30 November 2022

Medical Symposium Keynote:

Keynote: Impact on society:

*(*Conducting research and supporting knowledge transfer for the benefit of Industry)

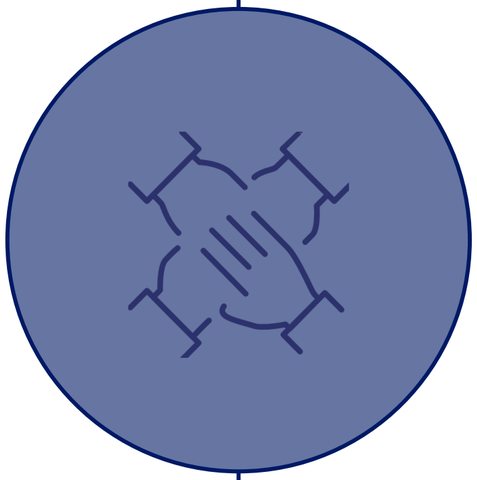
Dr. Thomas Alslev Christensen

Senior Vice President

Impact

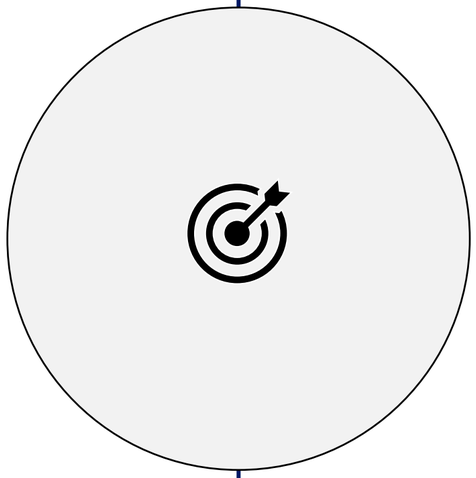
novo nordisk fonden

Outline



The Novo Nordisk Foundation

- A story on Impact of Science



How can impact be documented?

How does science impact society?

The Novo Nordisk Foundation – a history of how science creates impact in society - it began with insulin

