in generating impact

From an evaluation perspective, it is important to examine how and why CoE grants lead to significant scientific results. A key element is the strong emphasis on scientific quality in the assessment of applications, as well as the fact that the centres are led by some of Denmark’s leading researchers. The evaluation also shows that the nature of the DNRF grants (see Chapter 4) is perceived as highly important for the results achieved, both by centre leaders and the affiliated researchers.

In the survey, centre leaders evaluated aspects of the grant in relation to scientific impact. The results are shown in Figure 5.16, which clearly illustrates that the strong impact on Danish research stems from several factors that distinguish CoE grants from other funding programmes.

**Figure 5.16. The role of key grant components in fostering research impact**



Source: Survey of centre leaders  
 Note: N=45.

No centre leaders consider any of the programme’s four distinctive features to be of little or no importance.

The interviewees largely confirm these findings, emphasising that it is the combination of substantial grant size, high flexibility in exploring new research directions, and the extended duration of the centres that underpins their success.

Many of the interviewed centre leaders emphasise that the grant, combined with the long-term research horizon, allows them to recruit researchers with complementary scientific expertise at a level not possible under other funding programmes. In many centres, this interdisciplinarity has been instrumental in achieving strong results and scientific breakthroughs.

Flexibility from the funder is also highlighted as crucial for high-risk research, as it enables the focus to be adjusted in response to insights and opportunities that emerge along the way. Furthermore, a CoE grant is described as a substantial framework grant (see also Chapter 4), providing the resources to build a strong scientific environment with unique capacity in terms of equipment, data, and infrastructure.

### 5.6 Differences across research areas and CoEs

This final section examines variations in scientific impact across fields and Centres of Excellence (CoEs). It is relevant to consider whether the strong results are driven primarily by a few centres, or whether they reflect a more general characteristic of the programme as a whole.

The table below presents the share of articles among the top 1% and 10% most cited within each broad field of science.

Overall, DNRF articles show a higher scientific impact—measured by both indicators—across all fields compared to Denmark as a whole. The only exception is the indicator measuring the share of medical science articles among the 1% most

cited. The share of DNRF articles among the most cited is particularly high within Engineering and Technology, the Humanities, and the Natural Sciences.

The table also reveals substantial variation across disciplines when compared with other Nordic CoE

programmes. In the Natural Sciences, Engineering, and Agricultural Sciences, Denmark performs better than the other Nordic countries on both indicators. In the Medical Sciences, the opposite is true. Finally, the DNRF stands out in the Humanities, with a remarkably high proportion of articles among the top 1% most cited.

**Table 5.5. Share of articles among the top 10% and 1% most cited – by scientific fields, 2012-23**

|                                   | <i>The DNRF</i>                   |                                    | <i>Denmark</i>                    |                                    | <i>Nordic CoEs</i>                |                                    |
|-----------------------------------|-----------------------------------|------------------------------------|-----------------------------------|------------------------------------|-----------------------------------|------------------------------------|
|                                   | <i>Share in top 1% most cited</i> | <i>Share in top 10% most cited</i> | <i>Share in top 1% most cited</i> | <i>Share in top 10% most cited</i> | <i>Share in top 1% most cited</i> | <i>Share in top 10% most cited</i> |
| <i>Agricultural Sciences</i>      | 2.8%                              | 24.8%                              | 1.4%                              | 17.7%                              | 1.4%                              | 22.1%                              |
| <i>Engineering and Technology</i> | 4.3%                              | 25.2%                              | 2.2%                              | 18.6%                              | 3.3%                              | 23.9%                              |
| <i>Humanities</i>                 | 4.7%                              | 31.5%                              | 3.0%                              | 22.1%                              | 3.5%                              | 33.0%                              |
| <i>Medical Sciences</i>           | 2.5%                              | 21.2%                              | 3.0%                              | 18.9%                              | 3.8%                              | 24.0%                              |
| <i>Natural Sciences</i>           | 3.7%                              | 26.7%                              | 2.3%                              | 18.1%                              | 3.4%                              | 22.8%                              |
| <i>Social Sciences</i>            | 3.1%                              | 22.1%                              | 2.3%                              | 19.2%                              | 2.8%                              | 23.8%                              |

Source: IRIS Group based on data from Scopus

Note: Scientific publications include articles, reviews and conference papers with a DOI. A single article may be attributed to more than one scientific field. Articles are classified into scientific fields by Scopus.

A more detailed breakdown is presented in the table below, showing the share of articles that rank among the top 10% most cited within different scientific subfields (for DNRF articles and for Denmark as a whole). Only the four largest subfields within each broad scientific area are included, as the number of articles in the remaining subfields is too small to allow for a valid bibliometric analysis. For the Natural Sciences, however, the six largest subfields are included.

The table shows that the DNRF generally demonstrates a high scientific impact across several subfields when compared to the national average. For instance, slightly more than 30% of articles within

the Physical Sciences as well as Earth and Related Environmental Sciences are among the top 10% most cited – substantially higher than the corresponding share for all Danish articles in these fields. DNRF articles also perform strongly in several subfields within the Humanities, as well as in Mechanical Engineering, where they rank significantly above the Danish average.

It should be noted, however, that some areas are based on a relatively small number of articles, meaning that results from a single centre may have a considerable impact on the overall DNRF share.

**Table 5.6. Share of articles among the top 10% most cited, the D NRF and Denmark – by scientific subfields, 2012-23**

|   | D NRF | Denmark |
|---|-------|---------|
| <b>Natural Sciences</b>                                     |       |         |
| <i>Physical sciences</i>                                    | 31.7% | 21.1%   |
| <i>Biological sciences</i>                                  | 24.8% | 18.1%   |
| <i>Earth and related environmental sciences</i>             | 30.5% | 20.1%   |
| <i>Chemical sciences</i>                                    | 22.0% | 14.8%   |
| <i>Computer and information sciences</i>                    | 19.5% | 16.9%   |
| <i>Mathematics</i>  | 16.4% | 16.3%   |
| <b>Engineering and Technology</b>                           |       |         |
| <i>Materials engineering</i>                                | 20.4% | 14.6%   |
| <i>Electrical engineering</i>                               | 24.3% | 22.7%   |
| <i>Chemical engineering</i>                                 | 15.5% | 17.4%   |
| <i>Mechanical engineering</i>                               | 28.9% | 21.7%   |
| <b>Medical and Health Sciences</b>                          |       |         |
| <i>Basic medicine</i>                                       | 20.2% | 17.3%   |
| <i>Clinical medicine</i>                                    | 19.3% | 20.0%   |
| <i>Health sciences</i>                                      | 20.6% | 17.6%   |
| <i>Medical biotechnology</i>                                | 17.7% | 14.4%   |
| <b>Social Sciences</b>                                      |       |         |
| <i>Economics and business</i>                               | 24.0% | 20.4%   |
| <i>Psychology and cognitive sciences</i>                    | 15.9% | 17.3%   |
| <i>Political Sciences</i>                                   | 27.8% | 21.5%   |
| <i>Law</i>  | 23.5% | 21.8%   |
| <b>Humanities</b>   |       |         |
| <i>History and archaeology</i>                              | 38.3% | 26.4%   |
| <i>Languages and literature</i>                             | 25.0% | 19.7%   |
| <i>Philosophy, ethics and religion</i>                      | 34.8% | 20.7%   |
| <i>Arts (arts, history of arts, performing arts, music)</i> | 40.9% | 24.0%   |
| <b>Agricultural Sciences</b>                                |       |         |
| <i>Agriculture, forestry, and fishery</i>                   | 24.3% | 18.1%   |
| <i>Animal and dairy science</i>                             | 21.4% | 15.5%   |

Source: IRIS Group based on data from Scopus

Note: Scientific publications include articles, reviews and conference papers with a DOI. A single article may be attributed to more than one scientific field. Articles are classified into scientific fields by Scopus.

### Variation in scientific impact across CoEs

The following analysis examines variations in both the number of published articles and the scientific impact of the CoEs.

The analysis covers CoEs funded in rounds 4–8 (initiated in the period 2004–15) that had published at least 100 scientific articles by 2023, ensuring robust and comparable bibliometric results. In total, 35 CoEs meet this criterion.

Figure 5.17 presents the total number of articles published by these 35 CoEs, as well as their average Field-Weighted Citation Impact (FWCI). The CoEs scientific field is indicated by colour.

The position of each centre on the x-axis shows the number of articles published during 2012–23, while the y-axis indicates the FWCI. A score above 1 means that publications receive more citations than the global average for comparable articles. The yellow vertical lines indicate the Danish average.

The figure illustrates considerable variation in the number of articles published by individual CoEs. A large share has published between 100 and 350

articles, while several have produced substantially more. Two centres have published more than 1,000 articles and are therefore placed on the final vertical line, indicating that their position on the x-axis lies beyond the figure's scale.

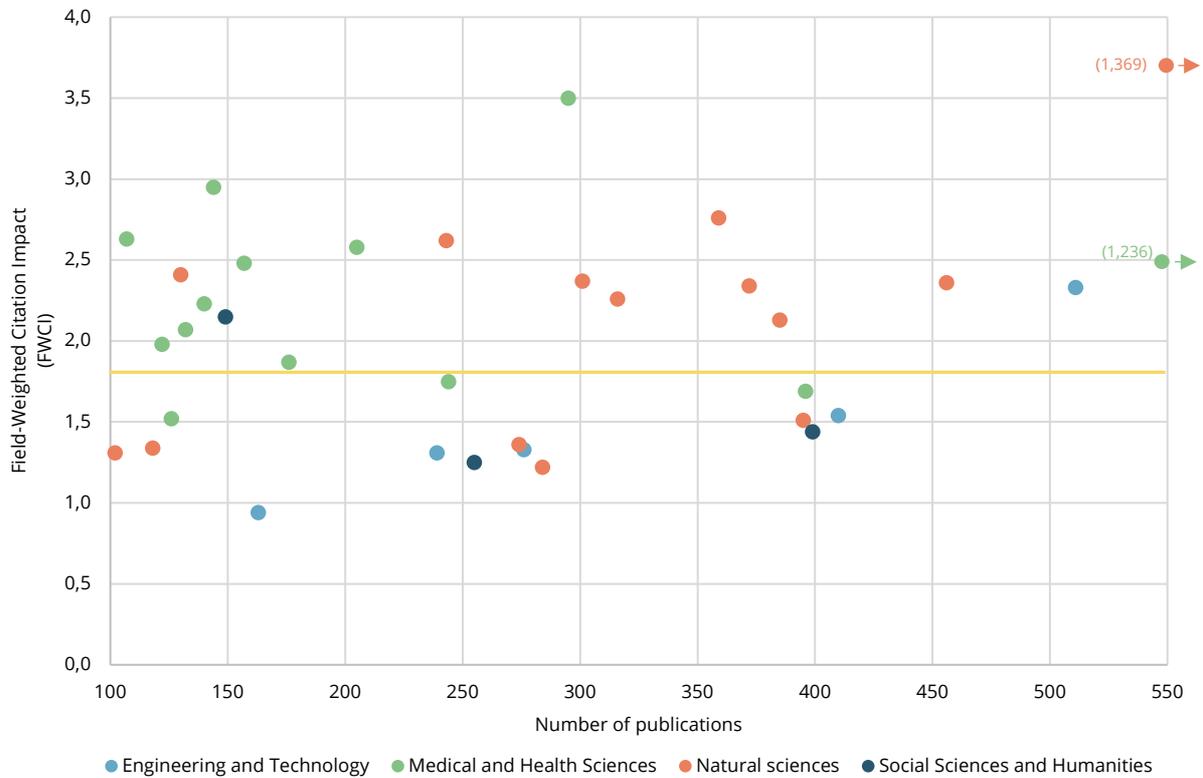
The relatively large variation in publication output should be interpreted in light of several factors, including differences in publishing traditions across scientific fields and the coverage of articles in Scopus.

Moreover, the scientific production of centres established before 2012 is not fully covered in the figure.

There is also significant variation in scientific impact across the CoEs, as measured by FWCI. Many centres have a score somewhat above 2, while a few achieve substantially higher scores, and a significant share perform below the national average.

As the figure shows, there is also considerable variation within the broad scientific fields (measured in terms of the scientific affiliation of the host environment).

Figure 5.17. Scientific output and field-weighted citation impact – by scientific fields, 2012-23



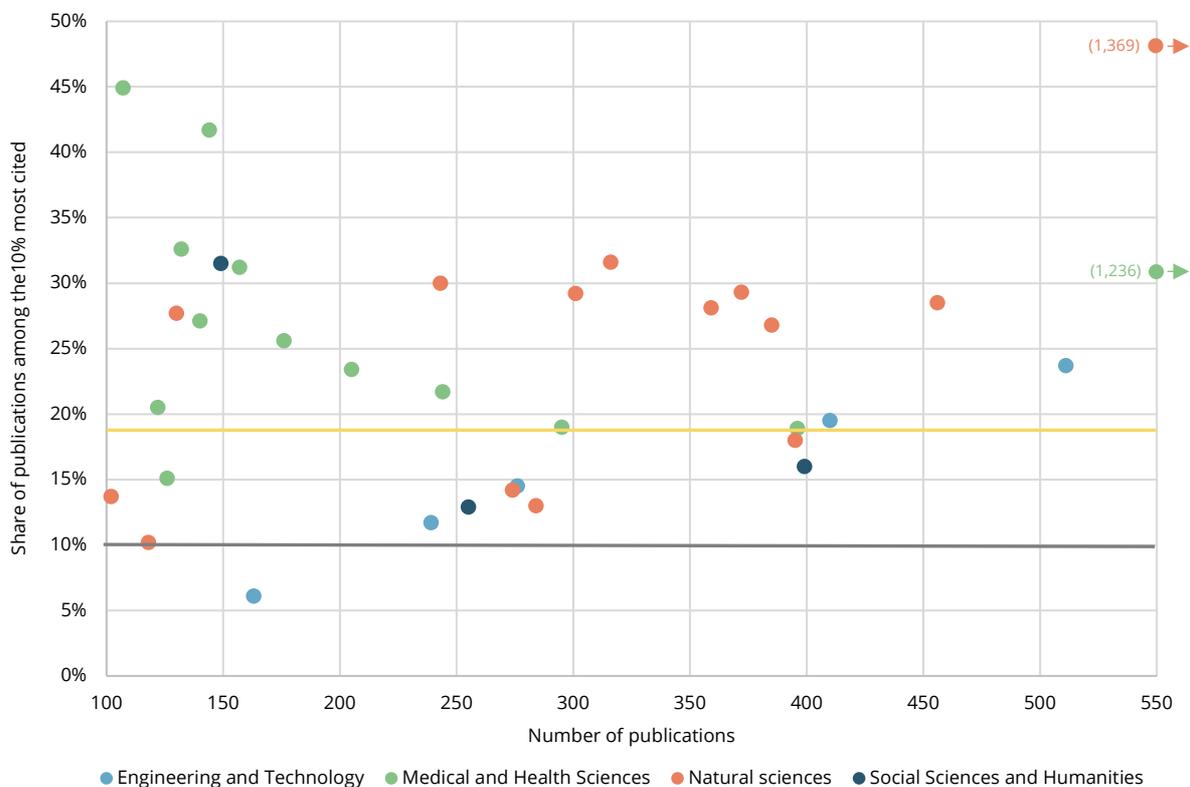
Source: IRIS Group based on data from Scopus

Note: Scientific publications include articles, reviews and conference papers with a DOI. Only CoEs from round 4-8 with at least 100 publications by 2023 are included. The categorisation of CoEs into scientific fields is based on the DNRF classification, which is not directly comparable with the classification used in the bibliometric analyses in this Chapter.

Finally, Figure 5.18 shows the share of articles that rank among the top 10% most cited publications worldwide within their fields. The yellow and black vertical lines indicate the global and Danish averages, respectively. The figure also shows the number of articles produced by each centre (same data as in Figure 5.17).

Considerable variation across centres is observed for this indicator as well. Many centres cluster around 30%, well above the Danish average, and some even exceed 40%. At the same time, a smaller number of centres score at or substantially below the Danish average. These are largely the same centres that scored below the national average in Figure 5.17.

Figure 5.18. Share of articles among the 10% most cited – by scientific fields, 2012-23



Source: IRIS Group based on data from Scopus

Note: Scientific publications include articles, reviews and conference papers with a DOI. Only CoEs from round 4-8 with at least 100 publications by 2023 are included. The categorisation of CoEs into scientific fields is based on the D NRF classification, which is not directly comparable with the classification used in the bibliometric analyses in this Chapter.

Overall, the analysis shows considerable variation in both the number of articles and the scientific impact across centres and research fields. While some CoEs have published extensively, others have contributed a more limited number of articles during the period.

In terms of scientific impact, the general picture is that the CoEs generally demonstrate a strong scientific impact across centres and disciplines, with performance above the Danish average. At the same time, a significant minority perform below the national benchmark. These findings are consistent with the previous evaluation, which also

highlighted notable differences between centres with regard to both publication volume and scientific impact<sup>26</sup>.

The variation should be interpreted considering a number of factors. First, centres are funded for different periods of time, and their publication profiles naturally evolve over the course of the grant. Second, publication and citation patterns vary considerably between scientific fields, which affects both the pace and the visibility of research outputs. Third, bibliometric coverage may differ

<sup>26</sup> Schneider & Costas (2013): "Bibliometric analyses of publications from Centres of Excellence funded by the Danish National Research Foundation"

across fields, meaning that not all publications are equally well represented in the data.

It should also be emphasised that the DNRF programme explicitly encourages high-risk, high-reward research. This focus inherently increases the likelihood of variation, as not all research trajectories will deliver equally strong results within the same time frame. The variation across centres is therefore not surprising but rather reflects the programme's ambition to foster such high-risk research.

## 5.7 Conclusions

The evaluation shows that the CoEs have generated a substantial scientific output, corresponding to almost 5% of all Danish research during the period 2012–23. This demonstrates that the CoEs make a major contribution to Denmark's overall research production, with a particularly strong position in the natural sciences.

The evaluation also shows that the scientific impact of CoE articles is high. They receive significantly more citations and are published more frequently in prestigious journals compared to Danish research as a whole, and the impact is consistently strong across all main fields of science.

The scientific impact of the centres also exceeds that observed in other Nordic CoE programmes and approaches the level of the ERC Advanced Grant scheme, underlining the CoEs' capacity to generate research of very high quality. In particular, results in engineering and the natural sciences contribute strongly to the superior performance of the Danish centres compared with those in other Nordic countries.

Many centres also demonstrate research outcomes that are groundbreaking within their respective fields, setting new directions for global research. The evaluation highlights several examples of how the CoE grant has enabled the emergence of entirely new research areas and the establishment of research environments that have developed into world-leading hubs in fields of major international interest.

Finally, the evaluation points to considerable variation in scientific impact across the centres. Such variation is not unexpected in a programme that supports new and untested research ideas, but it also illustrates that the centres' collective contribution to the scientific quality of Danish research is composed of both centres that overperform and centres that pull in the opposite direction.

## 6. CENTRES OF EXCELLENCE AND THE HOST ENVIRONMENT

This chapter examines the impact on the research environment, while also exploring the managerial challenges and opportunities associated with hosting a large and prestigious grant.

### 6.1 Introduction

For most research environments, becoming the host of a CoE represents a significant transformation. The grant brings a substantial increase in the number of researchers and PhD students, and the involved research groups grow considerably. In many cases, additional researchers from abroad also become tied to the environment.

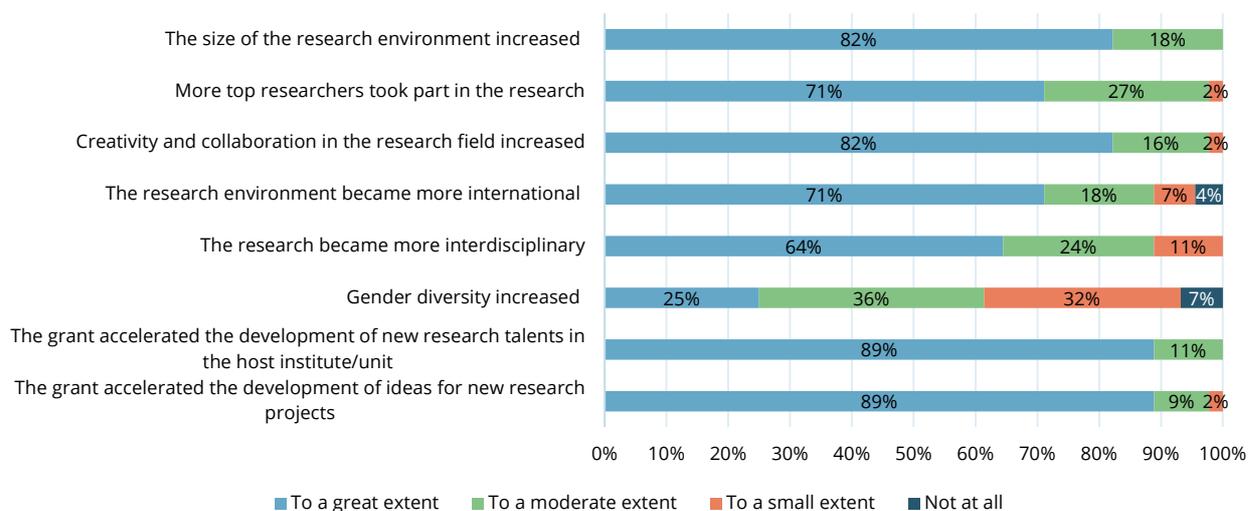
The host institute or department plays a crucial role in ensuring a successful integration of the centre, while also facing opportunities and challenges in accommodating a large research unit over a ten-year period.

This chapter examines the relationship between CoEs and their “hosts”. Section 6.2 looks at how the grant impacts the research environment. Section 6.3 discusses the role of local management in engaging with the centres and addresses challenges related to their integration. Finally, Section 6.4 analyses trends and variations across centres in the development after the grant period has ended.

### 6.2 How does a CoE grant affect the research environment?

As part of the survey, centre leaders provided assessments of the grant’s influence on the local research environment. An overview of the responses is illustrated in the figure below.