THE SCIENTISTS
Marie Krogh and August Krogh

THE CLINICIAN
H.C. Hagedorn

THE INVESTOR
August Kongsted

THE ENTREPRENEUR
Thorvald Pedersen

THE ENTREPRENEUR
Harald Pedersen

Our objectives

Corporate objective

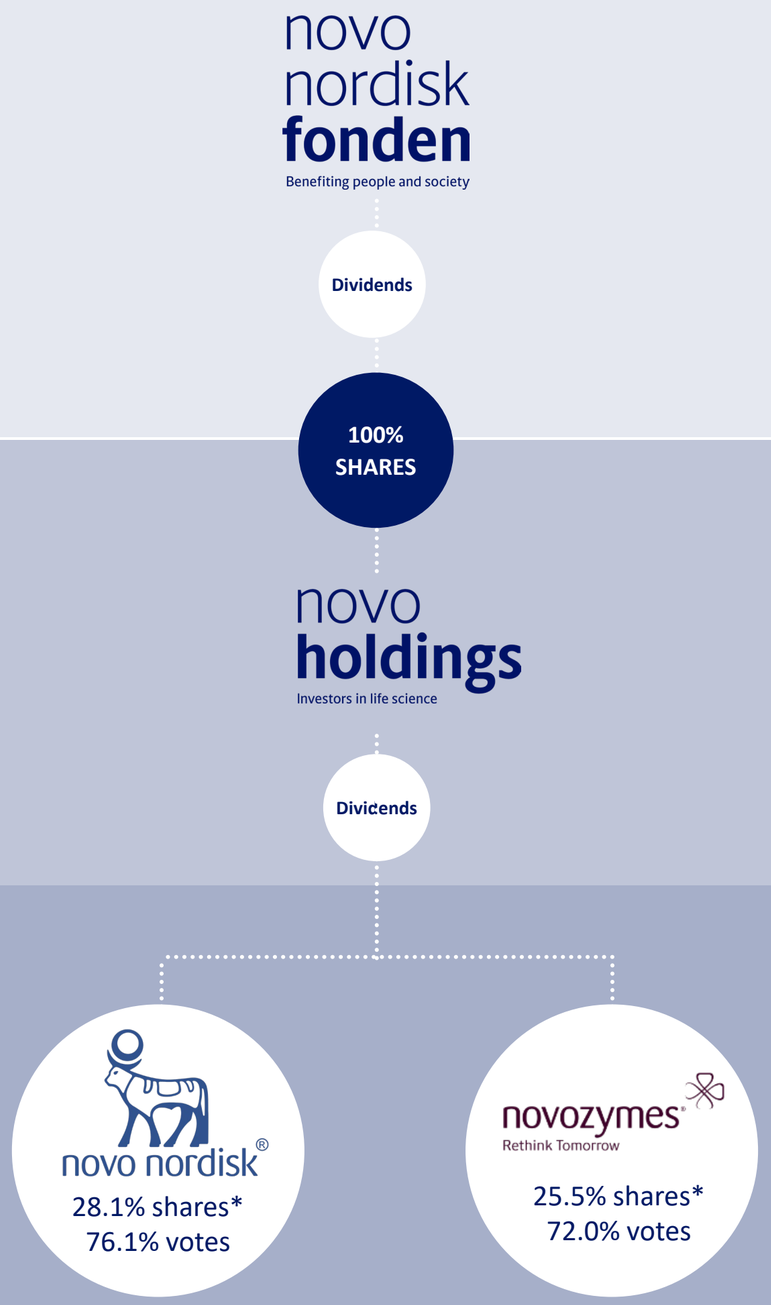
- To provide a stable basis for the commercial and research activities of the Novo Group companies.*

Grant-giving objectives

- To support physiological, endocrinological, metabolic and other medical research,
- to support Danish research hospital activities within diabetes, and
- to support other scientific, humanitarian and social purposes.

* The Novo Group comprises Novo Nordisk A/S, Novozymes A/S and Novo Holdings A/S, and companies in which Novo Holdings A/S may hold a material equity interest or over which it may have material influence.

The Novo Nordisk Foundation is an independent Danish enterprise foundation



Grant-giving areas

- Scientific research
- Diabetes treatment
- Innovation
- Education, humanitarian and social causes

Investments in +150 companies

- Principal Investments
- Growth Investments
- Venture Investments
- Seed Investments
- Capital Investments

Facts about the Novo Nordisk Foundation

03

The world's third largest
measured in grants

01

The world's largest
measured in assets:
$ ~100 billion*

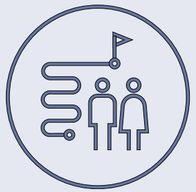
2021 in numbers*

Awarded ~DKK	Paid out ~DKK				Investment result 2021
8.8 billion	**4.8** billion	**617**	**2,771**	**~18%**	**37** ~DKK billion
$ 1.2 billion	$ 645 million	Grants awarded	Applications received	Success rate for research applications among open calls	$ 5 billion

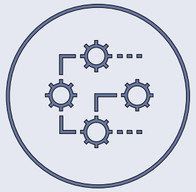
*Preliminary numbers year-end 2021

What does success look like for NNF? **Nine impact principles for society**

Output



Fostering the development of talent across different gender, life ages and scientific fields



Supporting organisations, systems, and infrastructure to catalyse a knowledge-based societal development

Stimulating collaboration across international borders, scientific disciplines, and sectors in society

Outcome

Promoting excellent research and innovation

Developing innovative products and solutions supporting a sustainable development

Developing new technologies, therapies and patient-centred and research-based care and disease prevention

Impact

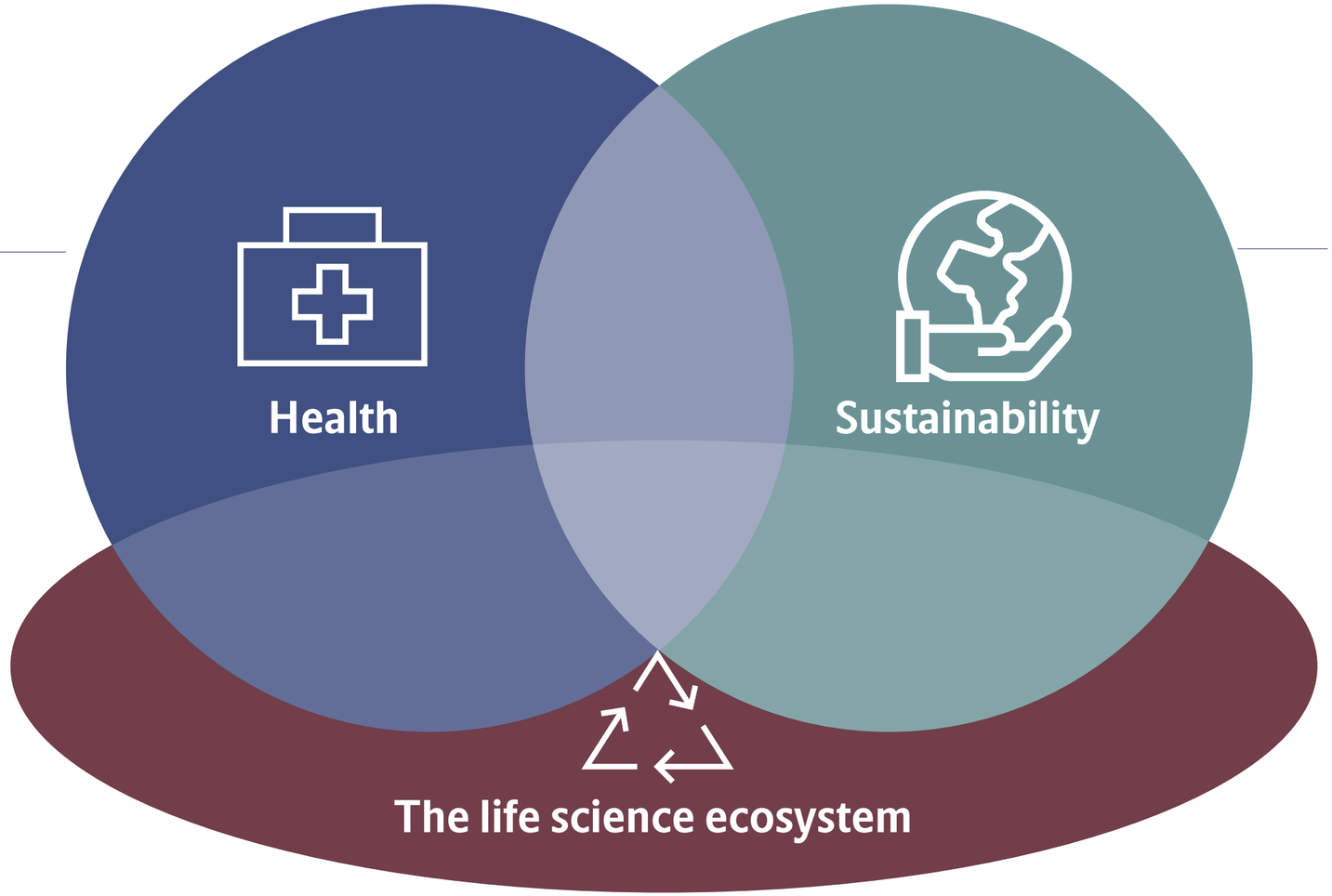
Creating jobs, sustainable growth, efficient use of resources and productivity in society

Support the development of world-class education at all levels and of a qualified and agile workforce

Supporting people in difficult health, social, environmental, and humanitarian settings

Our vision **to improve people's health and the sustainability of society and the planet** is pursued through a three-pronged mission