Figure 6.1. Centre leaders’ assessment of the extent to which the D NRF affects the local research environment



Source: Survey of centre leaders

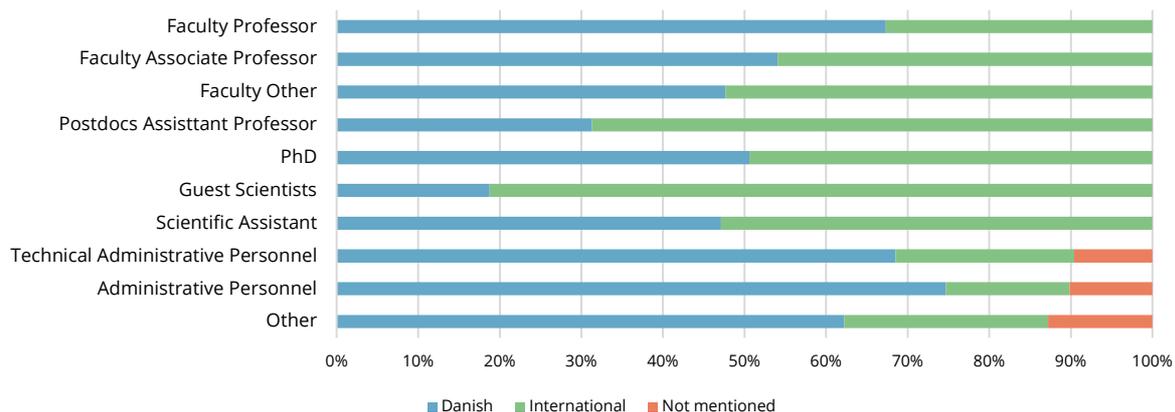
Note: N=44-45. Responses marked as “Too early to say” are excluded from the figure (see appendix 1).

The results illustrate the transformative nature of the grant. For a majority of the host departments, the implication is not only a major increase in the size of the research and number of researchers. The grant also brings a range of other positive changes. Notably, nine out of ten centre leaders report that the grant to a great extent has accelerated the development of new ideas for research projects. This underscores the role of the CoE instrument as a framework grant (see Chapter 4) that brings together researchers with complementary expertise – providing both freedom and strong incentives to develop new project ideas within the centre’s focus area.

The responses also indicate a clear trend towards increasing internationalisation. This is reflected in the large share of foreign PhD students and post-docs, as well as the involvement of leading scholars from international universities.

Figure 6.2 illustrates this development, showing that a substantial proportion of the academic staff are international, with well over half of the affiliated researchers and doctoral students coming from abroad.

**Figure 6.2. Nationality composition of Centre staff (round 8-12 total)**



Source: Material from the Danish National Research Foundation

In the interviews, many centre leaders also highlight that the centres develop into international knowledge hubs.

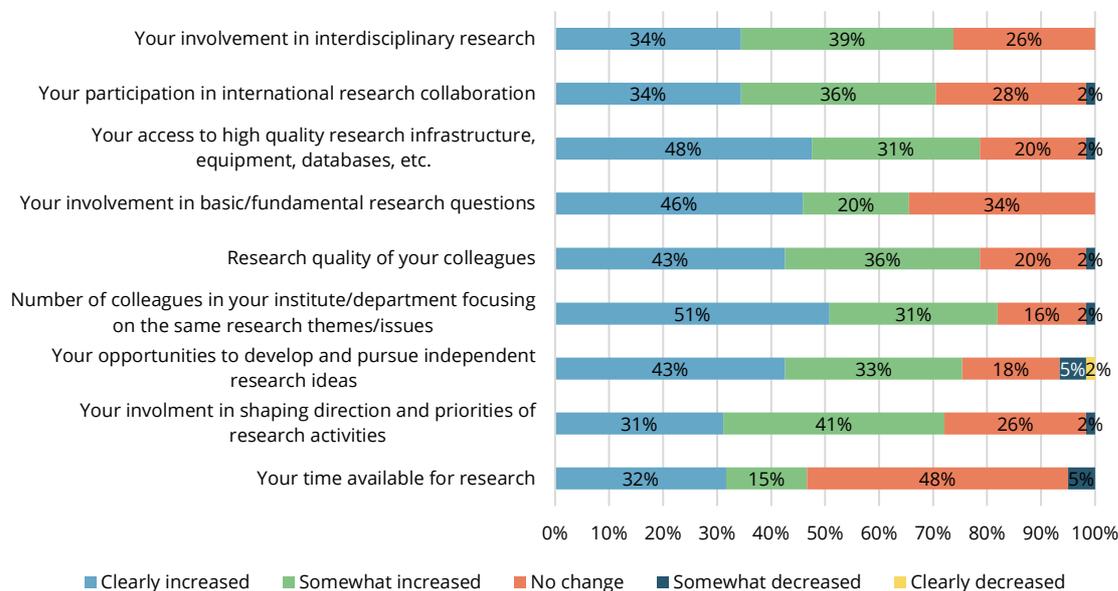
A large number of centres organise annual conferences or other types of international events and attract visiting researchers interested in accessing the knowledge and data generated in the centres.

Several of the interviewed department heads report that the centres attract a significant number of high-profile visiting researchers and guest lecturers.

Finally, Figure 6.1 indicates that in most centres more top researchers are involved in the research activities compared with before the grant. According to the centre leaders, the grant not only creates excellent opportunities for attracting international talent but also strengthens the ability to recruit strong candidates when departments open senior research positions.

Figure 6.3 presents the senior researchers’ responses to similar questions. In this case, the focus is on the impact of the specific research activities in which they have participated, rather than on the department as a whole.

**Figure 6.3. Affiliated senior researchers' assessment of the CoEs' impact on their research**



Source: Survey of senior researchers affiliated with the CoEs

Note: N= 60-61. The figure includes only respondents who indicated that their primary research focus had been within the centre for several years, in response to a question about their affiliation with the centre.

The responses echo the overall tendencies identified by the centre leaders, albeit with a more modest assessment of the changes.

It is not surprising that assessments based on a share of a large number of projects are not evaluated as leading to the same level of change as the centres' activities as a whole.

But the answers underscore that CoEs create greater critical mass, stronger engagement in basic research questions, and improved access to infrastructure, data, and other resources.

Moreover, a clear majority report increasing opportunities for pursuing independent research ideas. Together, the responses highlight the centres' role in fostering an environment that supports the further development of new research themes.

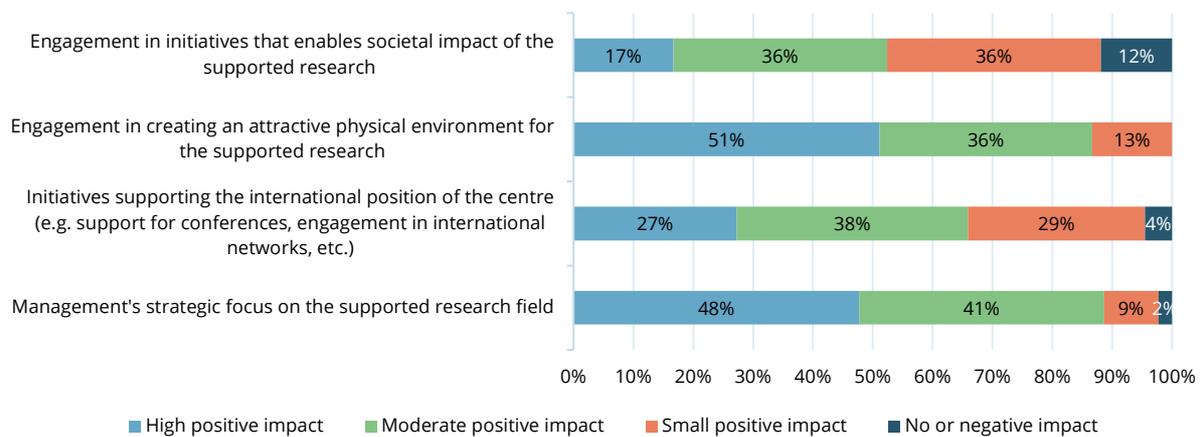
This point is further supported by interviews with university department heads, who emphasise that CoE grants provide a major boost and help enter new research fields with significant potential for generating ideas for new research projects.

### 6.3 The role and engagement of the host institution

This section focuses on the role and engagement of local management (i.e. institute directors) in the centres, and on how the CoEs are integrated into the host environments.

Figure 6.4 summarises centre leaders' answers to a question on how the DNRF grants have impacted behaviour and strategy of the host unit.

**Figure 6.4. Centre leaders' assessment of CoE grants' impact on behaviour and strategy of the host unit**



Source: Survey of centre leaders

Note: N=42-45. Responses marked as "Too early to say" are excluded from the figure (see appendix 1).

The answers indicate that hosting a CoE is a major event for the research environments, influencing their overall research strategy. Moreover, in most cases, the management is actively involved in creating a physical environment that provides the best conditions for achieving the ambitious research goals. Thus, more than half of the centre leaders report that the grant has had a highly positive impact on management's engagement in developing an attractive physical environment.

Engagement is, not surprisingly, more varied across centres when it comes to operational tasks, such as organising conferences.

Especially in smaller and medium-sized departments, securing a D NRF grant can have a major impact on strategic priorities. The interviews show that it is not uncommon for applicants to be promised additional permanent positions if they succeed in attracting a D NRF grant.

The interviews also indicate that attracting a CoE grant can bring challenges. High attention from top management (for example, personal congratulatory letters from the rector), increased strategic focus on specific research areas, greater imbalances in the size of research groups, and special

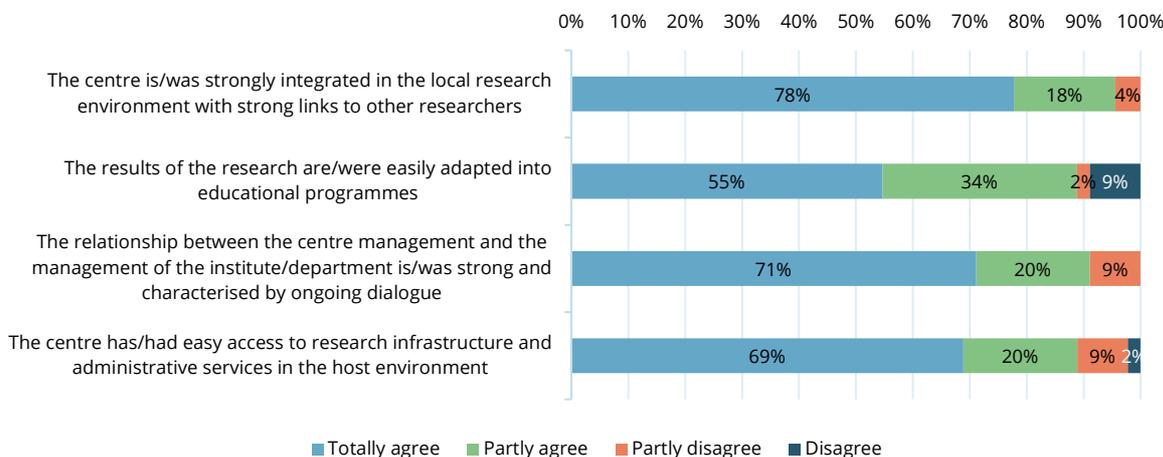
arrangements for improved physical facilities can generate jealousy and tensions within a research environment.

Some interviewees highlight the need for stronger support from university leadership in managing these challenges and integrating CoEs. It is considered crucial to be able to communicate and make visible the added value that a grant brings to the entire research environment.

In this context, the interviews also point out that the challenges vary across universities due to significant differences in the allocation of overhead. If no or only a limited portion of overhead is returned to the relevant institute, there is a real risk that more resources become tied up in the CoEs, because a large grant – all else being equal – places greater demands on local administration and infrastructure.

Figure 6.5 provides a more detailed view of the relationship between the centres and their host environment/management. It presents an overview of the centre leaders' assessment of integration with other research activities, as well as ongoing synergies with educational activities and collaboration with the institute leadership.

**Figure 6.5. Centre leader’s agreement with statements concerning the integration of the centre in the host environment**



Source: Survey of centre leaders

Note: N=44-45. Responses marked as "Too early to say" are excluded from the figure (see appendix 1).

The figure shows that the majority of centre leaders perceive the Centres of Excellence as well integrated into their host environments. Almost eight in ten report that their centre has been strongly embedded in the local research environment, with close links to other researchers. Similarly, more than two-thirds emphasise that their centre has enjoyed easy access to research infrastructure and administrative services, and more than 70% highlight a strong and ongoing dialogue with the host department or institute management.

The results are somewhat more mixed when it comes to the integration of research into educational programmes. While 55% fully agree that the centres’ research has been easily adapted into teaching, a further third only partly agree, and around one in ten express some level of disagreement. This suggests that, while centres are generally well connected to their host institutions, there remains scope to strengthen the links between cutting-edge research and education in some centres.

For all statements, there is a small minority who disagree. A similar picture emerges from the interviews, where some respondents note challenges

related to centres operating independently and becoming somewhat like a “state within a state.”

### 6.4 What happens after the grant expires?

Another interesting question is how the expiration of a DNRF grant affects the host environment. Just as the implementation of a CoE can have a major impact on a research environment, the same may hold true when a centre closes.

The interviews reveal considerable variation across centres. In some cases, the research theme is largely exhausted after ten years. A few of the affiliated early-career researchers may continue as senior researchers, but most move on to positions at other universities.

In other centres, the DNRF grant sets the research direction for decades. In some instances, the centres continue to hold active research grants even after ten years, with annual funding that exceeds the original DNRF grant.

Finally, some centres and departments experience a major decline in research activity and in the size

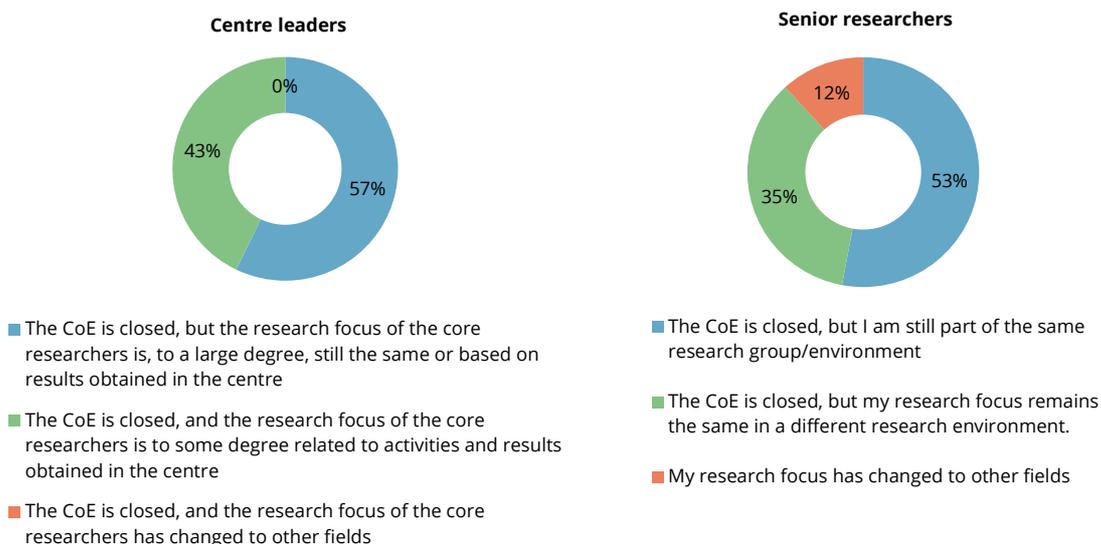
of the supported research groups, even though the potential for further research is considered high (see also Chapter 4). This is particularly the case within the humanities and social sciences, where access to large grants is limited (see Chapter 4).

The surveys indicate that a large majority of affiliated researchers continue to focus on projects closely related to the original theme of the CoE. Figure 6.6 provides detailed responses from

centre leaders and researchers from centres where the DNRF grant has expired. While the centre leaders' responses reflect the core team, senior researchers were asked to focus on their own research profiles.

As the figure shows, only a few researchers have shifted to other fields. The responses further underscore that the grants open new research avenues with long-term perspectives.

**Figure 6.6. Current research focus of affiliated researchers at centres where the DNRF grant has expired**



Source: Surveys among centre leaders and senior researchers affiliated with the CoEs  
 Note: N=21 centre leaders & N=51 senior researchers

In many centres, DNRF grants have also served as an excellent training ground for developing new research leaders capable of securing large research grants themselves. One example is the research environment for sugar molecules at the Department of Cellular and Molecular Medicine at the University of Copenhagen (KU). It was a DNRF grant in 2012 that laid the foundation for research aimed at developing improved methods to map and study glycoproteins, an area in which KU is now a global leader. Today, five researchers from the centre have established their own research groups, comprising approximately 50 senior

researchers in total. One of these new research leaders even received a DNRF grant in the most recent round.

### 6.5 Conclusions

The analyses in the chapter underscore the transformative nature of the programme. Beyond significantly expanding the research environment, the programme has fostered more interdisciplinary collaboration and accelerated idea development within the host institutions.

The evaluation also highlights a strong contribution to the internationalisation of Danish research, reflected both in the large number of foreign PhD students and postdocs, and in the involvement of leading international scholars.

In addition, many centres host major international events, and some have even developed into global knowledge hubs, organising the most important international activities and/or data collections within their specific fields.

Both survey results and interviews indicate a strong level of engagement and collaboration with local management. In smaller departments in particular, securing a DNRF grant can significantly influence research strategies and the prioritisation of permanent positions.

The downside of a Centre of Excellence grant may be imbalances with other research groups or the risk that the centre evolves into a “state within the state.” While CoE grants are, in most cases, positively received across the research environment, the evaluation also highlights a considerable leadership task in ensuring proper integration.

Finally, the evaluation shows that DNRF grants often set the direction of research for decades. Numerous examples point to second-generation effects, where younger researchers establish their own groups building on the work of the centres.

At the same time, some environments experience a substantial decline in research activity once the grant expires, particularly within the humanities and social sciences.

## 7. CAREER DEVELOPMENT OF AFFILIATED EARLY-CAREER RESEARCHERS

**This chapter examines the career development of early-career researchers affiliated with a CoE in the period 2012-21. First, it explores the institutional support available to affiliated PhD students and postdocs. Second, it analyses their subsequent career trajectories and the ability of early-career researchers to attract external funding. Finally, it examines the impact of CoEs on the career development of early-career researchers.**

### 7.1 Introduction

While the primary aim of the CoE programme is to promote excellent, curiosity-driven research, the centres also play an important role in shaping the careers of PhDs and postdocs.

Talent development is not a formal objective of the foundation, but the training of research talents and the career advancement of young researchers form an essential contribution to fulfilling its statutory purpose of strengthening Danish research at the highest international level. By equipping early-career researchers with strong research skills and valuable networks, the CoEs enhance both the immediate research environment and the long-term capacity of the Danish research system.

A substantial share of CoE resources is directed towards early-career researchers. Approximately 60% of the total grant volume is spent on salaries for PhD students and postdocs. A total of 505 PhD students were affiliated with a CoE in 2023, corresponding to just over 5% of all PhDs in Denmark.<sup>27</sup>

More than half of these students (54%) were international, underlining the strong attractiveness of CoEs as research environments. For comparison, around one-third of all PhD students in Denmark are international<sup>28</sup>.

This chapter examines the career development of PhDs and postdocs who have been affiliated with a CoE in the period 2012-21, including both researchers still connected to active centres and alumni who have since moved on to other positions.

Section 7.2 explores how the centres and their host institutions provide frameworks for talent development. Section 7.3 analyses the career paths and professional development of affiliated PhD students and postdocs. Section 7.4 examines the ability of early-career researchers to attract external funding, and Section 7.5 considers the overall impact of the CoEs on career development. The analyses draw on both survey data and register-based information on employment and grants.

### 7.2 Institutional support for affiliated PhDs and postdocs

This section examines how the CoEs contribute to talent development, with a particular focus on opportunities for PhD students and postdocs. It also considers differences across centres in the extent to which they prioritise training, career guidance, and support for early-career researchers.

A CoE grant entails a substantial increase in the number of early-career researchers, creating both opportunities to foster a fertile environment for

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<sup>27</sup> DNRF (2025); "Self-Evaluation Report" and Statistics Denmark: PhD programme

<sup>28</sup> Ministry of Higher Education and Science, Datawarehouse

talent development and responsibilities in terms of supporting these researchers.

A common feature across the centres, according to the interviewed centre leaders, is that the grant provides entirely new opportunities to attract talented researchers and PhD students from around the world. In other words, there is a significant boost in quality, and it is often within the group of early-career researchers that the centres' interdisciplinary approach is most clearly manifested.

However, the interviews also indicate that the commitment to talent development and support measures differs across centres.

Some centres and departments use the grant as an incentive to develop ambitious training programmes and to attract additional funding for this purpose. One example is the Centre for Pain Research at Aalborg University (AAU), which secured an EU grant for research training with a particular focus on preparing early-career researchers to establish their own research groups – leading to second-generation effects in the environment and success in obtaining funding from programmes

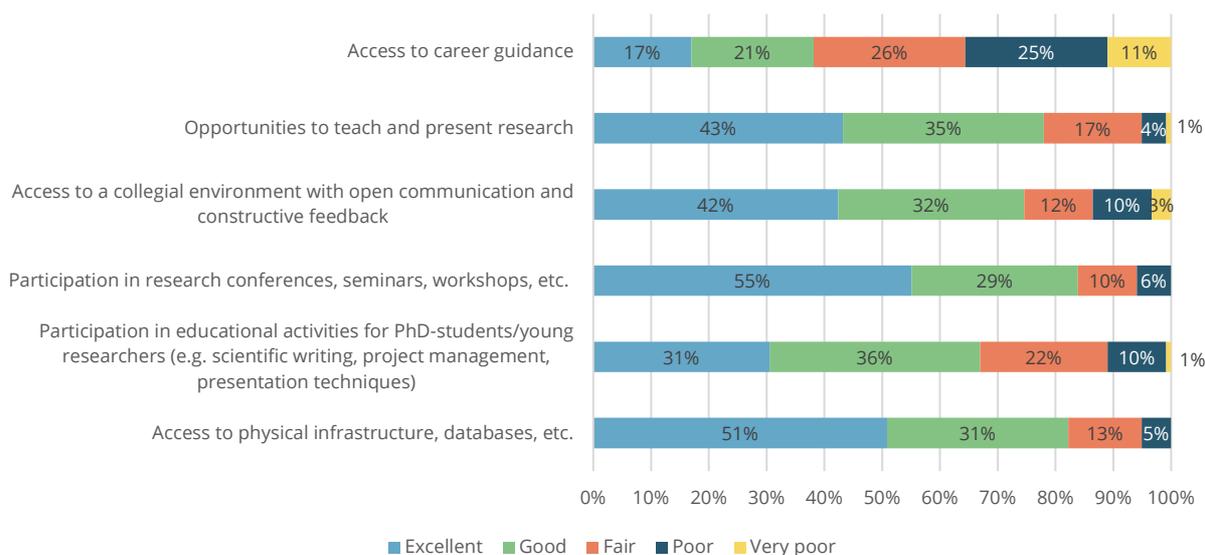
such as Sapere Aude (under the Danish Council for Independent Research), Marie Skłodowska-Curie, and ERC Starting Grants.

Similarly, the Cosmic Dawn Centre at University of Copenhagen has developed a specialised fellowship programme focusing on building research leadership skills among early-career researchers.

In other centres, the approach to and support for talent development has not been affected to the same extent. However, most centre leaders acknowledge the responsibility to provide career guidance and to assist early-career researchers in clarifying possible career paths. Some departments and centre leaders have also had close connections with private and public companies, which has opened career opportunities in organisations such as Novo Nordisk, Novozymes, Danmarks Nationalbank, and Haldor Topsøe.