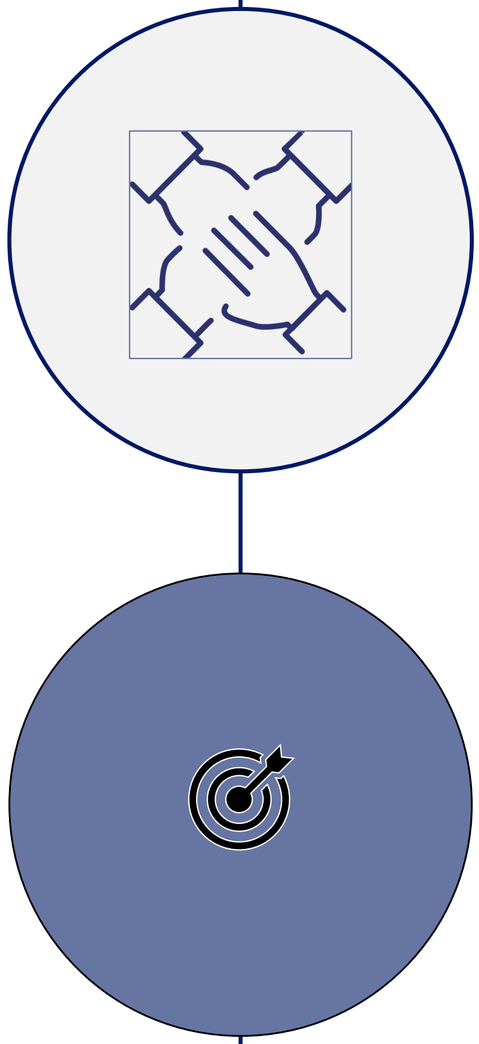
Progress research and innovation in prevention and treatment of cardiometabolic and infectious diseases



Advance knowledge and solutions to support the green transition in society

Invest in scientific research, education and innovation to enable a world class life science ecosystem

Outline



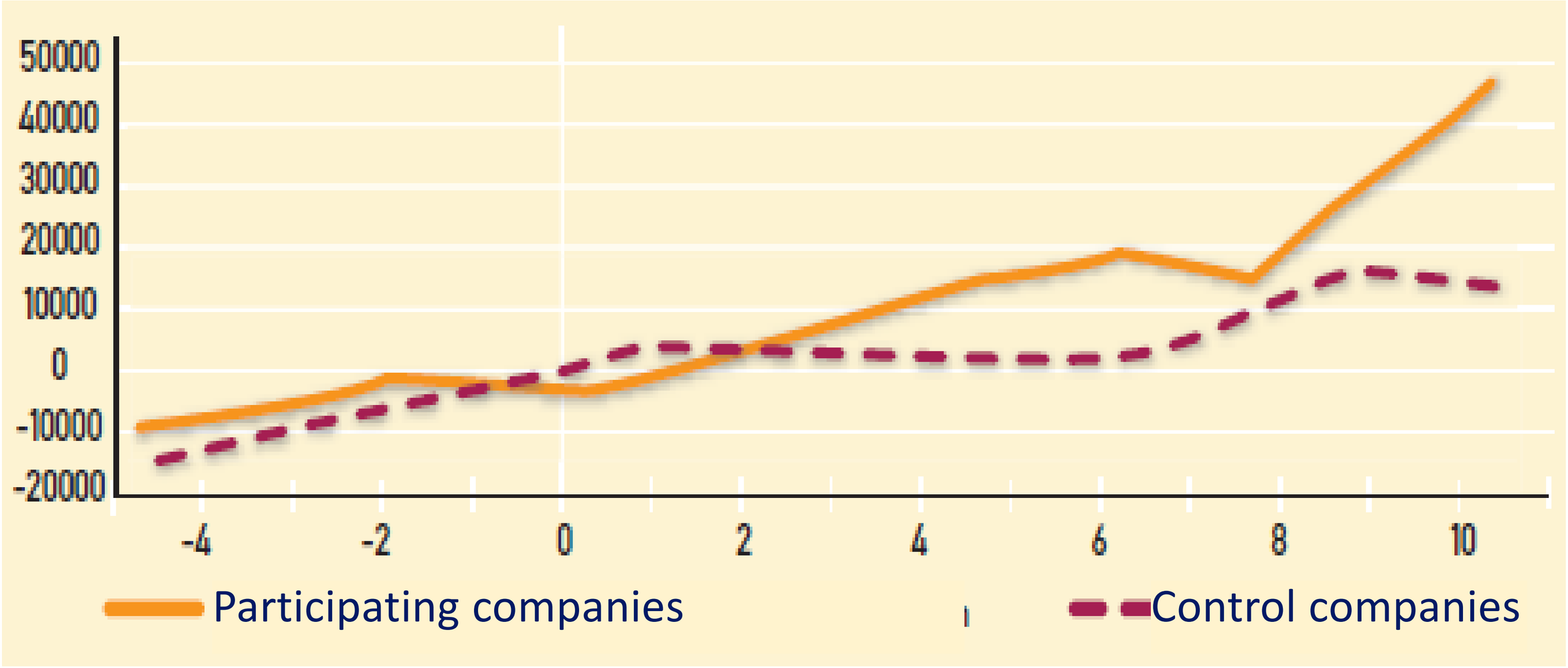
The Novo Nordisk Foundation

- A story on Impact of Science

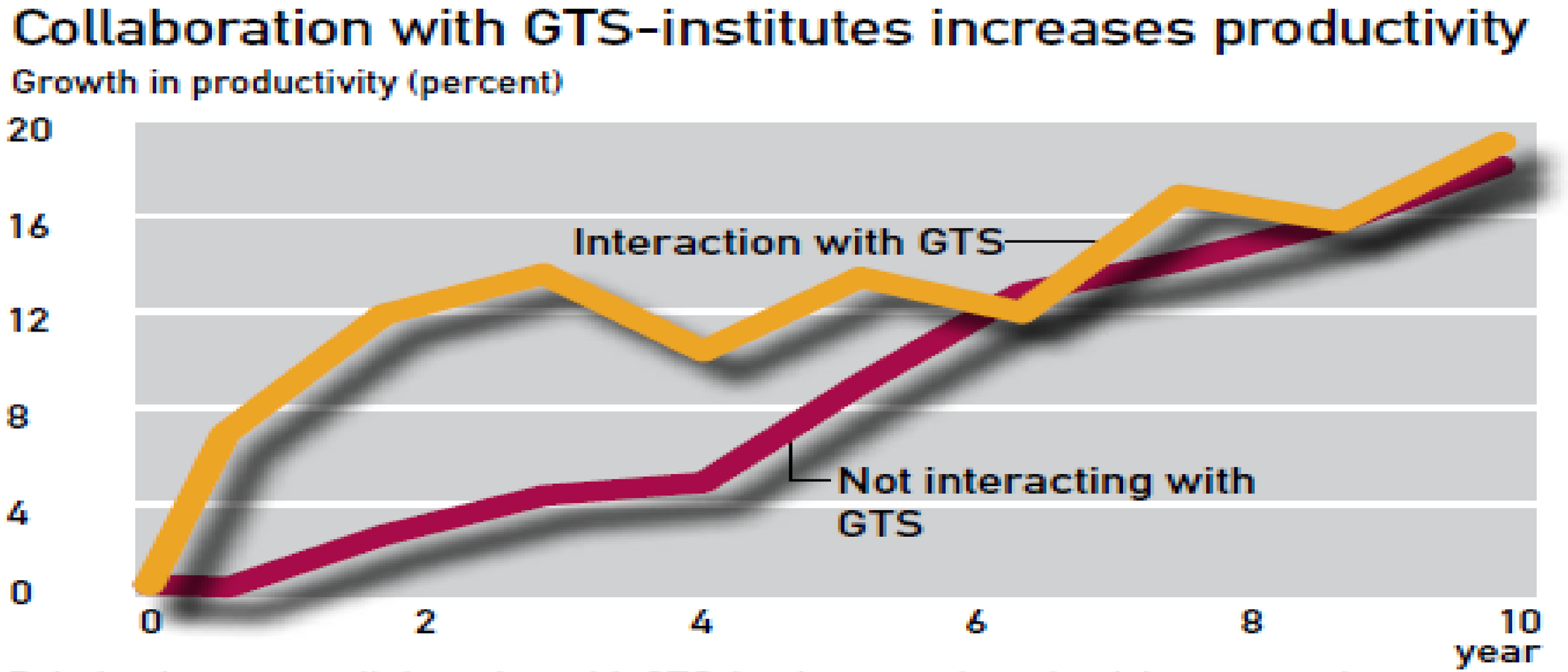
How can impact be documented?