Figure 7.1 illustrates how the affiliated PhD students evaluate their access to institutional support and the broader talent development environment during their time at the CoE.

**Figure 7.1. Affiliated PhD students' assessment of institutional support**

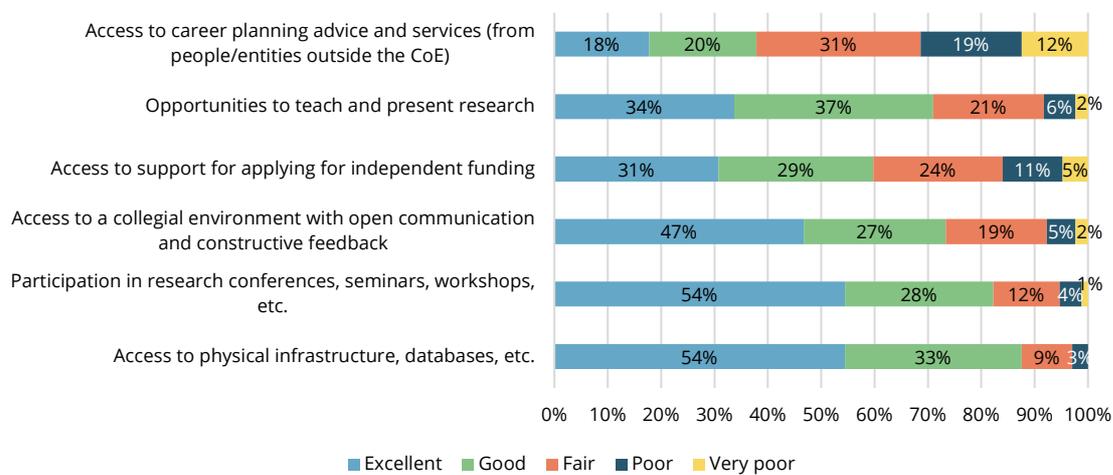


Source: Survey of early-career researchers affiliated with the CoEs  
 Note: N=118.

The affiliated PhD students' evaluation of the framework for talent development is generally positive – especially in areas related to research and opportunities for disseminating their work. Conversely, the responses support the picture that the prioritisation of career guidance and targeted training activities varies considerably across the centres.

The same picture is seen for the affiliated postdocs, as shown in Figure 7.2 below. A considerable minority among postdocs also evaluate career guidance as poor or very poor. At the same time, this group evaluates the quality of the research environment, access to infrastructure and data, and the opportunities to participate in valuable conferences very positively.

**Figure 7.2. Affiliated postdocs' assessment of institutional support**

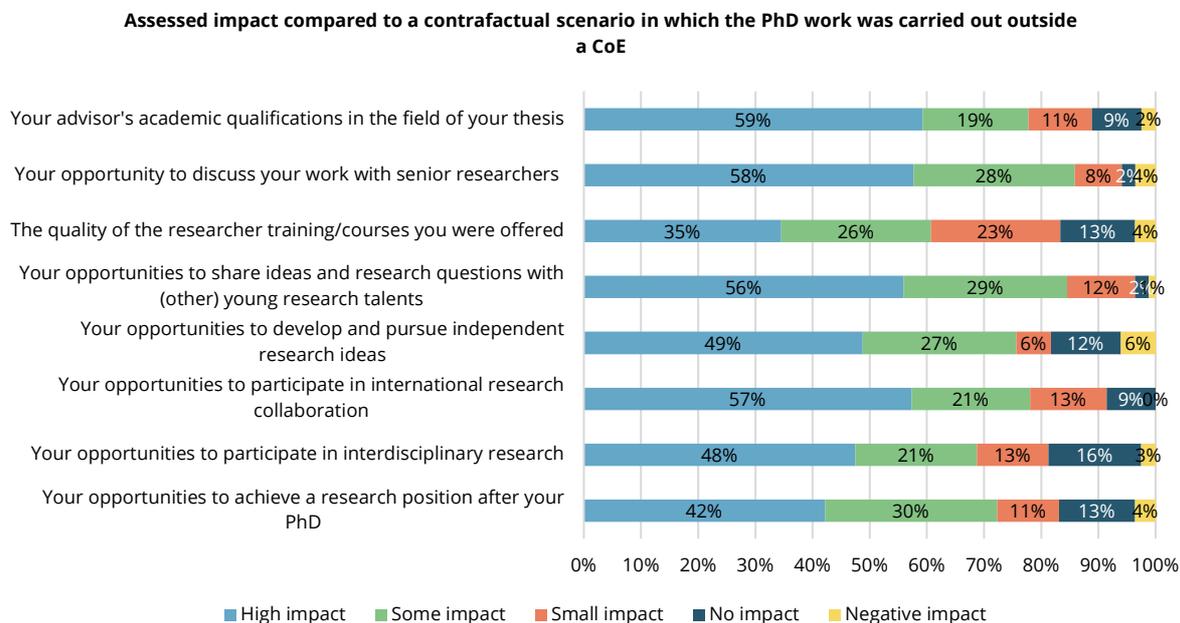


Source: Survey of early-career researchers affiliated with the CoEs  
 Note: N=169.

In the survey, the affiliated PhD students and postdocs were also asked to assess more specific elements of their research and research training. In the questionnaire, we asked the respondents to

assess these elements against a counterfactual scenario in which they did their PhD/postdoc work outside a CoE. The results for PhD students are shown in Figure 7.3.

**Figure 7.3. Affiliated PhDs’ assessment of CoEs impact on their research**



Source: Survey of early-career researchers affiliated with the CoEs

Note: N=80-85. Responses marked as “Do not know” are excluded from the figure (see appendix 1). The respondents were asked to consider the impact of the CoE by comparing what they think would be the situation if they did their PhD/postdoc work without being part of a CoE (e.g. in a relevant university department within a small research group).

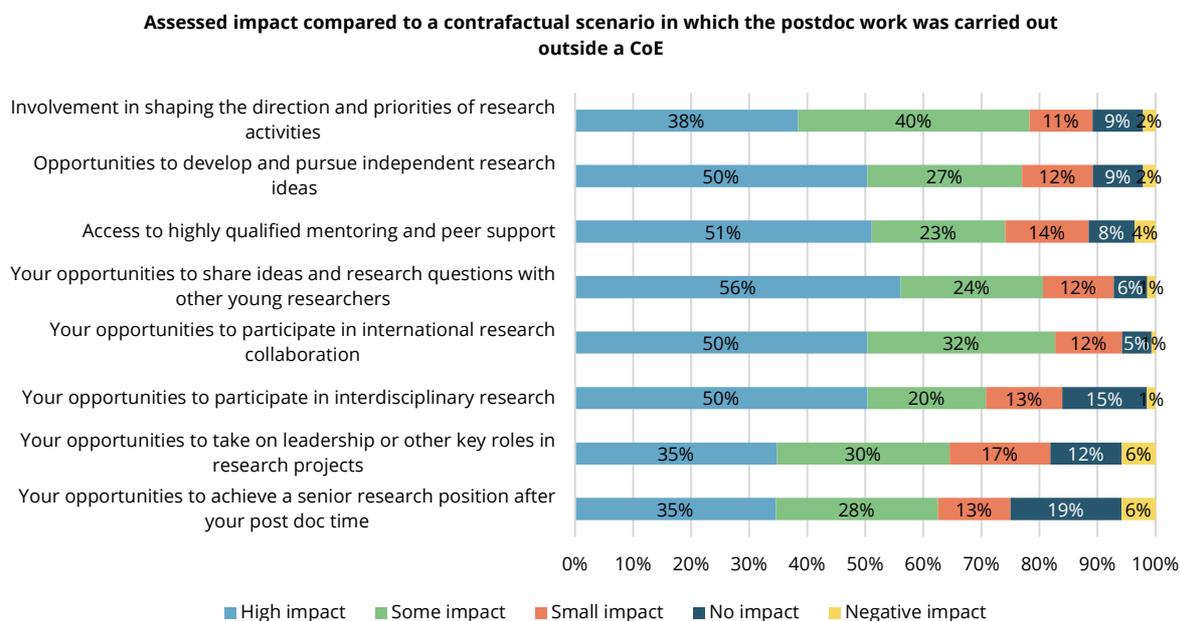
In all areas, a majority of the affiliated PhD students find that being part of a CoE has had either a high or some positive impact. The results thus underscore that the CoEs contribute to strengthening talent development at the universities.

In particular, access to advice from senior researchers, including the appointed supervisor, is evaluated very positively.

Once again, the quality of specific research training activities is the area showing the greatest variation across PhD students and centres.

The same type of questions were posed to affiliated postdocs, but with a stronger focus on the impact on their opportunities to shape research ideas and influence research agendas. The questions also addressed opportunities to take leading roles in projects and to develop their careers toward qualifying for senior positions, see Figure 7.4.

**Figure 7.4. Affiliated postdocs’ assessment of CoEs impact on their research**



Source: Survey of early-career researchers affiliated with the CoEs

Note: N=136-139. Responses marked as “Do not know” are excluded from the figure (see appendix 1). The respondents were asked to consider the impact of the CoE by comparing what they think would be the situation if they did their PhD/postdoc work without being part of a CoE (e.g. in a relevant university department within a small research group).

As with the PhD students, a majority of postdocs report high or some impact compared to “normal” postdoc positions. This clearly indicates that the CoEs provide a fertile environment for the development of research skills.

Not surprisingly, the most significant impact is related to the opportunity to share and develop research ideas together with other early-career researchers. Affiliated postdocs also report strong impact in relation to participation in interdisciplinary research questions and international collaborations.

The share reporting strengthened opportunities to achieve a senior research position is somewhat smaller, but this should be seen in light of the fact that a relatively large share continues their careers outside academia.

Finally, it is important to note that many early-career researchers find that the CoEs contribute to higher quality of mentoring and peer support.

It should be emphasised that the results, of course, are associated with some uncertainty, as many of the early-career researchers have not experienced the counterfactual scenario against which their responses are evaluated.

Nevertheless, the findings strongly support the view that the CoEs accelerate talent development among both PhD students and postdocs.

### 7.3 Career paths of affiliated PhD students and postdocs

This section examines the career paths of early-career researchers. The first part focuses on researchers who remain affiliated with Danish universities, while the second part covers all PhD

students and postdocs who have been associated with the CoEs.

To explore career development in the Danish research system in greater detail, we have conducted a register-based analysis focusing on individuals currently employed at Danish universities.

The analysis is based on personnel lists provided by the DNRF, which have been linked with databases containing information on academic positions and institutional affiliations. The methodological approach is described in more detail in the box below.

**Box 7.1. Analysis of career paths for early-career researchers in academia – approach**

The analysis of career paths for young CoE researchers still employed in academia draws on two databases.

**ORCID** is an international register containing information on academic positions, institutional affiliations and research outputs. ORCID profiles are maintained by the researchers themselves, meaning that the quality and completeness of the data depend on self-reporting.

**PURE** is a research information management system used by all Danish universities. It contains comprehensive profiles of researchers, including publications, projects, activities and institutional affiliations. The content in PURE is reported and verified by the universities.

To identify early-career researchers still active at Danish universities, we matched the two databases with a personnel list of researchers affiliated with the CoEs in the period 2012-21 covering 3,526 individuals (PhDs and postdocs). The match between the databases and personnel list was based on researchers' full names.

Through this process, 2,980 researchers with a CoE affiliation were identified, corresponding to 84% of the early-career researchers.

The databases do not indicate whether researchers are still research active; they only provide information on recent publications and institutional affiliations. We therefore applied an additional classification to

determine whether researchers could be considered research active.

A relatively strict criterion was used, defining researchers as active if they had published at least one article in 2024 or 2025. This ensures that those included can be regarded as genuinely engaged in research today.

In total, 1,422 researchers met this criterion. Of these, about half (758) are currently employed at a Danish university.

The approach has certain limitations that should be considered when interpreting the results.

First, the name-based matching between the personnel lists and the databases is sensitive to inconsistent use of names or spelling variations. Second, the relatively strict criterion for defining research activity means that some active researchers are not captured in the analysis. Finally, coverage in both PURE and ORCID is weaker further back in time, when fewer researchers regularly updated their profiles.

As described in Box 7.1, a total of 3,526 early-career researchers were affiliated with the CoEs during the period 2012–21, of which 758 are identified as research active at a Danish university today. The table below shows their distribution across the Danish universities.

**Table 7.1. Early-career researchers' affiliation with Danish universities**

| Danish university                      | Researchers |
|--|-------------|
| <i>University of Copenhagen</i>        | 383         |
| <i>Aarhus University</i>               | 158         |
| <i>Technical University of Denmark</i> | 137         |
| <i>University of Southern Denmark</i>  | 40          |
| <i>Aalborg University</i>              | 27          |
| <i>Other Danish Universities</i>       | 13          |
| <b>Total</b>                           | <b>758</b>  |

Source: IRIS Group based on data from PURE and ORCID  
 Note: N= 758. The table only includes researchers where information on their institution could be retrieved from either PURE or ORCID.

Overall, the pattern of affiliation reflects the size of the universities, with the largest numbers employed at the major institutions.

**A significant proportion hold senior positions**

As part of the analysis, we mapped the current job titles of the 758 identified researchers. The results are subject to some uncertainty, as the information is based on researchers' self-reported data in the databases, and job titles are not available for all individuals. In total, valid titles were identified for 301 researchers. The relatively low number reflects the fact that registering job titles in either the PURE or ORCID databases is not mandatory. Consequently, the results that follow should be interpreted with caution.

Figure 7.5 shows the current job titles of researchers who started their research careers as PhD

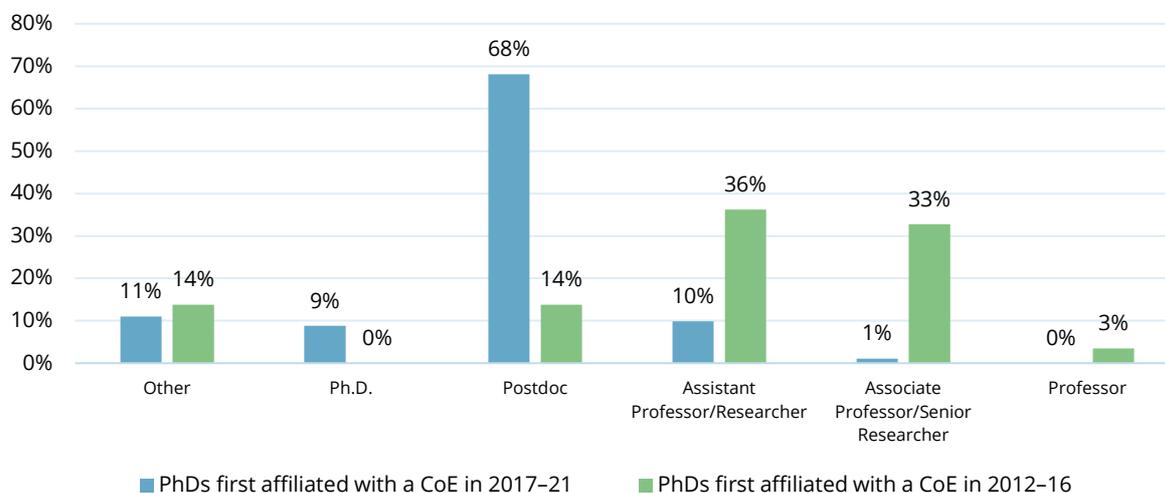
students at a CoE, presented for two cohorts: 2012–2016 and 2017–2021.

Among PhD graduates affiliated with a CoE in the most recent period (2017–2021), the majority are currently employed as postdocs.

This aligns with the expected next step in an academic career, in which the purpose of the postdoctoral stage is to further develop research competences and to build a foundation for the transition to more permanent academic positions.

For PhD graduates affiliated with a CoE during the earlier period (2012–2016), a larger share has advanced to senior positions. Nearly 70% are employed as assistant or associate professors, and a smaller number have already attained full professorships at Danish universities.

**Figure 7.5. Current positions at Danish universities of PhDs affiliated with a CoE during 2012-21**



Source: IRIS Group based on data from PURE and ORCID  
 Note: N=149. The category 'Other' covers remaining university positions, e.g. research assistant.

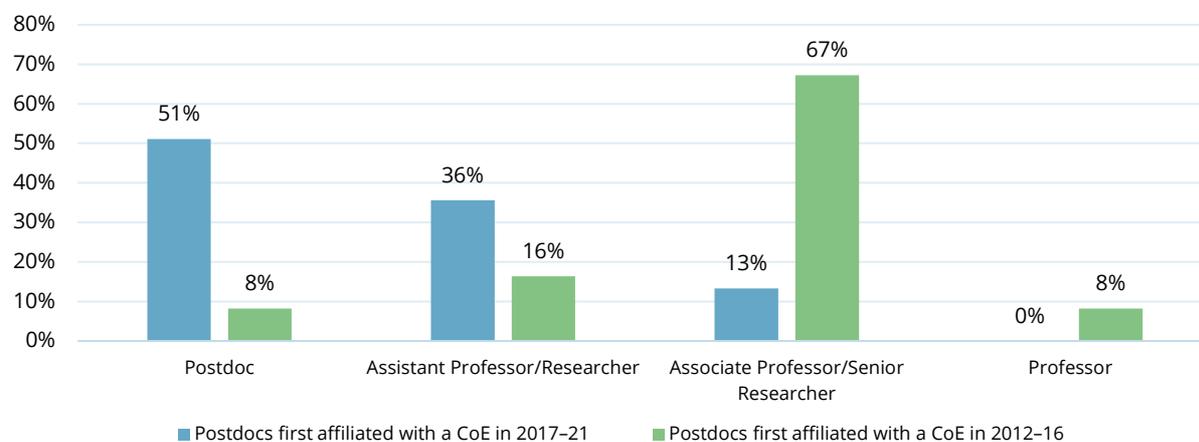
We also examined the current positions of researchers affiliated as postdocs in the CoEs in the period 2012–2021 (see Figure 7.6).

Among postdocs affiliated with a CoE in the most recent period (2017–2021), about half remain in postdoc positions today. The share reflects that a postdoc position in Denmark may last for up to

eight years. Around one-third of the cohort have advanced to assistant professorships, while a smaller share (13%) are now associate professors.

For postdocs affiliated with a centre in the earlier period (2012–2016), 67% currently hold positions as associate professors, and 8% have attained full professorships.

**Figure 7.6. Current positions at Danish universities of postdocs affiliated with a CoE during 2012-21**



Source: IRIS Group based on data from PURE and ORCID  
 Note: N=152.

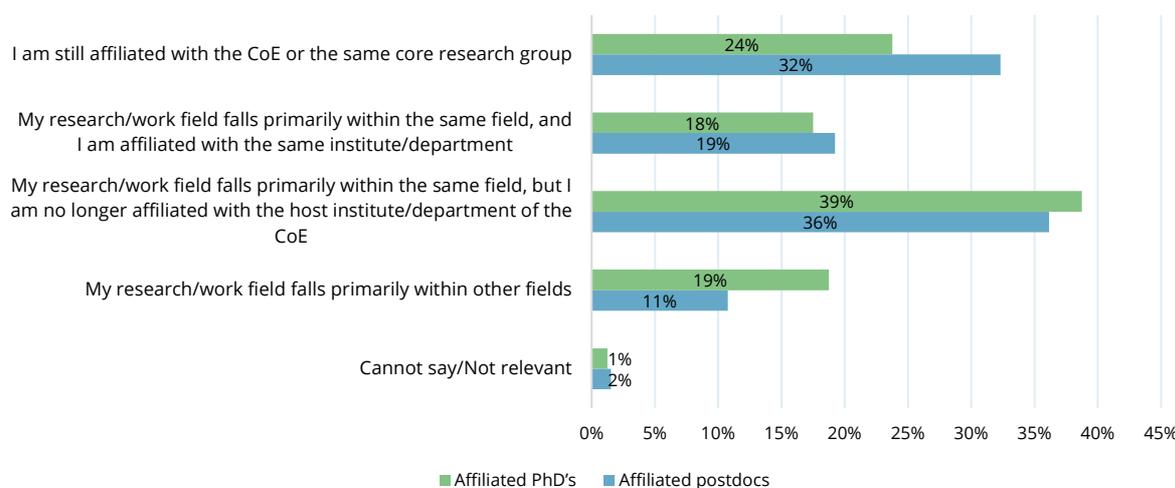
**Many early-career researchers remain active within the same field of research**

In the survey of PhD graduates and postdocs affiliated with a CoE during 2012–21, those still active in academia – either in Denmark or abroad – were asked about their current research focus. Overall,

a majority of both PhD graduates and postdocs continue to work in the same field (see Figure 7.7).

More than 80% of both groups remain primarily within the same research area, while only 11% of postdocs and 19% of PhD graduates have moved into different fields.

**Figure 7.7. Current research focus of affiliated early-career researchers still employed in academia**



Source: Survey of early-career researchers affiliated with the CoEs  
 Note: N=80 PhDs & N=130 Postdocs. The figure does not include affiliated PhDs/postdocs answering that their work was only to a limited extent related to the CoE.

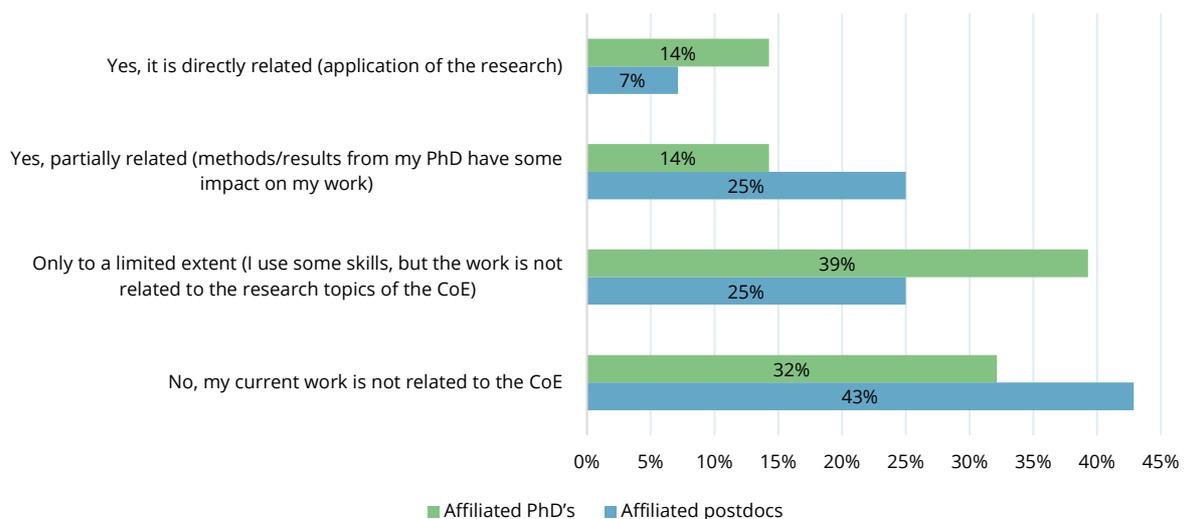
The figure also shows that a fair share of early-career researchers remains affiliated with the same core group. An additional 36–39% continue to work within the same research area, even though they are no longer part of the CoE's host department. This suggests that the research activities have opened new research directions that provide a foundation for early-career researchers to build their careers on.