How does science impact society?

The impact on profits from collaboration between industry and science

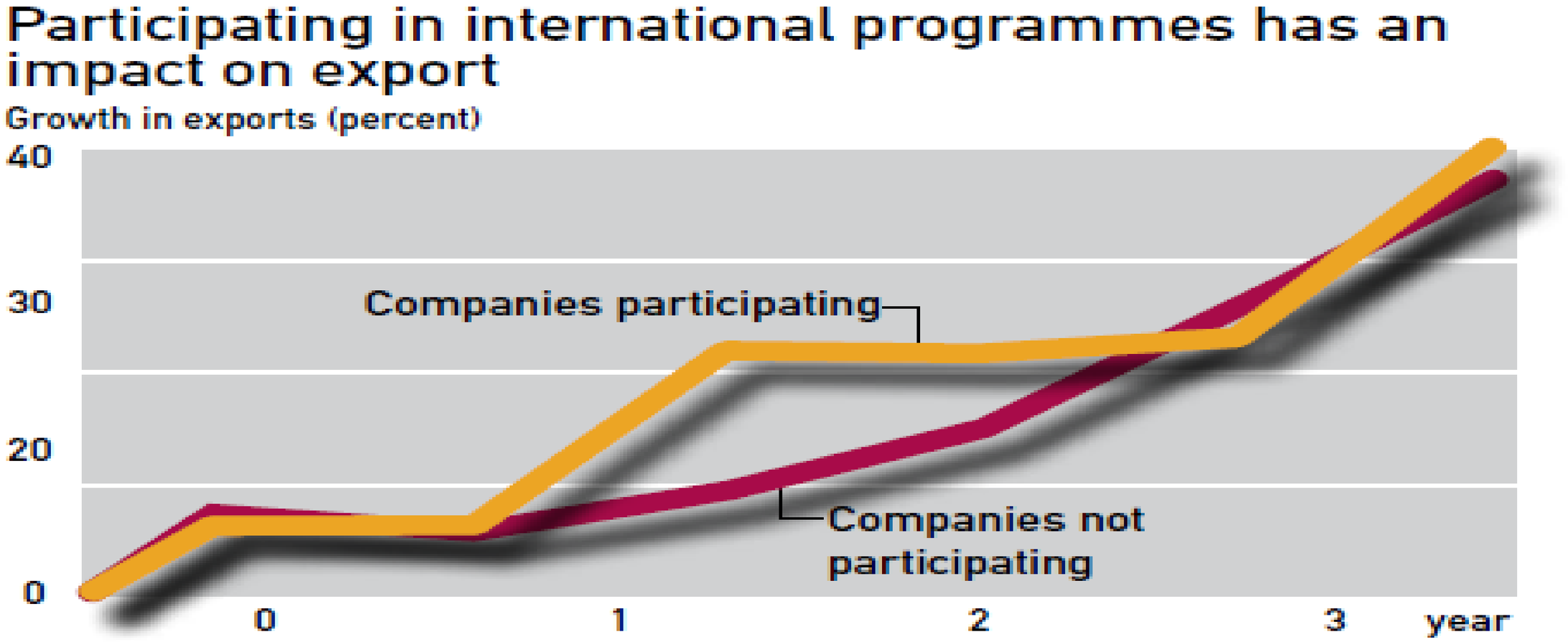


Productivity growth in companies collaborating with universities and GTS-institutes (technological services (TNOs))



Relation between collaboration with GTS-institutes and productivity per employee.
Source: DAMVAD extract of data from Statistics Denmark