A significant share of the early-career researchers also pursues careers outside academia after their time at the CoE. The survey explored whether their current work remains related to the research topics of the CoE. Within this group, only a small share

continues working on topics directly related to their former CoE research, with 14% of PhD graduates and 7% of postdocs remaining in closely related fields (see Figure 7.8). Around one-third of PhD graduates and 40% of postdocs employed outside academia have moved into different subject areas than those pursued at the CoE.

At the same time, many continue to apply the skills and competences acquired during their time at the CoE. An additional 40% of PhD graduates and one quarter of the postdocs employed outside academia report actively using methods and techniques developed during their research training.

**Figure 7.8. Current research focus of affiliated early-career researchers employed outside academia**



Source: Survey of early-career researchers affiliated with the CoEs

Note: N=80 PhDs & N=130 Postdocs. The figure does not include affiliated PhDs/postdocs answering that their work only to a limited extent was related to the CoE.

## 7.4 Attraction of funding

External funding accounts for an increasingly large share of research funding in Denmark (see Chapter 4). Consequently, the career progression of early-career researchers aiming to remain in academia increasingly depends on securing external grants. Those unable to obtain funding face

considerable challenges in maintaining positions within the university sector.

This section examines the extent to which early-career researchers affiliated with a CoE in the period 2012-21 have been successful in obtaining external funding during and after their time at the centre. The analysis is based on register data and covers the largest private and public research

funding bodies in Denmark as well as ERC Starting Grants.

**Box 7.2. Approach to grant analysis**

The analysis draws on grant lists compiled from the Danish Research Portal, supplemented with data provided directly by selected foundations.

The data applied in the analysis includes the following funding bodies and years:

- Carlsberg Foundation (2015-23): 2,506 grants
- ERC – Starting Grant (2015-22): 8,043 grants
- Lundbeck Foundation (2012-23): 1,940 grants
- Independent Research Fund Denmark (2012-23): 5,506 grants
- Novo Nordisk Foundation (2012-23): 4,405 grants
- Villum Foundation (2012-23): 816 grants
- Velux Foundation (2012-23): 117 grants

In total, the database comprises nearly 24,000 grants.

The analysis is based on a personnel list provided by the DNRF covering 3,526 early-career researchers (PhD students and postdocs) affiliated with a CoE between 2012 and 2021.

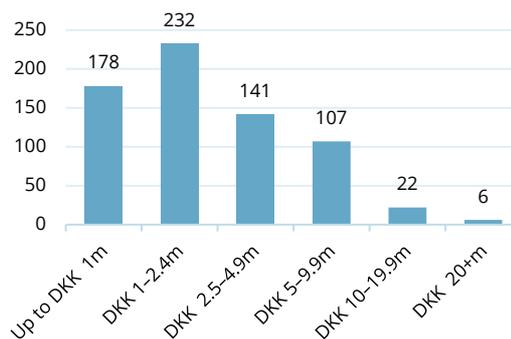
This list was matched with the grant database by name to identify projects where the young DNRF-researcher was registered as the grant holder.

It is important to be aware that the approach has certain limitations, as name matching may be affected by changes in surnames (e.g. in connection with marriage), inconsistent use of middle names or spelling variations. The results should therefore be interpreted with these caveats in mind.

By linking data from the grant database with a list of affiliated researchers (see box 7.2), we find that early-career researchers affiliated with the CoEs were awarded a total of 686 research grants in the

period 2012–2023, corresponding to a total volume of DKK 2,356 million. Figure 7.9 shows the distribution of these grants by size.

**Figure 7.9. Young DNRF-researchers' attraction of external funding**



Source: IRIS Group based on data from research foundations  
 Note: N=686 projects

A large proportion of the projects are relatively modest in size, with grants of up to DKK 2.4 million. These typically include early-career instruments such as the Carlsberg Foundation’s Internationalisation Fellowships, the Independent Research Fund Denmark’s Research Project 1, and Lundbeck Foundation’s Postdoc projects.

The share in this segment reflects that the researchers are at an early stage of their careers and typically begin by applying for grants aimed at supporting the establishment of an independent research profile.

As researchers become more established, they increasingly apply for larger grants that allow them to build their own research groups. Grants in the range of DKK 5–9.9 million are examples of this, including programmes such as the DFF Research Project 2, the Villum Young Investigator programme, and the Novo Nordisk Foundation’s Investigator Scheme.

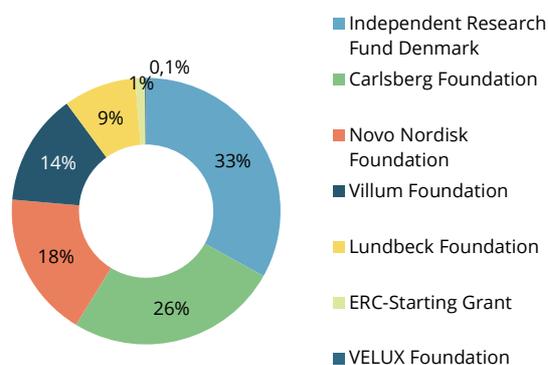
For most researchers who have secured such grants, five to ten years have passed since their initial affiliation with a CoE.

Finally, a small group of researchers have succeeded in obtaining large-scale grants of DKK 10 million or more, including prestigious programmes such as ERC Starting Grants and the Lundbeck Foundation Fellowship Scheme.

**Funding is obtained from a variety of funding bodies**

The figure below shows the distribution of the 686 awarded grants by funding body.

**Figure 7.10. Young DNRF-researchers' attraction of grants - by funding body**



Source: IRIS Group based on data from research foundations  
 Note: N=686 projects

The Independent Research Fund Denmark and the Carlsberg Foundation together account for approximately half of the projects. Both foundations place a strong emphasis on supporting early-career researchers through schemes that allow them to test ideas and establish an independent research profile, including opportunities for research stays at leading international institutions. In addition, both foundations broadly support projects across all main fields of science.

The average Carlsberg Foundation grant amounts to around DKK 1.6 million, while the Research Fund Denmark grants are somewhat larger at DKK 2.8 million on average.

The Independent Research Foundation's instruments Research Project 1, Research Project 2 and Sapere Aude provide funding opportunities for

researchers at different stages of their careers. Research Project 1 typically provides smaller grants targeted at researchers in the early stages of their careers, while programmes such as Research Project 2 and Sapere Aude offer larger awards aimed at more advanced early-career researchers.

On average, grants from the Villum Foundation and the Novo Nordisk Foundation are somewhat larger (around DKK 5 million), as they are typically targeted at more experienced researchers, for example through programmes such as Villum Investigator.

Finally, ERC Starting Grants make up just 1%. The limited number of ERC grants reflects the highly competitive and prestigious nature of the programme.

In the interviews, early-career researchers reflected on their experiences in securing external funding. Many emphasised that affiliation with a CoE was widely recognised as a mark of scientific excellence, enhancing their prospects of obtaining additional grants. Coupled with strong networks and collaborations with leading researchers, the CoE affiliation is seen as an important driver for obtaining grants.

**7.5 CoEs' impact on career development**

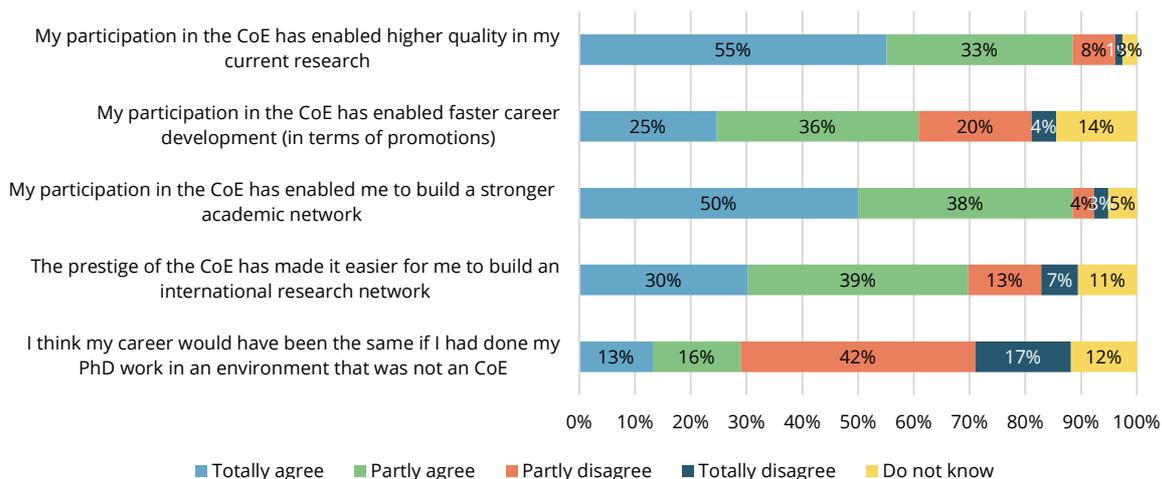
The results of the analyses in the previous sections indicate that affiliation with a CoE can have a positive influence on the career development of PhD students and postdocs.

A relatively large share has advanced to permanent positions at universities, and most report that they continue to benefit from the knowledge and skills acquired during their time at the CoE.

In the survey, *PhD graduates* were asked to reflect on the extent to which their CoE experience has influenced their career. Among those *currently working in academia*, almost all agree (fully or partly) that participation in a CoE has enhanced the quality of their research activities. A similar

proportion assess that the CoE experience has helped them build a stronger academic network (see Figure 7.11).

**Figure 7.11. Affiliated PhD students' assessment of CoE's career impact (employed in academia)**



Source: Survey of early-career researchers affiliated with the CoEs

Note: N=69-78. Respondents marked as "Too early to say" are excluded from the figure (see appendix 1). The figure does not include affiliated PhDs answering that their work only to a limited extent was related to the CoE.

More than half of the PhD graduates also agree, fully or partly, that being part of a CoE has enabled them to accelerate their career development.

The significance of the CoE affiliation is further underscored by the fact that only 31% believe their academic career would have followed the same path had their PhD been conducted in a more traditional university environment.

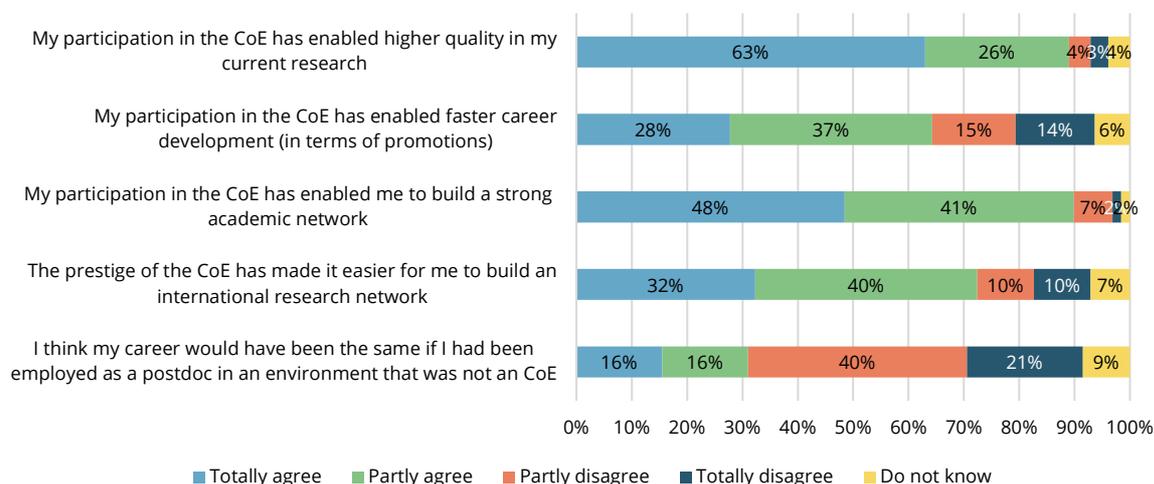
Interviews with PhD graduates support the survey findings, portraying the CoE as a unique platform for career development. Several early-career researchers highlight that their CoE experience

served as a door opener, both by providing access to funding and by strengthening their applications for academic positions.

Some describe the CoE as a valuable quality mark on their CVs, enhancing visibility and credibility in competitive environments. Others emphasise that the CoEs foster international and interdisciplinary networks that continue to shape their career opportunities.

Among postdocs from the CoEs currently employed in academia, a similar pattern emerges, cf. Figure 7.12.

**Figure 7.12. Affiliated postdocs' assessment of CoE's career impact (employed in academia)**



Source: Survey of early-career researchers affiliated with the CoEs

Note: N=127-129 (employed in academia) & N=28-30 (employed outside academia). The figure does not include affiliated postdocs answering that their work only to a limited extent was related to the CoE.

Nearly all postdocs agree, fully or partly, that participation in a CoE has enabled them to conduct higher-quality research and helped strengthen their academic networks.

Likewise, only 16% fully agree their career path would have been the same if they had done their postdoc work without being part of a CoE.

Several of the interviewed postdocs also pointed out that their affiliation with a CoE has been important for their subsequent career development, although the experiences varied.

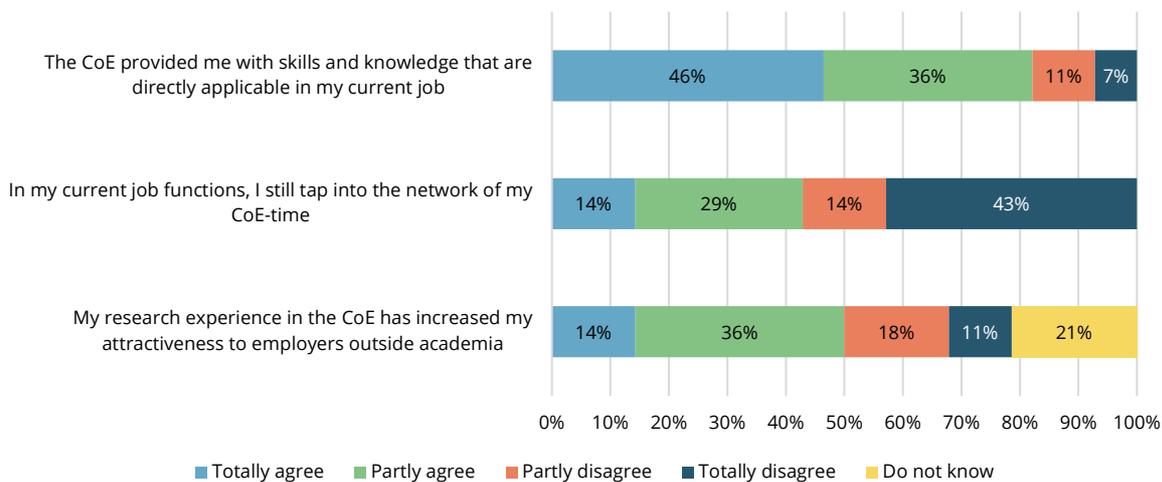
They emphasised that methodological and technical skills, high research output and international exposure gained through the centre were decisive factors in advancing their careers.

At the same time, some noted that the CoE affiliation did not always have direct impact outside the specific scientific field. For these researchers, it was sometimes challenging to translate their experience into new contexts or to demonstrate its relevance when applying for external funding beyond the centre environment.

Among PhD graduates currently working outside academia, nearly 80% agree that the CoE-affiliation has provided them with skills directly applicable in their current jobs, see Figure 7.13.

Almost 50% also assess that the research experience gained at the CoE has made them more attractive to employers beyond academia.

**Figure 7.13. Affiliated PhD students’ assessment of CoE’s career impact (employed outside academia)**



Source: Survey of early-career researchers affiliated with the CoEs

Note: N=28. The figure does not include affiliated PhD students answering that their work only to a limited extent was related to the CoE.

Interviews with PhD graduates in this segment confirm that many continue to rely heavily on skills acquired during their CoE time. Qualifications such as methodological rigour, technical independence, laboratory techniques, and advanced data analysis are highlighted as directly applicable in current jobs. Several also note that the research-based approach to problem-solving has proven valuable even in entirely new contexts.

## 7.6 Conclusions

The analyses in this chapter underline the pivotal role of the CoEs as talent factories shaping the careers of future researchers. The centres provide strong frameworks for research training, enhance the quality of supervision, and open opportunities for building international and interdisciplinary networks.

They also equip young researchers with transferable skills valued both within and beyond academia. Many affiliated researchers have advanced to senior positions, while others have successfully transitioned into careers outside the university sector.

At the same time, the evaluation shows that support structures for talent development vary across centres, with notable differences in the availability of career guidance and structured training.

Nevertheless, the overall evidence indicates that CoE affiliation accelerates career progression and strengthens the ability of young researchers to secure external funding. In this way, the centres not only advance scientific excellence but also foster the next generation of research leaders, thereby amplifying the long-term impact of the DNRF’s investments.

## 8. SOCIETAL IMPACT OF THE COES

**Chapter 8 evaluates the broader societal value created by the CoEs. It explores whether – and how – the Centres’ activities generate societal impact across various areas of importance to society. Furthermore, it provides deeper insight into the mechanisms that link research with societal needs, illustrated through examples and case studies.**

### 8.1 Introduction

While innovation and other types of societal impact are not stated aims of the DNRF, it is evident that basic research is an important driver for research-based innovation and for the generation of new knowledge that might lead to better regulation, the solving of societal challenges, etc.

According to the DNRF, innovation activity at the CoEs has changed significantly since the programme was initiated, mirroring the changes in the political view of the role of research and increasing focus on “third leg” activities at the universities. There is, for example, no evidence of spinout activity among the earliest centres (rounds 1-3). Spinout activity more than doubled during the period 2012-23 compared to the preceding period. During 2012-23, the active centres created an average of 3.3 spinout companies per year. This means that the CoEs were involved in 12% of all spinouts from public research institutions during that period.<sup>29</sup>

Evaluating the societal impact of CoEs is not an easy task.

Firstly, the road from groundbreaking research to impact can be very long, and time and costs vary significantly across scientific areas and impact measures.

Secondly, the relationship between research and societal impact is often indirect and complex. In some cases, impact stems from multiple grants, with external factors also playing a central role.

Consequently, it is difficult to isolate the specific contribution of, for example, a CoE instrument.

Thirdly, it is important to emphasise that the primary channel to societal impact is likely the development of human resources. The CoEs’ research activities are translated into research-based education, and new knowledge from the centres is applied in businesses and the public sector when PhD graduates and postdoctoral researchers are employed, for example, in research and development positions (see Chapter 6).

Fourthly, societal impact can take many forms, and the relative significance of each type varies across research fields.

It is therefore important to evaluate impact within a broad framework that captures the diversity of CoEs. In this evaluation, with minor modifications, we have applied the classification of impact used in the British REF system, which distinguishes six main types of impact<sup>30</sup>:

- *Economic impact* – Contributions to economic growth, innovation, productivity, job creation, etc.
- *Technology and know-how* – Development of new technologies, collaboration with industry, and the establishment of new research-based companies.
- *Health* – Improvements in public health, clinical practices, or treatment methods.

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<sup>29</sup> DNRF (2025); “Self-Evaluation Report”

<sup>30</sup> The Research Excellence Framework (REF) is the UK evaluation system for assessing the quality of university research and its societal impact. REF was introduced in 2014. See <https://ref.ac.uk>.

- *Policy and public sector impact* – Contributions to legislation, policy, public administration, and public services.
- *Climate and environment* – Contributions to sustainability, resource management, climate action, and nature conservation.
- *Culture and society* – Contributions to public debate, cultural development, social practices, and citizen engagement.

### **Approach – how to evaluate societal impact**

In recent years, the body of research and literature on how to assess the societal impact of science has expanded considerably. This development encompasses both the refinement of supplementary metrics (altmetrics), which link scientific publications to non-academic repositories and databases, and the advancement of qualitative evaluation approaches and frameworks, such as the British REF (see above).

However, unlike the analysis of research impact (see Chapter 5), there is still no established golden standard for assessing the societal impact of research programmes<sup>31</sup>. There is, however, broad agreement in the literature that robust approaches to evaluating societal impact involve the triangulation of methods and data in order to account for the uncertainties mentioned above<sup>32</sup>.

In the evaluation, we have chosen to rely on a combination of survey data and insights from interviews with centre leaders and external beneficiaries of the research. While the survey data provide an overview of how many centres have contributed to different types of societal impact, the interviews offer examples of how the centres' research creates impact — and of the factors that may hinder the translation of basic research into value creation beyond academic impact.

We also considered including data from altmetric databases that link research and research articles to social media activity, references in policy documents, appearances in news media, blog posts, and similar sources.

However, altmetric databases are still far from providing comprehensive coverage of activities outside academia. In addition, it is difficult to compare and weigh the very different types of data sources – for instance, how should a post on X (formerly Twitter) be valued compared to a contribution to a policy document? Moreover, in our assessment, altmetrics reflect outreach activities rather than serving as robust evidence of impact, which should reflect real value contributions within the six areas listed above.

The following sections provide an overview of how the centres have contributed to societal impact since 2012, based on a large number of interviews and surveys to centre leaders and affiliated senior researchers. In both the surveys and the interviews, we asked researchers to include activities carried out within the centres as well as those initiated as a result of the research conducted there.

For some centres, however, it is impossible to account for all indirect effects, and in many cases the long path to impact means that centre leaders have reported expected rather than realised effects.

Finally, it should be noted that evaluation theory distinguishes between *outcome* and long-term *impact*<sup>33</sup>. Outcomes may, for example, relate to changes in behaviour, the establishment of new organisations, or policy changes which, over time, lead to impacts measurable in terms of GDP, public health, cultural provision, etc.

The time lag between research and impact means that, in practice, we are only able to evaluate

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<sup>31</sup> Dotti, N. F. & Walczyk J. (2022): What is the societal impact of university research? A policy-oriented review to map approaches identify monitoring methods and success failures. *Evaluation and Program Planning*

<sup>32</sup> Dotti, N.F. & Walczyk J. (2022) samt Zhang, I, Sivertsen G., Huang Y. & Glänzel W. (2021): Gender differences in the aims and impacts of research. *Scientometrics*

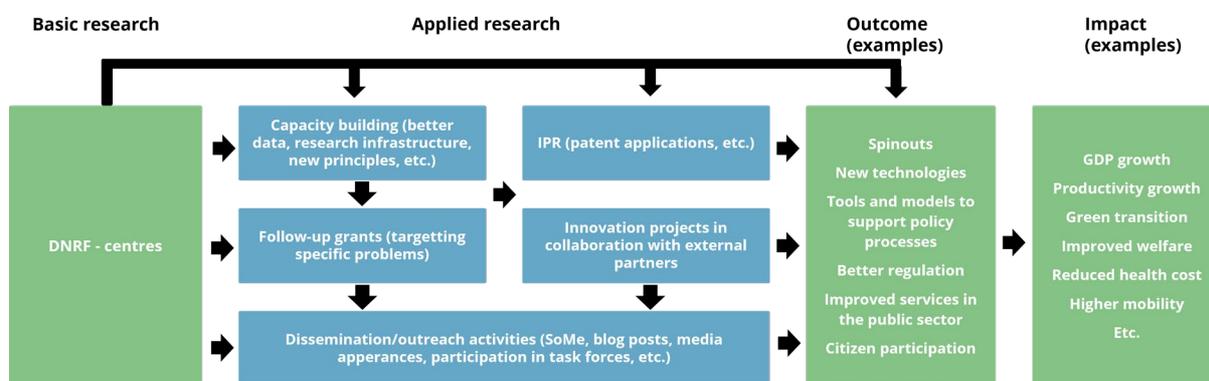
<sup>33</sup> Khandker, S, Koolwal G. & Samad H. (2009): Handbook on Impact Evaluation: Quantitative Methods and Practices. *The World Bank*

outcomes – thereby assessing the likelihood that the centres will generate long-term impact to a greater extent than we can measure directly. Accordingly, when we use the term “impact” in the remainder of this chapter, the more precise evaluation term in most cases would be “outcome.”

The relationship between the centres’ research activities and impact is illustrated in the figure below,

which also provides examples of outcomes and impacts. The figure further shows that outcomes may be both a direct result of the centres’ research and an indirect result linked to subsequent grants. Finally, participation in general dissemination activities (such as lectures and media appearances) is an important factor in translating groundbreaking research findings into practical use.

**Figure 8.1. Pathways to societal impact**



Source: IRIS Group

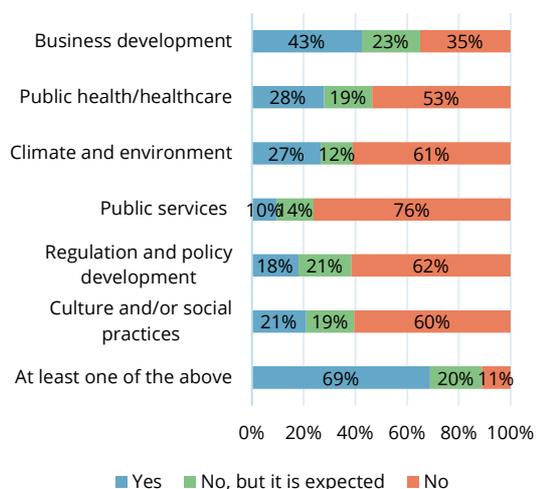
## 8.2 The majority of centres generate societal impact

In the survey, centre leaders were asked to indicate whether their research has generated impact within the six areas listed above.

To account for the temporal dimension, the response options included “No, but it is expected” and “Too early to say”. Centres selecting the latter option have been excluded from the further analyses to avoid including cases where the prospects for impact remain highly uncertain.

Figure 8.2 shows the share of centres that, according to their leaders, have generated positive impact within each of the six impact areas.

**Figure 8.2. Societal impact of the centres – by impact area**



Source: Survey of centre leaders  
 Note: N=39-43. Responses marked as “do not know/too early to say” are not included in the figure (see appendix 1).

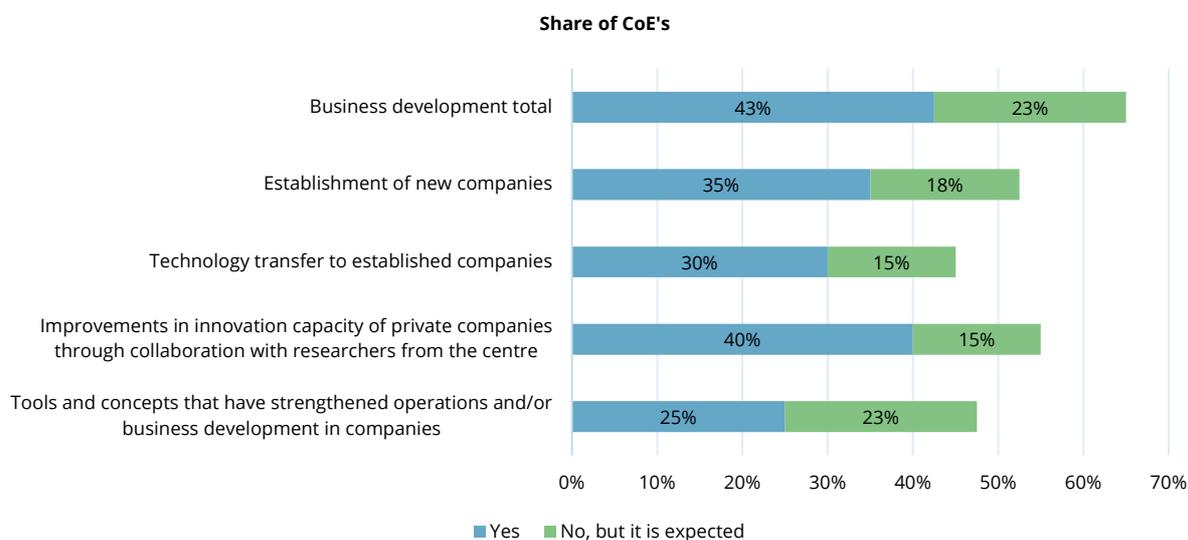
The lower bar shows that nine out of ten centres have generated some kind of positive impact or expect to do so. The highest proportion report – or expect to generate – impact through the commercial application of their research. In addition, a substantial share of centres contributes with solutions to major societal challenges, such as health, climate, and the environment. Finally, a smaller but notable minority indicates impact on regulation and policy development.

In the questionnaire, centre leaders were asked to specify the types of impact their centres have generated within each of the six impact areas. The responses are presented in the following sections, together with illustrative examples (based on interviews) showing how the research has generated value in selected centres.

### 8.3 Business development and commercialisation

In figure 8.3, impact on business development has been divided into four subcategories. The first refers to knowledge transfer in terms of the formation of new companies based on the centres’ research. The second covers transfer of technology to existing companies through licence agreements and sales of patent rights based on intellectual property rights (IPR) from the research. Finally, knowledge transfer can take place through collaborative projects or by developing new tools and concepts that enable companies to strengthen operations.

Figure 8.3. CoE impact on business development



Source: Surveys among centre leaders

Note: N=40. Responses marked as "Do not know/Too early to say" are not included in the figure (see appendix 1).

The responses show that many centres engage in research that paves the way for business innovation. 43% have already generated impact in new or existing businesses, while a further 23% expect to do so. Notably, the impact appears to be well distributed across both startups and established companies.

### Spinouts from the centres

Figure 8.3 indicates that the formation of new companies plays a significant role in transforming knowledge into societal value in several centres.

The survey responses also reveal that the portfolio of centre-based startups includes both spinouts (companies based on IPR owned by the research institution) and other types of startups established by researchers or students on the basis of the centre's research.

Among the 45 centres where the centre leader responded to the survey, 14 centres have generated new companies. Together, these 14 centres have so far provided the foundation for a total of 28 companies, 19 of which are spinouts<sup>34</sup>.

The DNRF also collects data on spinout activity. According to the self-evaluation, the active centres generated an average of 3.3 spinouts per year during the evaluation period (2012–23)<sup>35</sup> or approximately 40 in total. As the survey coverage is below 100%, and since the DNRF-number might include some new companies not formally based on IPR owned by the research institution (the formal definition of a spinout), the two numbers appear to correspond well.

Several of the established spinouts have already experienced significant growth and attracted substantial venture capital. They exemplify how large, long-term investments in frontier basic research can provide the foundation for radical innovation and the development of deep-tech startups that are world leaders within their niche.

One example is *Sparrow Quantum*, founded on research from two groups at the Niels Bohr Institute, which form the core of the CoE HyQ (Centre for Hybrid Quantum Networks). Sparrow Quantum is developing a new generation of photonic quantum systems, building directly on the research conducted at HyQ. As highlighted in Box 8.1, this represents a groundbreaking technology that has also attracted major venture capital investments.

#### Box 8.1. Groundbreaking research leads to radical innovation in Sparrow Quantum

Sparrow Quantum was founded in 2015 and is based on exclusive rights to exploit research results on photonic light sources from the Niels Bohr Institute at the University of Copenhagen.

Photonic chips represent a critical component in quantum computers that rely on light sources, as opposed to atoms or superconducting circuits, which are alternative technologies.

Sparrow Quantum has developed and commercialised stand-alone quantum chips, but its current research focus is on developing so-called 'entangled photons' – photonic chips producing streams of photons that are quantum-mechanically interconnected. The advancement of photonic quantum computers depends on creating systems that enable strong and reliable interactions between individual photons, an area where Sparrow Quantum is a world leader thanks to the research originating from the CoE HyQ.

Over a period of 7–8 years, HyQ has conducted research to perfect quantum chips and develop experimental techniques for controlling quantum mechanical systems. This effort has required the creation of extremely pure materials, the establishment of advanced experimental capabilities, and close collaboration between theorists, nanofabrication experts, and experimental quantum physicists.

HyQ and Sparrow Quantum collaborate through joint projects and industrial postdocs, with former centre director and company founder Peter Lodahl taking partial leave from the University of Copenhagen to contribute directly to the firm's research.

<sup>34</sup> The number of student startups is likely underestimated, as it is often difficult to establish a clear link between this type of company and the underlying research. In addition, students are under no obligation to report their startup activities.

<sup>35</sup> DNRF (2025): Self-evaluation report

The company has recently attracted DKK 150 million in new capital for its development activities, in addition to approximately DKK 50 million in project funding from the EU and the Innovation Fund Denmark. Today, it employs 40 people.

Sparrow Quantum sees substantial market potential, with the quantum computing market expected to exceed USD 10 billion in the coming years. The company has formed strong partnerships with leaders in photonic quantum computing.

According to Sparrow Quantum's management, the grant from the Danish National Research Foundation has been instrumental in enabling the company to achieve its position as a global leader in quantum systems.

Achieving functioning quantum technology in a research laboratory requires focus, patience, interdisciplinarity, and substantial resources. Becoming a world leader in photonics research and developing systems ready for commercialisation involves, among other things, the development of ultra-pure materials and devices, the refinement of quantum chips, and the creation of experimental techniques to control quantum-mechanical systems.

Sparrow Quantum's management also emphasises that the strongest innovation environments in quantum technology are closely linked to the world's leading research institutions. This is an area where world-class research and innovation mutually reinforce each other, and where the engineering work of developing chips and devices within companies also has a positive feedback effect on the research.

Lightnovo is another successful spinout, built on research and patents from the CoE IDUN. Although its technology is not as radical as that of Sparrow Quantum, it exemplifies how the interdisciplinary nature of CoEs provides a strong foundation for developing new high-growth businesses.

### Box 8.2. Lightnovo develops the world's best performing Raman spectrometer

Lightnovo was founded in 2019 and is based on research at the CoE IDUN, which focuses on developing new nanomechanical sensor systems for fundamental studies of molecular and cellular behaviour, as well as the structural properties of molecules and materials.

In 2016, the centre recruited the Ukrainian researcher Oleksii Ilchenko to lead the development of new optical methods for characterising molecular structures in various substances – a key step in the centre's ambition to detect small amounts of specific molecules present in complex matrices, such as urine, blood samples, or the supernatant of bacterial cultures.

Building on these results, Oleksii founded Lightnovo with the vision of developing the world's smallest and highest-performing Raman spectrometers for use in research and quality control across multiple industries.

The company's solution is a compact, handheld, and highly energy-efficient device that uses laser technology to characterize molecular structures in substances and liquids. The first product was sold in 2022, and the company's projected sales for 2025, primarily to research groups, are approximately EUR 1 million. Lightnovo aims to expand its customer base to industries such as pharmaceuticals and food processing in the coming years, with a target turnover of EUR 35 million by 2030.

To date, Lightnovo has secured more than EUR 3 million in soft funding from the EU, the Novo Nordisk Foundation, and the Innovation Fund Denmark, as well as EUR 4 million in equity funding from private investors and EIFO. The company currently employs 25 full-time staff across Birkerød, Ukraine, and Poland.

According to the CEO, the company's technology builds on the diverse expertise available in and around IDUN at DTU. Research at IDUN brings together specialists in mechanical engineering, software development, sensor systems, chemistry, and data analysis, creating a unique interdisciplinary environment. This collaborative expertise, combined with access to fermentation samples from other DTU sections (DTU Sustain) and IDUN's advanced research infrastructure, proved crucial in developing a competitive and innovative technology, supporting innovation in existing businesses.

Although the centres are founded to create basic and fundamental research, many centres are or have been engaged in collaboration with established companies.

Companies are rarely directly involved in the research activities. However, several of the centres' research activities have application perspectives that can be pursued in other projects funded by, for instance, the Innovation Fund Denmark. A 2023 survey showed that the CoEs were involved in 28 active grants from the Innovation Fund Denmark<sup>36</sup>.

The interviews reveal that many of the centres are actively seeking collaboration with companies. As an example, the CoE IDUN organises an annual industry day focusing on the centre's research and exploring potential areas of collaboration.

### **IPR and patent citations**

The centres' potential for commercialisation and collaboration with industry can also be assessed by looking at the extent to which inventions are patented, and the degree to which research from the centres is cited in patent applications.

Data from DNRF show that, between 2012 and 2023, Danish research institutions were granted 37 patents based on research carried out in CoEs. This corresponds to 7% of all patents granted to Danish research institutions in that period. At the same time, CoEs accounted for 10% of all patent applications filed by Danish research institutions<sup>37</sup>.

A survey conducted by DNRF further shows that 72% of all centres active during 2012–2022 have published articles cited in patents. Among the centres with activities dating back to 2012, 19% have been cited in more than 100 patent applications<sup>38</sup>. This reflects the fact that research in many centres is considered to have significant application potential.

## **8.4 Public health and healthcare**

Almost 50% of the centres have realised, or expect to generate, impact on public health and healthcare. This relatively large share reflects both the high proportion of centres within medical and health sciences (see Chapter 3), and the fact that several projects in the technical and natural sciences also address disease-related research and the development of diagnostic and treatment technologies.

As the figure below indicates, a significant share of the centres has succeeded in developing techniques for improved prevention, diagnosis, or treatment of diseases. However, implementation in clinical practice is, in most cases, still pending – most likely reflecting that many of the new technologies arising from the research are still in pre-clinical or clinical trial stages.

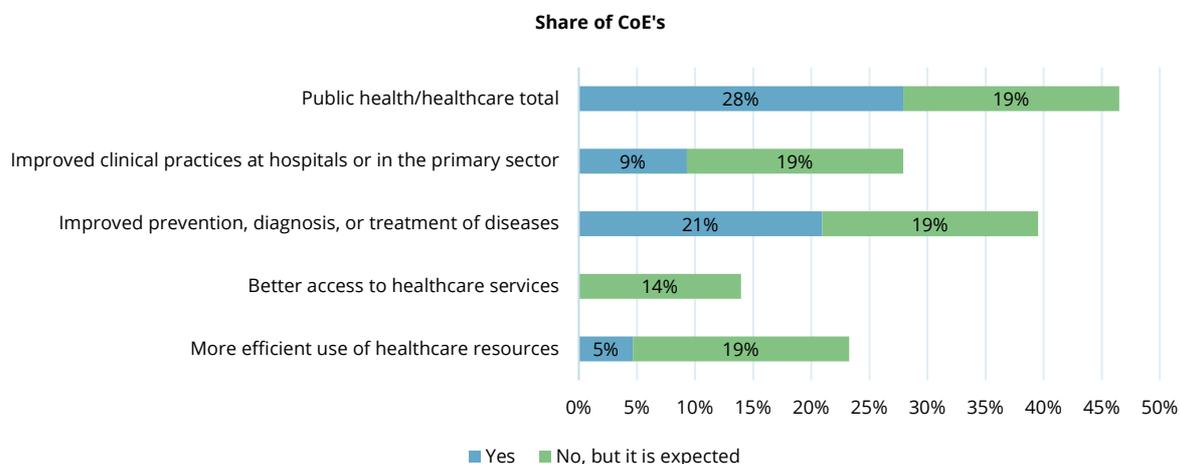
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<sup>36</sup> DNRF (2023): Self-evaluation report

<sup>37</sup> DNRF (2023): Self-evaluation report

<sup>38</sup> DNRF (2023): Self-evaluation report

**Figure 8.4. CoE impact on public health/healthcare**



Source: Surveys among centre leaders

Note: N=43. Responses marked as “Do not know/Too early to say” are not included in the figure (see appendix 1).

For most centres reporting impact in this area, spinouts serve as the bridge between research and health innovation. Accordingly, a large share of the centres that generate impact on public health and healthcare also contribute to impact through the creation of new companies (see section 8.3).

A strong example is the CoE PUMPkin (2007–17). The centre’s research has been instrumental in creating a handful of spinouts and also stands as a clear illustration of how new knowledge generated through basic research can lead to innovation and applications across a wide range of fields – in PUMPkin’s case, from treatments for Parkinson’s disease to the development of sustainable and healthy foods.

**Box 8.3. PUMPkin’s research enables multiple spinouts**

The CoE PUMPkin was an interdisciplinary centre bringing together researchers from Aarhus University (AU) and the University of Copenhagen (KU). The centre conducted research on the structure and function of proteins like the sodium-potassium pump, originally discovered by Nobel laureate Jens Chr. Skou.

The sodium-potassium pump is embedded in the cell membrane of the body’s cells, and it is crucial for the large differences in ion concentrations that are found inside and outside of cells and that drive many crucial cell functions.

The centre’s research in membrane transport processes has provided important expertise and technological developments behind several spinouts that in recent years have emerged from Aarhus University and attracted more than a billion DKK in venture capital investments.

The centre’s research first translated into the spin-out Pcovery aiming for development of new antifungals, and later into three other application areas:

- *Neuroscience* – At Aarhus University, the neuroscience centre DANDRITE was established in 2013 with parts of its research basis coming from PUMPkin. Professors Claus Olesen and Poul Henning Jensen from Dept. Biomedicine spun out the company Synuca Therapeutics, which is developing a new therapy for Parkinson’s disease. The aim is for the development of so-called calcium modulators that affect a calcium pump and interfere with the disease mechanism.

- *Reproductive medicine* – Based on insights into molecular and cellular physiology acquired in PUMPkin, and from new research introduced in reproductive medicine, Professor Karin Lykke-Hartmann founded the company Notify Therapeutics. The company is developing a novel type of non-hormonal fertility treatment with the potential to help millions of infertile women who do not benefit from conventional therapies.
- *Sustainable food* – PUMPkin also focused on pump functions in plant cells. This line of research from Michael Palmgren and colleagues has led to subsequent research at the Department of Plant and Environmental Sciences at KU, for developing evergreen grain crops that are more sustainable and require fewer chemicals when grown.

According to PUMPkin’s centre leader<sup>39</sup>, the DNRF grant has played a key role in developing a strong innovation culture at Aarhus University. The experimental approach to research and the generation of new knowledge about the physiological effects of cells has provided a strong foundation for developing new health technologies.

Several of the centre’s researchers have, following their participation in PUMPkin’s research, obtained funding from sources such as the Danish Council for Strategic Research, Novo Seeds, AU’s proof-of-concept funds, and venture capital to pursue application opportunities.

Another example is the Centre for Glycomics (2012–22), which conducted research on sugar molecules and developed a new technological platform to identify how sugars are attached to

proteins. Today, the platform is widely used in research and in the development of new diagnostic and therapeutic approaches for rare genetic diseases, cancer, and obesity. The technology has also led to a cancer therapy that has reached clinical application.

## 8.5 Climate and environment

Another key area where research plays a pivotal role in addressing societal challenges is climate, energy production, and the environment.

In 2022, four so-called *Innomissions* were launched, bringing together leading researchers, companies, and public authorities. The objective is to place Denmark at the forefront of carbon capture and utilisation, Power-to-X, climate- and environmentally friendly agriculture and food production, as well as circular economy solutions focusing on plastics and textiles.

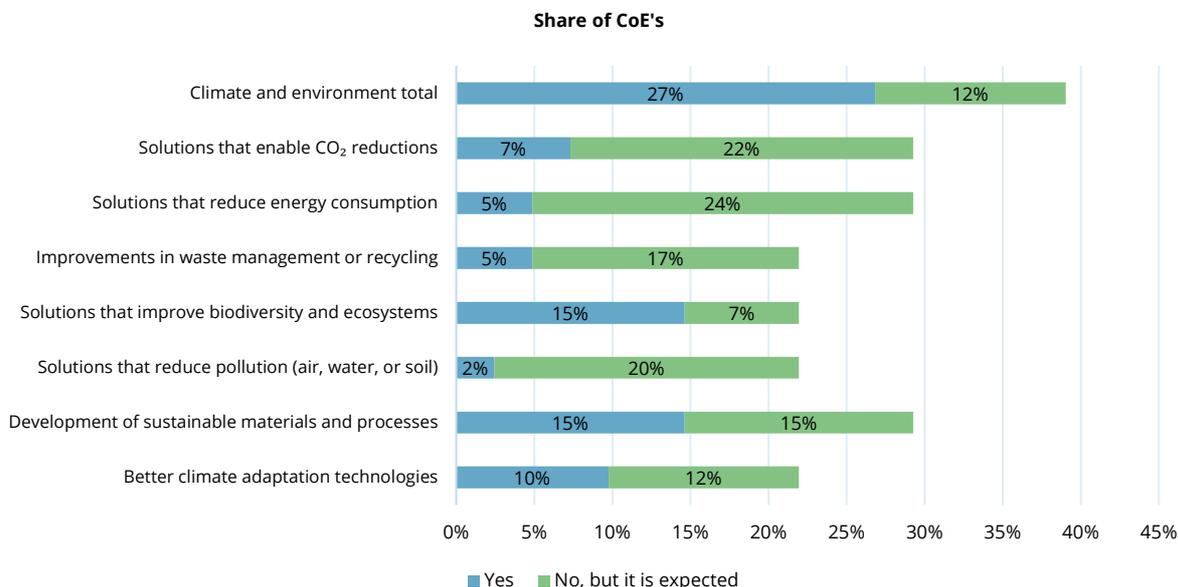
In addition, a number of funds and programmes at both the national and EU level support research and innovation in the green transition.

But what is the role of basic research in generating impact and preconditions for the development and scaling of green technologies?

Figure 8.5 illustrates the share of CoEs reporting that they have generated – or are expected to generate – impact in relation to climate and environment. The responses clearly indicate that the green transition is a focal point for a number of centres. 27% have already generated impact in new or existing businesses, while a further 12% expect to do so.

<sup>39</sup> Interview with Professor Poul Nissen, Department of Molecular Biology and Genetics, Aarhus University

**Figure 8.5. CoE-impact on climate and environment**



Source: Surveys among centre leaders

Note: N=41. Responses marked as “Do not know/Too early to say” are not included in the figure (see appendix 1).

Power-to-X is one of the technology areas where Denmark is making strong investments in the development of technologies that enable the conversion of energy into fuels, chemicals, and hydrogen.

These investments rely heavily on research originating from CoEs, especially within catalysis. Thus, catalysis plays a crucial role in Power-to-X processes, as they drive the reactions and optimise efficiency when converting chemical substances at a large scale.

As highlighted in Box 8.4 below, in particular two CoE centres have paved the way for building knowledge and capacity within catalysis processes. The centres have in turn formed the basis for subsequent investments in Power-to-X research funded by the Villum Foundation and through the new Pioneer Centres.

**Box 8.4. From groundbreaking research in catalysis to Power-to-X technologies**

One of the earliest CoEs was the Centre for Material Physics at the Atomic Scale (1993–2003), followed by the Centre for Individual Nanoparticle Functionality (2005–2015). Both centres were anchored at DTU Physics and focused on catalysis and surface physics. The latter of the two centres, in particular, had an ambition to develop and experimentally explore processes applicable to energy conversion.

Beyond developing and testing theoretical principles and computational predictions in experiments, the grants enabled the building of substantial capacity in terms of equipment and facilities, material knowledge, and human capital. A number of post-docs and PhD students from these centres are now senior researchers leading projects in the Power-to-X field.

In 2016, the two DNRF grants were followed by a DKK 150 million grant from the Villum Foundation to research specific Power-to-X technologies. This grant led to significant advances, particularly in catalysis processes for ammonia and methanol production

based on electrochemical and thermal methods, which remain core research areas at DTU Physics.

Subsequently, the DNRF, together with four private foundations, established the Pioneer Centre CAPeX, which also focuses on research in Power-to-X technologies coupled to AI-orchestrated materials discovery.

For both of these follow-up investments, it is important to note that they build on the capacity developed in the two original CoEs.

According to the CAPeX director, the Pioneer Centre CAPeX rests on a world-leading foundation in catalysis shaped in the Centres of Excellence<sup>40</sup>. CAPeX focuses on developing technologies for efficient hydrogen production as well as e-fuels for aviation and shipping, based on advanced materials to be used in scalable and sustainable catalysis. The centre collaborates closely with several companies and has multiple spinouts in the pipeline.

The Pioneer Centre represents a major asset in the global race to develop efficient Power-to-X technologies. It brings together research across physics (new materials), AI, robotics, computer science

and bioengineering. One of the features of the centre is the use of autonomous laboratories and AI-controlled robots capable of designing, synthesising, and testing materials at high throughput.

The grant for CAPeX runs until 2036 – more than forty years after the launch of the Centre for Individual Nanoparticle Functionality. The ambition is to develop and commercialise advanced materials technologies for large-scale industrial use. Although a few spinouts have also resulted from the first centres, the CAPeX trajectory clearly illustrates that the road from basic research to substantial societal impact is long, costly, and requires significant follow-up investments.

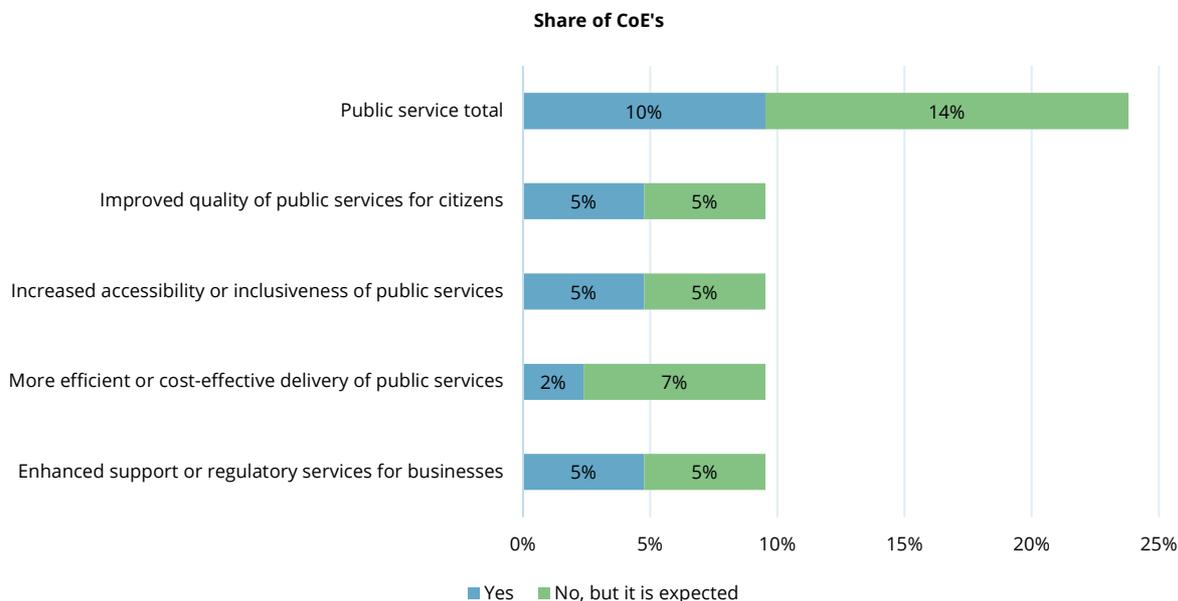
## 8.6 Public services

Knowledge and insights generated through basic research may also contribute to strengthening the capacity of public authorities in developing and improving services for citizens and businesses. 10% of the CoEs report having generated impact in this area, while a slightly larger share expects to do so, as illustrated in Figure 8.6

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<sup>40</sup> Interview with Tejs Vegge, CAPeX

**Figure 8.6. CoE-impact on public services**



Source: Surveys among centre leaders

Note: N=42. Responses marked as “Do not know/Too early to say” are not included in the figure (see appendix 1).

The path from basic research to improvements in services provided by public authorities is often long and indirect, and it may be difficult to disentangle the impact of specific research projects from other contributing factors. Consequently, the figures in Figure 8.7 should be interpreted with caution, as a high degree of uncertainty is associated with assessing expected impact in this specific area.

Nonetheless, some centres have clearly generated impact on public services. One example is the Centre for Permafrost (2012–22), which investigated the relationship between climate change, thawing of permafrost in the Arctic, the release of greenhouse gases, and short- and long-term changes in the Greenlandic ecosystem.

The research concluded that the impact of climate change, including the thawing of permafrost in Greenland on the global greenhouse gas inventory is close to neutral, since the release of greenhouse gases associated with thawing is more or less

offset by the increasing plant growth as a CO<sub>2</sub> sink, along with methane oxidation.

However, the thawing of permafrost has important implications for the Greenlandic society in several ways, and the CoE has engaged in collaboration with public authorities on matters of strategic importance, including cultural heritage, business development, and infrastructure planning (see Box 8.5).

**Box 8.5. CENPERM collaborates with Greenlandic authorities**

The CoE for Permafrost (CENPERM) investigated how the Greenlandic ecosystem will be affected by thawing permafrost in both the near future and over a 100-year perspective. Building on this research, the centre has worked with Greenlandic authorities to map perspectives and challenges in a number of important areas of relevance to public services, including agriculture, archaeology, and other key domains. Specifically, CENPERM has:

- Mapped the potential for sustainable sheep farming in West Greenland as a result of expanding grassland areas, which has led to collaboration with Greenlandic sheep farmers seeking to establish themselves near Nuuk.
- Mapped and quantified the implications of permafrost thaw for archaeological sites and worked with the Greenland National Museum on initiatives to protect cultural heritage and to prioritise areas with a high risk of degradation of organic material.
- Identified new areas and potential risks associated with future mining activities.
- Estimated the development of leaching of environmentally harmful substances, including mercury, and assessed its significance for Greenlandic biota.
- Mapped risks of destabilisation of infrastructure, including airports, which rely on permafrost as a structural foundation.

## 8.7 Regulation and policy development

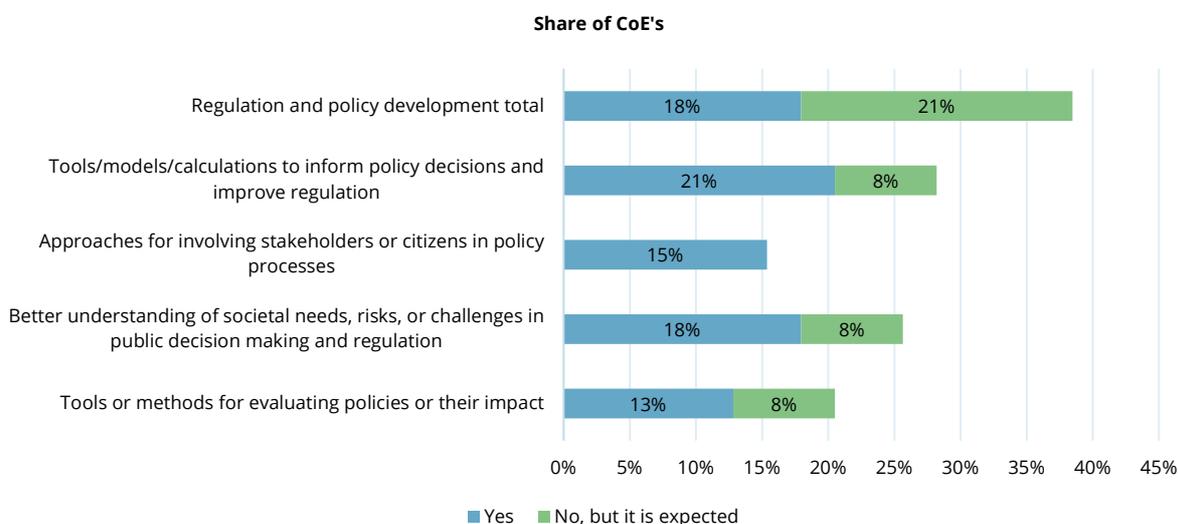
Research can affect regulation and the development of new policies in different ways.

At a general level, research can contribute new knowledge and insights that influence political initiatives and strategies. Climate research is a clear example of science shaping a political agenda.

Basic research can also result in new models and tools that support political decision-making – for instance, models that help illuminate societal conditions or assess the effects of policy proposals and regulations. The Centre for Research in Economic Policy (1993–2002) laid the foundation for the DREAM model, which is used in a range of socio-economic analyses.

Finally, basic research can help involve citizens and organisations more actively in political processes. This may take the form of public outreach, enhancing citizens’ understanding of important political issues, or through research on democratic processes and inclusion, fostering stronger connections between politicians, citizens, and vulnerable groups in society.

Figure 8.7. CoE impact on regulation and policy development



Source: Surveys among centre leaders

Note: N=39. Responses marked as “Do not know/Too early to say” are not included in the figure (see appendix 1).

Figure 8.7 shows that 18% have generated impact in this field, while a further 21% expect to do so.

The findings indicate that centres most frequently generate impact in two closely related areas: enhancing understanding of societal needs, risks or challenges in regulation, and developing tools to improve policy-making and regulatory processes. These areas are interconnected, as the centres involved build extensive empirical knowledge and compile large datasets that form the basis for analyses and tools applied in the preparation of new legislation.

This form of societal impact is particularly prominent among centres in the humanities and social sciences, with approximately 50% of centres in these disciplines reporting impact in the fields of regulation and policy development.

In the interviews, several centre leaders explained that the CoE grant has made it possible to build unique data and insights into the interplay between regulation and behaviour, which can be used to assess the potential consequences of new regulations. As a result, many centres contribute analyses, evaluations, and proposals to support complex political decision-making processes and regulatory preparation. This applies not only in Denmark, but also internationally.

One example is the CoE iCourts, which has been a pioneer internationally in researching the authority of international courts and their influence on national states. Moreover, the centre has been a first mover in developing big data and AI-solutions for analysis of court cases and judgements.

### Box 8.6. iCourts and the Copenhagen Declaration

The CoE iCourts (2012-23) was a pioneer in investigating the role of the growing number of international courts (ICs), their legitimacy and authority. As a part of the research, the centre gathered and structured decisions from all international courts throughout their lifetime and developed a

number of models to analyse large amounts of judgements from the courts.

Today the centre stands out globally as a leading hub when governments and NGOs demand independent analysis and assessments of how institutions like The European Court of Human Rights adjudicate in specific types of cases.

When Denmark assumed the Chairmanship of the Council of Europe in 2018, the government launched an initiative to reform the European human rights system with the aim of ensuring a more balanced and focused approach to human rights. In this context, the director of iCourts was assisting a government task force preparing the reform process, and iCourts' research and analytical model was used to assess the potential reform proposals' effects on the development of the European human rights system.

iCourts has also collaborated with the Danish state's legal counsel, Kammeradvokaten, in two Supreme Court cases representing the Danish state. In both cases, iCourts' big data models were applied to perform a statistical analysis of previous judgments from the Court of Justice of the European Union and the European Court of Human Rights, respectively. The analysis identified which judgments within the legal area in focus that could be considered leading – that is, those most frequently cited and most central (based on a complex network analysis of interconnections between judgments). In this way, iCourts contributed to highlighting the most relevant precedents for the cases in question, as well as the key elements emphasised by the two international courts in their decisions.

The cases described in the last part of box 8.6 represent the first time that big data models have been used in Supreme Court proceedings, and iCourts' partner in the two cases highlights three significant societal benefits that iCourts' pioneering work may help generate<sup>41</sup>:

<sup>41</sup> Interview with Partner Sune Fugleholm, Kammeradvokaten

- Higher quality of judgments through improved analyses and stronger foundation in precedents.
- Greater transparency, thereby enhancing legal certainty for citizens and businesses.
- Higher productivity and reduced resource use – for law firms, courts, and citizens alike – as the identification of relevant precedents, typically a highly time-consuming task, becomes more efficient.

Another example is the Centre for Economic Behaviour and Inequality, which investigates how human behaviour shapes inequality. By combining subjective data on behaviour, risk attitudes and personal preferences of people with information from administrative data on income and wealth, and by conducting large-scale controlled experiments, the centre has generated significant insights into the interplay between regulation, behaviour and the dynamics of inequality.

As highlighted in Box 8.7, the research of the centre has in several instances contributed directly to strengthening the evidence base for new regulation. In addition, CEBI members have participated in several government-appointed commissions and councils.

**Box 8.7. Centre for Economic Behaviour and Inequality informs policy decisions**

CEBI investigates the role of individual behaviour in generating unequal outcomes. According to the centre leader, answering this question is fundamental for understanding the sources of inequality, how policy affects inequality, and how circumstances and behaviour interact to reduce or produce inequality. CEBI aims to address the role of behaviour in generating inequality and the underlying sources of such behavioural inequality. Through its research, the centre has developed a unique body of data and knowledge, which authorities and ministries have drawn on multiple occasions. The centre has thus contributed to the following areas:

- Analysis and input regarding the regulation of certain types of loans, with a focus on specific groups' risk of repayment difficulties.
- Expert knowledge during the COVID-19 crisis concerning expected consumption effects of releasing pension funds.
- Participation in ministerial advisory group on measuring behavioural effects of tax measures.
- Documentation of the effects of international regulations on taxation.
- Analysis of how job centre consultations influence users' likelihood of entering employment.

The Government has appointed CEBI members for the following commissions and councils:

- The Chairmanship of the Economic Council (*Formandskabet for Det Økonomiske Råd*)
- The Expert Group on the Future of Employment (*Ekspertgruppen for fremtidens beskæftigelse*)
- The Expert Group on a Green Tax Reform (*Ekspertgruppe for en grøn skattereform*)
- The Expert Committee on Social Affairs (*Ekspertudvalget på socialområdet*)
- The Benefits Commission (*Ydelseskommisionen*)
- The Pay Structure Committee (*Lønstrukturkomiteen*)
- The Competition Council (*Konkurrencerådet*)

The examples illustrate that results and data generated through basic research can have direct relevance for the preparation of new regulations. These centres function as knowledge and data hubs, having developed insights that make it easier to anticipate and assess the effects of new regulatory measures.

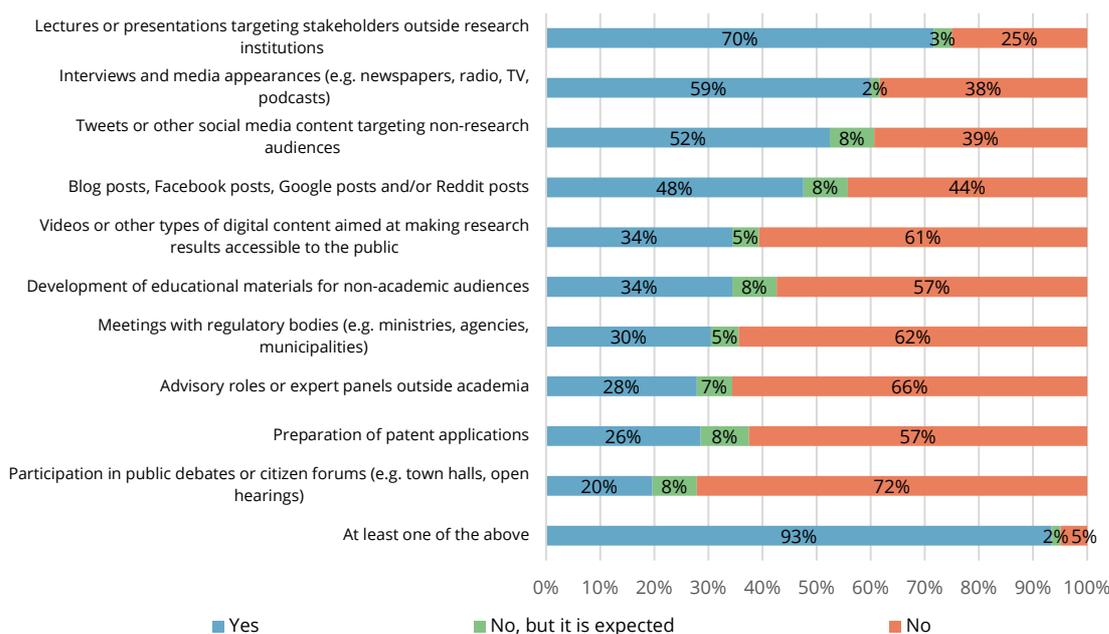
## 8.8 Culture and/or social practices

The evaluation shows that many of the centres and their affiliated researchers have been highly engaged in public outreach activities. The research ideas on which the centres are founded often attract broad public interest, and a majority of the centre leaders interviewed express a clear ambition to use the centre’s research as a platform for sparking wider interest in their field. This is particularly evident within the humanities and the natural sciences.

The emphasis on public outreach is reflected in the fact that nine out of ten researchers affiliated with the centres have participated in activities, targeting audiences outside the academic community, as shown in Figure 8.8 below.

The figure shows that the most common channels for public outreach are talks and lectures (e.g. in public educational programs such as Folkeuniversitetet), media interviews, and dissemination via social media platforms.

Figure 8.8. CoE researchers’ participation in dissemination activities



Source: Survey of senior researchers affiliated with the CoEs

Note: N=61. The figure includes only respondents who indicated that their primary research focus had been within the centre for several years, in response to a question about their affiliation with the centre.

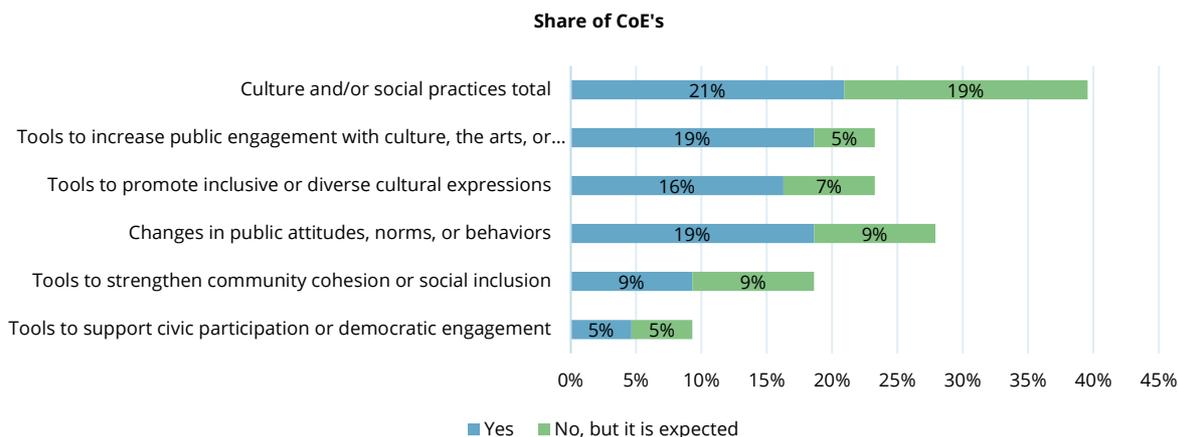
There is, of course, a significant step from public outreach activities to achieving actual impact in terms of changes to, for example, norms, social practices, or the engagement of citizens in socially relevant issues.

For this reason, it is difficult for centre leaders to assess whether the centres have in fact realised

such impact. In some cases, the pathway to impact runs through teaching materials, dialogues in community groups, or when individuals become engaged with a topic after reading a book or watching a documentary to which the centre’s researchers have contributed.

With this caveat in mind, Figure 8.9 shows the share of centre leaders who indicate that the centre has created impact in this final impact area.

**Figure 8.9. CoE impact on culture and/or social practices**



Source: Surveys among centre leaders

Note: N=43. Responses marked as "Do not know/Too early to say" are not included in the figure (see appendix 1).

While 21% report to have generated impact within this area, almost the same share expects to do so. The most common realised impact areas are 1) tools that support public engagement with culture, heritage and arts and 2) changes in public attitudes, norms and behaviours.

Among the CoEs we interviewed, UrbNet stands out as an example of extensive engagement in public outreach. The centre's ambition has been both to strengthen interest in the humanities and to promote public understanding of the importance of learning from history in addressing today's crises and disasters.

**Box 8.8. UrbNet engages in multiple dissemination activities**

The CoE UrbNet is an interdisciplinary research centre (combining disciplines from humanities and natural sciences) exploring the development of urbanism and urban networks from the Hellenistic period to the Middle Ages. Its focus has been to compare the archaeology of urbanism in medieval Northern Europe with that of the

ancient Mediterranean and the Indian Ocean World, and to determine how – and to what extent – urban networks in the past catalysed societal and environmental expansions and crises.

UrbNet seeks to advance the understanding of the historical processes underlying the development of urban societies, achieved by refining archaeology's ability to characterise the scale and pace of events and the ways in which societies adapted to, for example, crises and disasters. The centre is founded on the premise that we can learn from history in addressing present-day crises.

In collaboration with the Science Club Denmark (Videnskabsklubben), the centre has developed an archaeology programme for primary school pupils that playfully combines the humanities and the natural sciences. The children engage in activities such as extracting DNA, analysing pigments, constructing prehistoric buildings from LEGO, and investigating the diets of ancient peoples. The programme is the first among the Science Club's initiatives to draw on the humanities.

The programme also teaches pupils how scientific analysis can provide answers to important humanistic questions, such as when an event took place, what the preceding environmental conditions were, and how resilient past societies proved to be.

At the same time, participants learn that scientific methods cannot stand alone, but only make sense when placed within a broader context and cultural understanding

In addition, the centre contributes to research dissemination through a variety of channels:

1. Development and production of documentary films.
2. The management regularly contributes as columnists to the world's largest archaeological magazine.
3. Public lectures, including at the Danish University Extension (Folkeuniversitetet).
4. Exhibitions at museums.
5. Podcasts.

## 8.9 Potentials for increasing the societal impact of the CoEs

The evaluation shows that most CoEs generate not only high academic impact but also significant societal impact, for example through new businesses, solutions to societal challenges, improved regulation, and cultural contributions.

Since societal impact is not part of the statutory objectives of either the CoE programme or the DNRF, it has not previously been systematically analysed or evaluated whether the potential in this area could be even greater, and what barriers might hinder its realisation.

Identifying barriers to realising this potential was not a primary focus of the evaluation. However, the interviews provide several illustrative examples:

- Engaging in spinout activities is both time-consuming and costly. Existing proof-of-concept programmes tend to focus on incremental

innovations, where market potential can be estimated and go-to-market strategies defined. There appears to be a need for discovery-oriented grants that allow principles and small-scale experiments in research labs to be tested at larger scales and in relevant settings.

- Time is a limited resource, and centre leaders play a key role in bridging research and societal impact. As a result, some ideas and opportunities are lost because neither time nor dedicated bridging grants are available.
- Several interviewees emphasise that groundbreaking research may lead to radical innovation, but the technologies are often less mature and the application areas more diffuse than in applied research projects.

This implies that, in many cases, funding opportunities to test or mature ideas into innovation projects have been lacking. In particular, programmes like InnoExplorer under the Innovation Fund (IFD) are geared toward more mature projects and assume an ambition to start a company.

Centre leaders call for grants that, for a limited period, could provide funding for activities specifically focused on developing tools, models, or concepts aimed at translating research into tangible impact.

In addition, several centre leaders highlight that the DNRF's encouragement is an important factor in whether centres dedicate extra time and resources to pursuing application-oriented perspectives, including seeking funding from relevant foundations.

One natural focal point could be the midterm evaluation, which currently includes a section on "outreach" – i.e., the centres' engagement in dissemination activities beyond academia. Societal impact is a broader concept, encompassing projects and initiatives that help translate research into value for society. The midterm evaluation could therefore address not only activities already

undertaken but also the potential for societal impact to be pursued in the second phase.

Annual reports could also, where relevant, explore the topic in greater depth, providing the DNRF with a stronger platform for discussions with the centres, for example at annual meetings.

## 8.10 Conclusions

69% of the CoEs indicate that they have delivered societal impact in at least one area, while a further 20% expect to do so.

Across the six types of societal impact, four distinct roles or pathways to impact appear to emerge:

- *Formation of new companies:* Startups that aim to translate the research from the centres into market-ready products and solutions.
- *Centres as Knowledge Hubs:* Some centres have built unique insights, databases, and tools that both public authorities and companies can access and tap into.
- *Public engagement:* Certain centres generate knowledge of broad public interest; dissemination of this knowledge contributes to public welfare, engagement, and understanding of history, nature, and societal challenges.
- *Follow-up projects:* In some cases, research conducted in the CoEs does not directly lead to impact. However, the results may pave the way for research and innovation projects with a clearer application focus, creating the link between the groundbreaking research conducted in the centres and value creation in society.

The examples also underscore that the boundaries between basic and applied research are increasingly blurred.

In the case of the CoEs, one reason is that applicants compete for grants based on novel and

innovative angles and hypotheses. Many of these naturally emerge from current societal challenges and trends that shape societal development. The implication is that research findings and insights from the centres often have significant societal value or can lead to technologies and tools that do, as the examples in this chapter clearly demonstrate.

Overall, there appears to be scope for placing even greater emphasis on societal impact, particularly in the second phase of the centres' lifetimes.

A natural focal point could be the midterm evaluation, which could address not only activities already undertaken but also the potential for societal impact to be pursued in the second phase.

Annual reports could also, where relevant, examine the topic in greater depth, providing the DNRF with a stronger platform for discussions with the centres (for example during annual meetings), as well as improve external communication to the public.

The DNRF should also consider whether it could strengthen its dialogue with the Innovation Fund Denmark (IFD) to improve the links between the instruments offered by the two organisations. A dialogue on trends and perspectives could help IFD identify the potential of emerging research areas at an earlier stage, thereby facilitating a smoother transition to IFD-supported projects when opportunities arise.

Such a dialogue could also address funding gaps in the transition from inventions in basic research to commercialisation activities, or other projects generating societal value. Accordingly, there appears to be a need for a *discovery grant* specifically designed to take results from basic research and explore their potential for application in technologies, products, or societal solutions.

## 9. FUNDING PRINCIPLES AND ADMINISTRATION

**This final chapter evaluates the appropriateness of the D NRF’s procedures for soliciting and assessing applications and allocating grants, and mechanisms for continual evaluation of progress in CoEs. It also examines the interaction between the D NRF and the supported research environments, including the foundation’s role and effectiveness in enhancing diversity in research. Finally, the chapter discusses potentials for improved communication to the research sector and to the public.**

### 9.1 Introduction

This concluding chapter focuses on the D NRF’s administration, funding and evaluation principles, as well as its communication and ongoing interaction with active centres.

Section 9.2 evaluates the assessment and selection processes of the CoE programme, while Section 9.3 examines evaluation and monitoring practices related to active CoEs. Section 9.4 discusses the grant levels. Section 9.5 reviews the ongoing support for and interaction with the centres. Section 9.6 examines the D NRF’s efforts and effectiveness in promoting diversity within the centres. Finally, Section 9.7 addresses efforts to disseminate information to both universities, researchers and the public.

Each section begins with a brief description of current practices in the administration of the CoE programme, followed by an evaluation based on interviews and survey data.

### 9.2 The assessment and selection process

The aim of D NRF’s selection process for Centres of Excellence is to ensure transparency, thoroughness, and a strong emphasis on scientific excellence. The process begins with an open call and involves two stages: submission of outline proposals, followed by full applications from selected candidates. Each full proposal undergoes

international peer review by three experts, and the candidates are interviewed by the board before final decisions are made. Selection criteria emphasise the originality and potential of the research idea, the qualifications of the centre leader and the core team, and the ability to create a dynamic research environment (see Chapter 3).

Following the board’s decision, successful applicants enter contract negotiations, while applicants not selected are offered individual feedback.

#### **A transparent process in which a certain degree of randomness is unavoidable**

In the interviews, almost all centre leaders report that they have found the application process transparent and characterised by a high standard of academic quality.

Heads of department – drawing on experience with both successful and unsuccessful applications – expressed the same view. Several interviewees emphasised that a degree of chance in the assessment process is unavoidable when proposals involve new, high-risk research ideas. Ultimately, such judgements rest with individual panel members, whose views on what constitutes risk, original ideas and relevance will inevitably differ.

Only a few interviewees had comments on the review process. A couple of centre leaders consider the three-member panel model to work well, even though, by definition, it gives each member considerable influence compared to programmes

where more researchers participate in the review process. The view is that panels with larger numbers of researchers tend to produce more mainstream thinking and less willingness to take risks.

According to the DNRF Board<sup>42</sup>, the board receives a large number of highly qualified applications, and the final selection process is tough and highly competitive. The board’s overall assessment is that the average academic impact would not be compromised even if the number of accepted applicants were doubled. This underscores the importance of selecting the right leaders and teams from a large pool of applicants who all perform well in terms of academic quality and novelty/riskiness of their research questions.

Since the distinctive DNA of the CoEs (compared with other programmes offering large grants) is the focus on developing new research environments and building long-term capacity, the commitment and leadership skills of the core team are of critical importance. In this light, it may be worth considering whether the programme’s selection process could be strengthened by placing greater emphasis on the leadership abilities of the centre leader and key researchers in the core team.

**Both established research fields and new research areas receive grants**

Frontline research can emerge from both established and new scientific areas. It is deemed important that the DNRF supports both new research ideas within already internationally strong environments, as well as emerging environments or themes where Denmark has the potential to establish leading research communities. Survey responses suggest this objective is being met. Approximately one quarter of respondents indicated that their environment was already internationally leading, while around 17% identified their project as addressing an emerging research theme, where no leading research communities had yet been established at the time of application (see Figure 9.1).

**Figure 9.1. Position of the supported scientific area prior to the CoE grant**



Source: Survey of centre leaders  
Note: N=45.

**9.3 Evaluation and monitoring**

The CoEs are evaluated two times in their lifetime. The midterm evaluation after six years covers the scientific quality of the centres’ output and the ambitions for a second funding period and provides the DNRF board with information for decisions regarding the future of the centre. Moreover, the midterm evaluation provides the researchers and their host institutions with a report on the centre’s performance.

For the midterm evaluation, centres are asked to submit a self-evaluation report and an application for a second term.

Three international reviewers are identified. When assessing the research, reviewers focus on whether the quality of the scientific output meets the standard of excellent international research and whether the proposed research for another four years remains original, ambitious, and has

<sup>42</sup> Interview with Chairperson and Vice Chairperson from the DNRF

the potential to deliver groundbreaking results. In addition, factors such as organisation, leadership, and educational activities for early-career researchers are considered. The reviewers are not asked to rate the centres, but rather to present concluding remarks on the centres' standing in comparison to world-leading environments in their fields.

The DNRF Board conducts interviews with the centre leaders as a means to address matters of uncertainty or concerns, as well as issues raised by the reviewers before deciding on a possible second funding period.

Since the birth of the CoE instrument, approximately 10% of the centres have been embedded due to the results of the midterm evaluation (the ratio has been falling).

The *final evaluation* is conducted by the DNRF Board without use of external reviewers.

For the final report the centre leaders are asked to outline new insights and key results, including any impact on redefining research within its field. The centre leaders are asked to highlight the centres' contributions and compare its accomplishments to those of leading international research groups in the field.

### **Annual follow-up meetings and scientific reporting**

Every year each centre is visited by the DNRF at the centre's premises. The centres prepare an agenda based on the foundation's guidelines and the meeting covers the centres' activities during the past year and include presentations on selected research topics.

One or two DNRF Board members, the CEO and the centre's DNRF contact person participate. The meeting is divided into an open and a closed session. During the open session, all centre members are encouraged to participate together with the dean and/or head of department. In the closed

session the DNRF representatives meet with a smaller group of centre members.

Every second year the DNRF conducts a closed meeting with the PhD students and, in alternating years, with the postdocs. At these meetings, the foundation learns about the early-career researchers' experiences, their involvement in teaching, how supervision works, future career plans, etc.

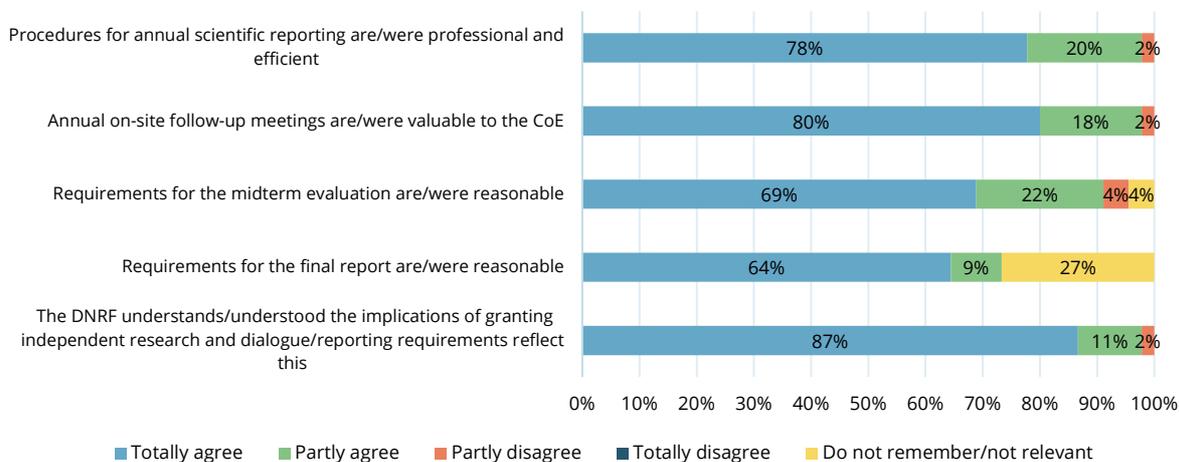
Each year, the centres must account for the scientific activities over the past year. The scientific report assists the DNRF in monitoring the development of the grant and its research results. The report of a maximum of eight pages must describe research activities carried out in the previous year, comparing the results achieved to the objectives outlined in the research plan. Further the reports must account for recruitment strategy, including considerations on diversity, as well as reflections and initiatives regarding research integrity. A one-page highlights section, to be published on the foundation's homepage, must further be appended.

The scientific reports are read by the DNRF, and a letter of approval is sent to the grant holder.

### **Monitoring practices are welcomed and strengthen engagement and leadership**

Figure 9.2 summarises how the centre leaders assess the value of the evaluation and monitoring practices, as well as the burdens associated with them. Overall, the centre directors are highly positive about DNRF's approach to evaluation and monitoring. A clear majority fully agree with the various statements, although the midterm evaluation requirements stand out as the area with the highest share of less than complete satisfaction. The final bar in the figure further indicates that the DNRF has a strong understanding of the nature of basic research, and that this understanding is reflected in the reporting requirements.

**Figure 9.2. Centre leaders' agreement with statements on evaluation and monitoring practices**



Source: Survey of centre leaders  
 Note: N=45

The interviews also reveal that the activities, especially the annual reporting and the on-site meetings, create value to many of the centres.

According to the centre leaders, the highlights in the annual report help maintain a high level of ambition and provides an opportunity to reflect on results and progress. Many centre leaders also use the annual report as a management tool to evaluate and hold discussions with researchers about their research output.

The status meetings are particularly valuable for early-career researchers, who experience the foundation as highly engaged. According to both centre leaders and interviewed early-career researchers, this attention helps raise motivation levels, and the meetings often result in a significant boost of energy. Several centre leaders also view the preparation for these meetings as a useful tool for internal discussions about where and how the research has excelled. The centre leaders describe DNRF's engagement as unique compared to other funding organisations' engagement within other programmes.

As regards the midterm and final evaluation, most centre leaders emphasise that the workload is

manageable and proportionate to the size of the grant. Moreover, they perceive the feedback to be constructive and valuable.

Finally, it should be emphasised that the DNRF engagement is highly dependent on the commitment of the Chair. The level of commitment has, according to the centre leaders, varied considerably during the evaluation period.

**Stronger focus on societal impact?**

As highlighted in Chapter 8, it is relevant for the DNRF to consider a stronger emphasis on societal impact as part of the monitoring of the centres – particularly in the second grant period. In this context, the DNRF could also play a facilitating role in linking the centres with the Innovation Fund Denmark.

It may also be worth considering whether, going forward, both the DNRF Board and the Secretariat should include a member and an employee with dedicated expertise in bridging research and innovation. Such expertise could enhance the foundation's capacity to engage in dialogue with the centres on activities aimed at realising their potential for societal impact.

## 9.4 The grant levels

As described in Chapter 3, since Round 11 (2023), the DNRF has operated with two predefined budget frameworks: up to DKK 6 million or up to DKK 10 million per year. In the previous rounds, no fixed financial ceilings were in place. For all grant rounds during the evaluation period, however, the vast majority of centres received a Phase 1 grant close to DKK 10 million per year. Interviews also indicate that this level is now widely perceived as the standard in research environments.

As noted in Chapter 3, the average grant per centre over the entire 10-year period increased from DKK 72.6 million (Round 1) to DKK 90.3 million (Round 12), while cumulative inflation over the same period has exceeded 75%. Many centre leaders and department heads interviewed therefore point out that the real value of the grants has declined. All else being equal, this reduces the capacity-building potential of the funding, since salaries represent the largest cost for the centres.

With the increasing prevalence of large-grant programmes among private foundations (see Chapter 4), there is also a risk that one of the unique features of the CoE scheme could erode over time. Consequently, interviewees stress the importance of upward adjustments to the grant framework in upcoming rounds.

Based on the interviews, there does not appear to be strong justification for operating with two separate budget levels. The current setup effectively requires applicants to choose between DKK 6 million and DKK 10 million per year. In particular, within the humanities and social sciences, the lower budget level is perceived as being reserved for these fields, while other disciplines are expected to apply under the higher level. Several interviewees consider this an overly simplistic view of the variation in funding needs across disciplines, especially as interdisciplinary centres often require larger budgets.

Many interviewees suggest instead that the DNRF define a funding interval within which applicants

can apply, accompanied by guidelines indicating what typically justifies awarding a grant at the upper end of the interval. This could include, for example, extraordinary costs for data, experiments, or equipment, or interdisciplinary research ideas that require onboarding multiple complementary skill sets.

## 9.5 Support and interaction with the centres

The DNRF strives to be easily accessible and to offer flexible and unbureaucratic support to the centres when needed. At the same time, the foundation organises activities aimed at supporting centre leaders in their work to develop and manage the centres.

Besides the annual meetings (see section 9.3), the support for the centres includes:

- Assignment of a dedicated contact person from the DNRF Secretariat to ensure continuity and a direct communication channel.
- Introductory onboarding meeting for new centres, at which the DNRF meets with the centre leadership to outline expectations, administrative procedures, and the foundation's principles for collaboration.
- Thematic retreats and annual joint meetings involving all active centres that provide a platform for experience exchange, strategic discussions, and informal networking.
- Biannual retreats for centre coordinators.
- Ad hoc dialogue and support, including additional meetings when needed to address challenges, facilitate reflection on centre development, and support leadership.

### High level of trust, engagement, and valuable network activities

Figure 9.3 provides an overview of the centre leaders' assessment of their interaction with the DNRF and the value of the retreats.

Once again, evaluations are very positive. In terms of interest, engagement, and accessibility, the DNRF Secretariat receives top marks.

Most centre leaders also fully agree that the retreats for centre leaders and centre coordinators are valuable events (except for centres that closed before the introduction of coordinators' retreat, who answered "not relevant" to that statement).

Although the research areas differ widely, centre leaders often share the same challenges (such as managing large research groups, developing interdisciplinary research, and motivating early-career researchers) and the retreats are seen as an important forum for sharing ideas and approaches. The events probably provide most value for new centre leaders, but experienced centre leaders also benefit from them.

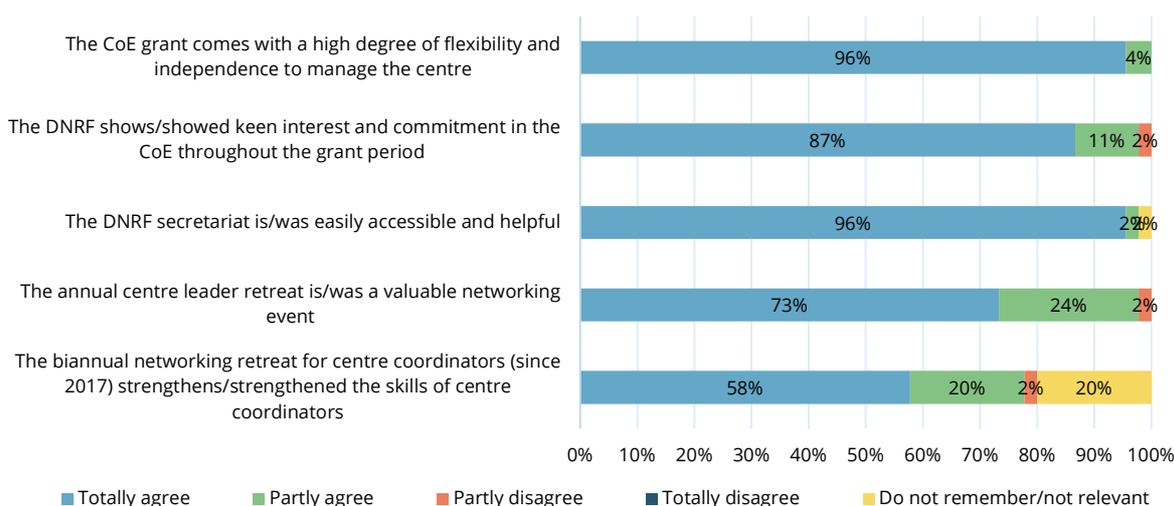
Some cohorts have built strong networks, with centre leaders taking the initiative to organise regular meetings throughout the grant period. In

these cases, the DNRF's onboarding meeting has played an important role as the starting point for establishing relationships across centres.

Centre leaders experience the DNRF as very flexible and responsive. It is easy to adjust budget items if it benefits the centre and the research, and the centres receive quick responses from the secretariat. Furthermore, several centre leaders express that they find great support from the Secretariat or the Chairmanship in addressing specific challenges. These have ranged from establishing optimal physical facilities at the institute to managing leadership issues within the centre.

Many centre leaders describe their relationship with the DNRF as close and trust-based, enabling open discussion of challenges and adjustments that benefit the research. Funding is far less tied to earmarked allocations than those of other foundations, allowing centres to navigate freely and seize opportunities that arise during their lifetime.

**Figure 9.3. Centre leaders' agreement with statements on the DNRF's interaction and engagement**



Source: Survey of centre leaders

Note: N= 45.

## 9.6 Enhancement of diversity

The DNRF is expected to foster diversity across the research environments it supports, with a particular focus on gender balance and disciplinary breadth. While scientific excellence remains the overriding selection criterion, the foundation is expected to actively monitor and encourage a broad and inclusive representation within its funding instruments.

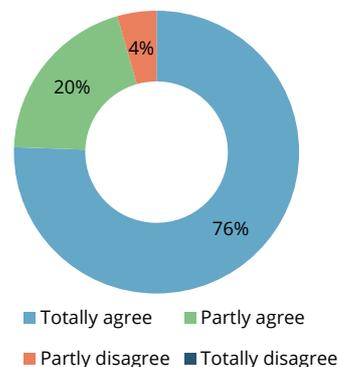
At the policy level, the DNRF Board strives to ensure that all academic disciplines have equal opportunity to succeed in the highly competitive selection process.

Regarding gender diversity, the DNRF pays attention to the gender balance among grant holders. Review panels and interview practices are likewise structured to promote fairness, transparency, and awareness of unconscious bias.

Finally, the DNRF attempts to encourage diversity considerations at the centre level, including reflection on recruitment practices, supervision culture, and the composition of research teams. These elements are addressed through the DNRF's annual reporting and dialogue with centres.

As shown in Figure 9.4, a majority of centre leaders state that the foundation performs well in communicating its focus on diversity. The theme has, among other initiatives, been placed on the agenda during the annual visits to the centres. Some of the interviewed centre leaders have found the dialogue fruitful, helping them to focus on gender balance and the integration of research disciplines in the design of research projects.

**Figure 9.4. Centre leaders' agreement with the statement that "DNRF successfully conveys its commitment to diversity in research"**



Source: Survey of centre leaders

Note: N=45.

### Approximately one third of the centre leaders are female

The ambition of gender balance seems to be reflected in the gender balance among centre leaders.

Thus, female centre leaders accounted for 30–36% of grant holders in rounds 8–12 – a relatively high share compared with the overall pattern at Danish universities, where only 25% of professorships were held by women in 2022.<sup>43</sup>

When it comes to affiliated researchers, however, the picture is somewhat different. While 35% of all associate professors at Danish universities are women, the share of female associate professors affiliated with CoEs in the period 2012–23 was only 26%. Similarly, women accounted for 38% of PhD students and 34% of postdocs and assistant professors in the centres during the same period<sup>44</sup>. By comparison, the corresponding national figures for Danish universities in 2022 were 52% and 43%, respectively.

<sup>43</sup> Uddannelses- og Forskningsministeriet (2023): "Mænd og kvinder på de danske universiteter – Danmarks Talentbarometer 2022"

<sup>44</sup> Staff list provided by the DNRF

Part of the explanation is likely linked to the strong representation of centres within the natural sciences, where only about 25% of researchers at Danish universities are women, whereas the share is close to 50% in the social sciences, which are underrepresented among the centres.

It is therefore difficult to assess whether the overall gender composition of the centres reflects a sufficient commitment to diversity without more systematic data on the underlying research environments. Taken in isolation, however, the figures appear somewhat on the low side – particularly below the level of centre leadership.

### **CoEs lead to interdisciplinary research, but some disciplines are under-represented**

The evaluation clearly shows that the CoE instrument encourages interdisciplinary thinking in research. By promoting innovative research ideas supported by a substantial grant, applicants are stimulated to integrate different research fields in the design of their application. Among the active centres, there are examples that span multiple institutions, disciplines, and main scientific areas. In the survey, 88% of researchers report that their research has become more interdisciplinary due to the CoE grant.

In some centres, interdisciplinarity is reflected in the composition of the core group, for instance by including researchers from two main scientific areas. More prominently, however, interdisciplinarity is expressed through the recruitment of early-career researchers from a range of disciplines that are essential for addressing the research questions. Box 9.1 provides an example.

#### **Box 9.1. Interdisciplinarity in iCourts**

iCourts (2012-23) investigated the role of the growing number of international courts (ICs), their legitimacy, and their authority. In order to shed light on this complicated issue and to analyse their judgements and impact, many research disciplines had to be brought into play. The centre recruited researchers from six continents, with backgrounds in law, sociology,

political science, philosophy and data science. The centre was the first in the world to develop a AI language model for the statistical analysis of large volumes of judgments, having compiled data on all judgments delivered by the international courts.

As shown in Chapter 3, it is noteworthy that more than 50% of the funded centres in rounds 9–12 have a host institution in the natural sciences, and that the natural and health sciences together account for approximately 70% of the centres established since Round 7.

By contrast, the social sciences – representing 9% of the centres compared to nearly 20% of Danish research measured in academic staff FTEs – are clearly underrepresented. Only around one in five centres are based in the humanities or social sciences (Round 7-12), despite the fact that these fields are at a clear disadvantage in attracting private foundation funding (see Chapter 4).

According to the interviewed university leaders, the main reason is likely that these fields have less of a tradition for large research groups and major research grants. The prevailing approach in these areas is more oriented towards applying for smaller grants, such as those from the Independent Research Fund Denmark (DFF), and establishing a CoE requires even greater organisational change than in many of the ‘wet’ research fields.

The view among the university leaders is that it is the universities’ own responsibility to motivate more researchers in the humanities and social sciences to apply for DNRF funding. Nevertheless, there is a paradox in the fact that the number of applications and awards is low in precisely those fields where the alternatives to the DNRF are weakest (see Chapter 4).

## **9.7 Communication**

The DNRF has developed a communication strategy in order to support its mission to maintain

transparency about programmes and activities while facilitating the dissemination of research by grant holders. The approach includes various communication channels.

In recent years, there has been a growing emphasis on creating content such as articles, interviews, and videos featuring, for example, centre leaders, young scientists, and award winners. These efforts aim to highlight the research and to reach a broader audience beyond academia.

In the 2013 evaluation, it was recommended that the DNRF should incorporate social media into its communication strategy to engage younger generations of potential applicants. This recommendation was implemented with the creation of profiles on platforms such as X, LinkedIn, and Bluesky.

In addition, the DNRF also manages a website, issues press releases, distributes newsletters, and organises an annual photo competition.

All grant holders are introduced to the communications team and encouraged to reach out for assistance with communication-related queries or to share updates on publications, awards, and other milestones.

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

Additionally, the DNRF invites centre coordinators to participate in a biannual retreat, where communication strategies are reviewed. During these retreats, participants are encouraged to prioritise public communication of their research.

### **Supporting upcoming centre leaders**

Based on interviews with, among others, department heads, we do not find a demand for additional communication about the foundation's instruments. There is broad satisfaction with the initiatives already in place.

At the same time, universities place strong emphasis on promoting awareness of the CoE instrument. Most universities actively work to identify

potential centre leaders at an early stage and to support the development of CVs that will enable them to submit competitive applications to the DNRF in the future.

However, some department heads also emphasised that research leaders often are uncertain about what it takes to secure a centre grant. While some departments, such as the Niels Bohr Institute at the University of Copenhagen, have “cracked the code” and achieved a high success rate, uncertainty remains high in many other environments, particularly at smaller universities. This is especially true within the humanities and social sciences, where experience with applications for large research groups is limited.

Uncertainty is particularly pronounced regarding:

- The scientific track record required to become a centre leader.
- The required level of originality and risk in the research theme.

The DNRF could help reduce this uncertainty by providing information on the profiles of centre leaders who have received funding in the past rounds. By presenting concrete examples or archetypes – highlighting variations in factors such as age, prior achievements, leadership experience, research ideas, and the centres' grounding in existing research – the foundation could support younger professors in planning a roadmap toward securing a DNRF grant.

### **Communication about societal impact**

Another potential focus area could be the dissemination of information about the societal impact of the centres. According to centre leaders and department heads, the current political perception is that CoEs are primarily instruments for enhancing research quality and strengthening Denmark's position in international rankings.

However, as explored in Chapter 8, some centres are deeply engaged in activities that generate societal impact in a variety of ways. In several cases,

it is precisely the large grants, the interdisciplinary nature of the centres, and the requirement for innovative research themes that have created a unique foundation for societal impact.

Thus, there appears to be room for communication about the DNRF's role in bridging research, innovation and impact.

Indeed, the evaluation suggests a need for a new paradigm and fresh perspectives on communicating the relationship between basic research and societal value. In political communication, this link is often portrayed as a long, linear journey: basic research is first translated into applied research (through new projects) and eventually into trials that may, for example, lead to commercial activities. Success in publishing in top-tier journals is sometimes perceived as an obstacle to delivering research results that create societal value.

The evaluation indicates that the opposite is true: political support for and interest in the foundation's activities could be further strengthened through communication highlighting the types of impact described in Chapter 8.

In recent years, the DNRF has placed greater emphasis on this topic – for example through the report *“The Lasting Value of DNRF Centres of Excellence”* published in 2023. This report focused on developments after the conclusion of the centres. As noted above, the evaluation provides a strong basis for an enhanced communication effort, which could also highlight developments during the lifetime of the centres. This could take the form of articles, social media posts, and illustrative examples on the DNRF website.

## 9.8 Conclusions

The evaluation reveals a very high level of satisfaction with the programme's administration and DNRF's engagement with the centres.

The DNRF's monitoring practices, including the annual report and annual meetings with the centres, are seen as valuable elements that help raise

motivation levels and facilitate internal dialogue on progress, results, and expectations. In terms of interest, engagement, and accessibility, the DNRF Secretariat also receives top marks.

Many centre leaders describe their relationship with the DNRF as trust-based, enabling open discussions about challenges and adjustments that benefit the research.

Overall, the assessment and selection process is viewed as transparent and characterised by a high standard of academic quality.

However, since the final selection is tough and highly competitive, the evaluation also highlights the potential for placing greater emphasis on the leadership skills of the core team in the final selection process.

The evaluation highlights a potential for more targeted communication to the pool of talented senior researchers who may eventually develop into leaders of future Centres of Excellence. In some research environments, there is uncertainty about what it takes – and how realistic it is – to build a CV strong enough to pass through the DNRF's highly selective process.

Moreover, the DNRF could play a key role in communicating new perspectives on the interplay between basic research and societal value creation – illustrated with concrete examples from the centres.

Finally, it appears relevant to consider an adjustment to the budget framework. First, the current two-tier structure could be replaced with a single funding interval, accompanied by clear guidelines on what is typically required to secure a grant at the upper end of the interval. Second, the DNRF should consider a substantial increase of at least 15% to ensure that CoE grants continue to stand out significantly within the supported research environments, compared with other types of grants.

## APPENDIX 1. METHODOLOGY

### 1. Surveys

As part of the evaluation, three online surveys were conducted, targeting the following groups:

1. Centre leaders in CoEs established between 2004-21.
2. Senior researchers affiliated with a CoE in the period 2012-22.
3. PhD students and postdoctoral researchers affiliated with a CoE in the period 2012-2021.

The target groups were identified using staff lists submitted by CoEs to the Danish National Research Foundation (DNRF).

Since the staff lists did not include up-to-date contact information – particularly for younger researchers – we supplemented the initial mailing lists with updated emails. Special attention was given to identifying early-career researchers who are no longer affiliated with a university, as contact details were often missing for this group.

The surveys were distributed via the web-based platform SurveyXact. A share of the target group did not participate in the survey for various reasons. Some did not receive the invitation due to outdated or incorrect contact details, others were unavailable during the evaluation period, and a

small number reported only a very limited affiliation with the centre in question.

As a result, the effective net sample for each survey is slightly smaller than the total target population initially constructed.

To maximise the response rate, a reminder was sent shortly before the response deadline, and follow-up phone calls were made targeting the centre leaders. For the survey targeting senior researchers, the deadline was extended to increase participation. The table below shows the final survey samples and response rates.

As the survey covers CoEs established up to 2021, some centre leaders and affiliated researchers may find it difficult to assess aspects such as societal impact, while others—whose centres closed up to ten years ago—may not recall details of, for instance, administrative practices. Among the younger researchers, the ability to assess questions related to their research and research training may vary depending on when and for how long they were affiliated with the centre.

Responses marked as “Do not remember”, “Too early to say” or similar have therefore been excluded in a number of figures to ensure that the analysis is based on informed responses. Consequently, the number of respondents may vary between figures.

**Table 1. CoE participation and career development of affiliated senior researchers**

| <i>Survey</i>                   | <i>Sample</i> | <i>Responses / response rate</i> |
|---------------------------------|---------------|----------------------------------|
| <i>Centre leaders</i>           | 58            | 45 (79%)                         |
| <i>Senior researchers</i>       | 215           | 94 (44%)                         |
| <i>Early-career researchers</i> | 1,126         | 291 (26%)                        |

## 2. Bibliometrics

A bibliometric analysis was designed to assess the effects of the DNRF on academic output and scientific impact. To account for the time lag between the awarding of a grant and the point at which publications are cited, the bibliometric analyses include all scientific articles published in 2012–2023 by researchers affiliated with a CoE. The analyses are based on publication lists submitted by each CoE to the DNRF. All publications with a Digital Object Identifier (DOI) are included. In the overall analysis, the number of publications reported by individual centres is not decisive, as all articles are analysed as a whole. Out of a total of 18,719 reported publications with a DOI, 14,661 were identified in Scopus.

It is important to note that the bibliometric analyses therefore only cover articles with a DOI published in journals indexed in Scopus. This also means that some centres – particularly within the SSH fields – have few or no DOI articles and are therefore less well represented in the analyses.

Section 5.6 takes a closer look at the publication output of 35 centres from rounds 4–8. The analysis is restricted to centres with at least 100 publications in the period to ensure valid results.

In addition, at least 60% of a centre’s reported publications must have a DOI in order to be included. The average coverage rate - defined as the share of articles found in Scopus out of the total reported publications - is 86% across the centres included in this sub-analysis.

To contextualise and assess the performance of the DNRF-funded research, three reference groups were included in the analysis. The first reference group consists of all Danish publications within the period. This group provides a baseline for assessing the DNRF in relation to the overall Danish research output.

To enable a meaningful comparison of the DNRF outcomes with those of similar programmes, a reference group was constructed based on scientific

articles published by CoEs in the other Nordic countries. By including comparable Nordic programmes, we can benchmark the results of DNRF-funded research against other excellence-oriented initiatives.

All three countries – Norway, Finland and Sweden – have implemented CoE programmes that closely resemble the Danish model in terms of purpose, funding structure, and duration, as shown in the table below.

While there are national differences in scale and organisation, the core ambition of supporting long-term, high-quality, curiosity-driven research through competitive funding remains a common feature.

**Table 2. Comparative Overview of Nordic CoE Programmes**

|  | <i>Finland</i> | <i>Norway</i> | <i>Sweden</i> | <i>Denmark</i> |
|--|----------------|---------------|---------------|----------------|
| <i>Year established</i>                      | 1995           | 2002          | 2005          | 1993           |
| <i>initiative still active</i>               | Yes            | Yes           | No            | Yes            |
| <i>Grant volume per centre (DKK million)</i> | 58             | 65            | 140–160       | 100            |
| <i>Grant period</i>                          | 8 years        | 8-10 years    | 10 years      | 10 years       |

To construct the Nordic reference group, we contacted DNRF’s sister organisations in each of the three countries and requested lists of scientific articles published by researchers affiliated with their CoEs. These lists were subsequently quality-assured, standardised and merged.

In total, the Nordic reference group comprises just over 27,000 articles. Of these, approximately 58% originate from Sweden, while Norway and Finland account for 30% and 12%, respectively. This distribution reflects the fact that Sweden has the largest CoE programme among the three Nordic countries.

Finally, a third reference group was constructed based on publications by recipients of ERC Advanced Grants. These grants are highly prestigious and awarded through a competitive process to some of Europe's most accomplished researchers. Each grant typically amounts to DKK 18 million, making it one of the most significant individual research awards in Europe.

Since ERC Advanced Grant holders are widely regarded as representing the frontier of European science, the comparison helps situate Danish CoE research in relation to the very best in the European research landscape.

The reference group was constructed using funding data from the European Commission's Horizon 2020 database where all ERC Advanced Grant recipients are required to report scientific publications resulting from the grant.

To create a meaningful basis for comparison, a matching procedure was applied. For each DNRF publication included in the analysis, a corresponding ERC Advanced Grant article was selected. Matching was based on publication year, article type (e.g. journal article, conference paper), and research area. The resulting ERC reference group mirrors the DNRF publication set in structure and scope and comprises just over 14,500 articles.

It is important to note that the ERC reference is based on the output of individual grant holders, whereas the CoE model typically involves larger research environments with broader institutional embedding.

### 3. Career and grants

As part of the evaluation, we have conducted a career- and grant analysis for early-career researchers (PhD and postdoc) affiliated with a CoE.

The primary data source for the analyses is a set of annual staff lists submitted to the DNRF by each CoE, containing the name, role, and year of employment for all affiliated staff members.

The dataset included over 20,000 entries, encompassing both scientific staff and technical/administrative staff, as well as student assistants and affiliates. The dataset was initially restricted to scientific staff by filtering out non-academic roles, resulting in 17,322 entries.

To identify individual researchers across the annual reports, we constructed a unique ID for each researcher through name matching based on string cleaning and fuzzy clustering. In total, we identified 3,526 unique early-career researchers affiliated with a CoE during the period 2012–21. Of these, 2,120 started as PhD fellows, while 1,406 entered as postdocs.

#### **Enrichment of the dataset with ORCID and PURE identifiers**

To enrich the dataset of early-career researchers with individual-level information on publication activity and academic mobility, researchers were matched with two databases.

First, the researchers were matched with the ORCID registry. ORCID is a global data that assigns researchers a unique identifier, which includes information on institutional affiliations and academic titles.

We matched the early-career researchers with the ORCID database by using the publicly available API access. The matching was performed based on full name and, where available, additional identifiers (e.g. email or institutional affiliation). Each individual in the population was queried against the ORCID API, and where a match was found, the associated ORCID ID was linked to the researcher's record in the dataset.

Secondly, we attempted to identify the early-career researchers in the Danish PURE database. PURE is an online database used by all Danish universities to register data about research output and researcher profiles, including publications, projects, affiliations, and activities.

To identify current early-career researchers at Danish universities, we retrieved metadata on all

publications affiliated with the eight Danish universities from 2018 to 2024 via OAI access. Based on this, we constructed a local database containing information on all listed authors.

As with the ORCID matching, researchers were identified in the local PURE database using their full name and, when possible, additional details such as institutional affiliation or email address.

Once identified, the relevant PURE profile was used to extract information on publications and academic affiliations, which was then integrated into the researcher’s record in the dataset.

Out of the total of 3,526 early-career researchers, it was possible to identify 2,980 individuals in either of the two databases.

#### 4. Interviews

In total more than 60 interviews were carried out as part of the evaluation. The tables in appendix 2

provide an overview of the interviewed individuals.

The selection of interviewees was designed to ensure broad representation: centre leaders were chosen to achieve a balanced distribution across the 20-year period of CoE establishment, as well as coverage of all major scientific fields and host institutions.

Likewise, the group of early-career researchers were selected to reflect diversity in terms of time period, scientific discipline and subsequent career path – whether they continued in academia or pursued careers outside the research sector.

To ensure perspectives and input from a broad range of representatives and stakeholders, we also conducted interviews with a number of university leaders (primarily heads of department) as well as research funding foundations. In addition, we included users of the research in areas where this was important to enrich the evaluation of societal impact.

**Table A.1. Interviewees**

Centre leaders

| Name                   | Title     | Organisation                    |
|------------------------|-----------|---------------------------------|
| Anders Sørensen        | Professor | University of Copenhagen        |
| Anja Boisen            | Professor | Technical University of Denmark |
| Bo Elberling           | Professor | University of Copenhagen        |
| Claus Thustrup Kreiner | Professor | University of Copenhagen        |
| David Lando            | Professor | Copenhagen Business School      |
| Henrik Clausen         | Professor | University of Copenhagen        |
| Ib Chorkendorff        | Professor | Technical University of Denmark |
| Lars Peter Nielsen     | Professor | Aarhus University               |
| Marja Jäätelä          | Professor | The Danish Cancer Society       |
| Mikael Rask Madsen     | Professor | University of Copenhagen        |
| Peter Vuust            | Professor | Aarhus University               |
| Poul Nissen            | Professor | Aarhus University               |
| Rubina Raja            | Professor | Aarhus University               |
| Stig Helveg            | Professor | Technical University of Denmark |
| Sune Toft              | Professor | University of Copenhagen        |

|                       |           |                                 |
|-----------------------|-----------|---------------------------------|
| Susanne Mandrup       | Professor | University of Southern Denmark  |
| Teis Vegge            | Professor | Technical University of Denmark |
| Thomas Graven-Nielsen | Professor | Aalborg University              |
| Ulrik Lund Andersen   | Professor | Technical University of Denmark |

### University leaders

| Name                     | Title                     | Organisation                            |
|--------------------------|---------------------------|---|
| Brian Bech Nielsen       | Rector                    | Aarhus University, Universities Denmark |
| Carsten Sørensen         | Head of department        | Copenhagen Business School              |
| Eva R. Hoffmann          | Head of department        | University of Copenhagen                |
| Jakob Møller-Jensen      | Head of department        | University of Southern Denmark          |
| Jan Tønnesvang           | Head of department        | Aarhus University                       |
| Joachim Mathiesen        | Head of department        | University of Copenhagen                |
| Lars-Ulrik Aaen Andersen | Head of department        | Technical University of Denmark         |
| Niels Kroer              | Head of department        | University of Copenhagen                |
| Susanne Sørensen         | Dean for Natural Sciences | Roskilde University                     |
| Ulrik Ingerslev Uggerhøj | Head of department        | Aarhus University                       |

### Early-career researchers

| Name                      | Title                     | Organisation                    |
|---------------------------|---------------------------|---------------------------------|
| Anne Katrine Ravn         | Postdoc                   | San Diego University            |
| Christoffer Karoff        | Associate Professor       | Aarhus University               |
| Cornelius Rust Wiesener   | Assistant Professor       | University of Copenhagen        |
| Elvira Laila van Hauwaert | Scientist                 | Nordic Microbes                 |
| Emil Knudstrup            | Postdoc                   | Aarhus University               |
| Fabio Gigone              | Postdoc                   | University of Copenhagen        |
| Francesco Da Ros          | Senior Researcher         | Technical University of Denmark |
| Frederik Buchholzer       | Assistant Professor       | University of Southern Denmark  |
| Karen Marie Hilligsøe     | Director                  | Break The Mold                  |
| Line Hagner Nielsen       | Assistant Professor       | Technical University of Denmark |
| Mathias Rav               | Software Engineer         | Scalgo                          |
| Mette Kaasgaard           | Assistant Professor       | University of Southern Denmark  |
| Morten Alder Schulz       | Senior Research Scientist | Agilent Technologies            |
| Morten Høgh               | Associate Professor       | Aalborg University              |
| Tina Hecksher             | Postdoc                   | Roskilde University             |

### External stakeholders and collaborators

| Name                   | Title   | Organisation                                      |
|------------------------|---|---|
| Christian Kjær Monsson | Head of Research, Education and Diversity                       | Danish Industry                                   |
| Kasper Nørgaard        | Scientific Director   | Novo Nordisk Foundation                           |
| Jan Egebjerg           | Senior Vice President, Grants & Prizes, Director of Science     | The Lundbeck Foundation                           |
| Jes Broeng             | Member of DFIR, Professor and Director for DTU Entrepreneurship | Danish Council for Research and Innovation Policy |
| Jesper Risom           | Head of Office  | Independent Research Fund Denmark                 |
| Kurt Stokbro           | CEO   | Quantum Sparrow                                   |
| Lasse Horne Kjældgaard | Director  | The Carlsberg Foundation                          |
| Lia Leffland           | Academy Director  | The Danish Academy of Technical Sciences          |
| Oleksii Ilchenko       | CEO and Founder   | Lightnovo   |
| Peter Lodahl           | Founder   | Quantum Sparrow                                   |
| Sune Fugleholm         | Partner   | Poul Schmith / Kammeradvokaten                    |
| Susanne Ditlevsen      | President   | The Royal Danish Academy of Sciences and Letters  |
| Søren Asp Mikkelsen    | VP Missions and Partnerships                                    | Innovation Fund Denmark                           |
| Thomas Bjørnholm       | Research Director   | Villum Foundation                                 |
| Thomas Sinkjær         | General Secretary   | The Royal Danish Academy of Sciences and Letters  |

### Others

| Name                | Title                        | Organisation                        |
|---------------------|------------------------------|-------------------------------------|
| Christian S. Jensen | Deputy chairman of the board | Danish National Research Foundation |
| Dorthe Dahl-Jensen  | Chairman of the board        | Danish National Research Foundation |

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