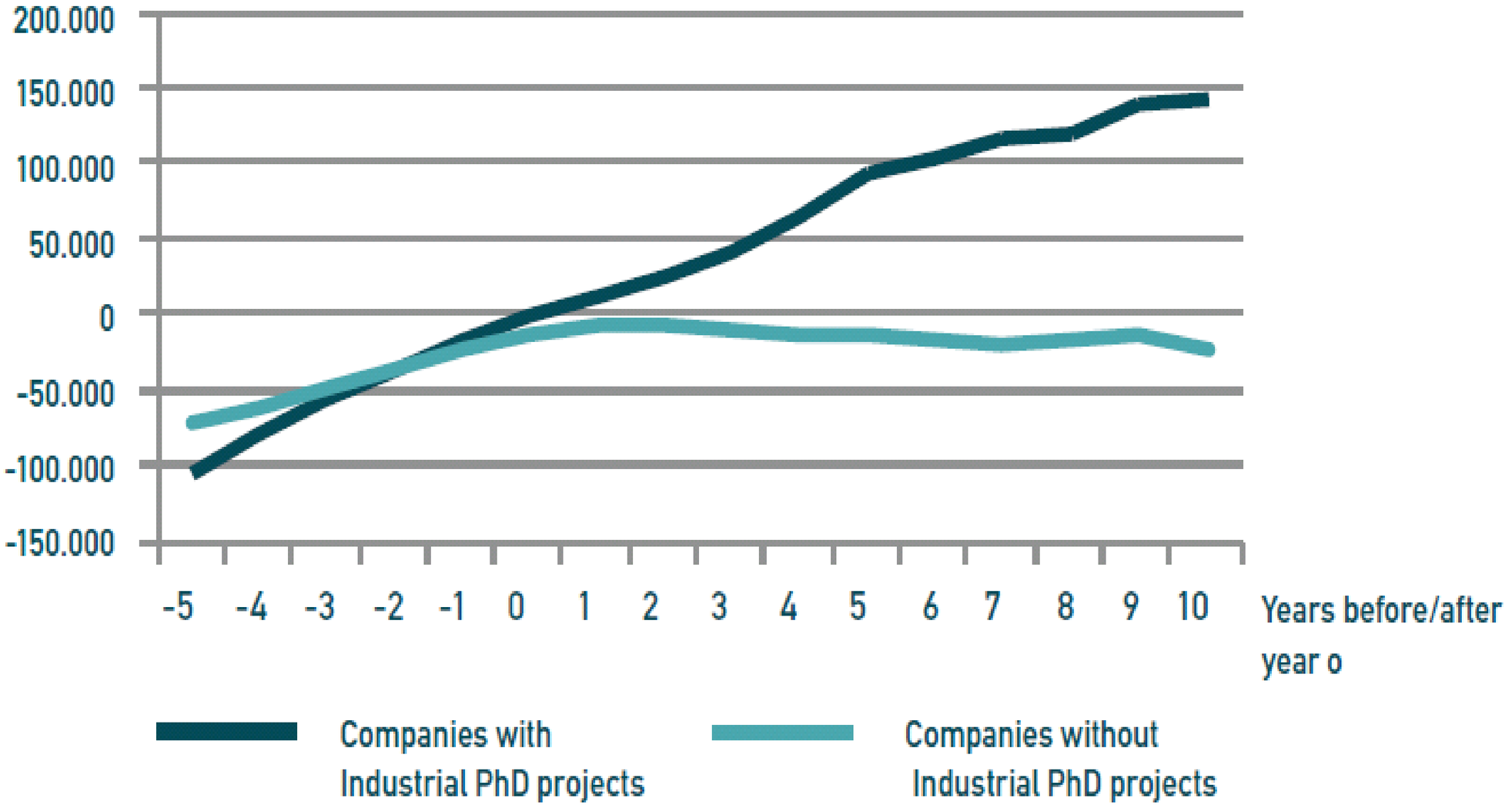
The impact on export growth from collaboration between industry and science



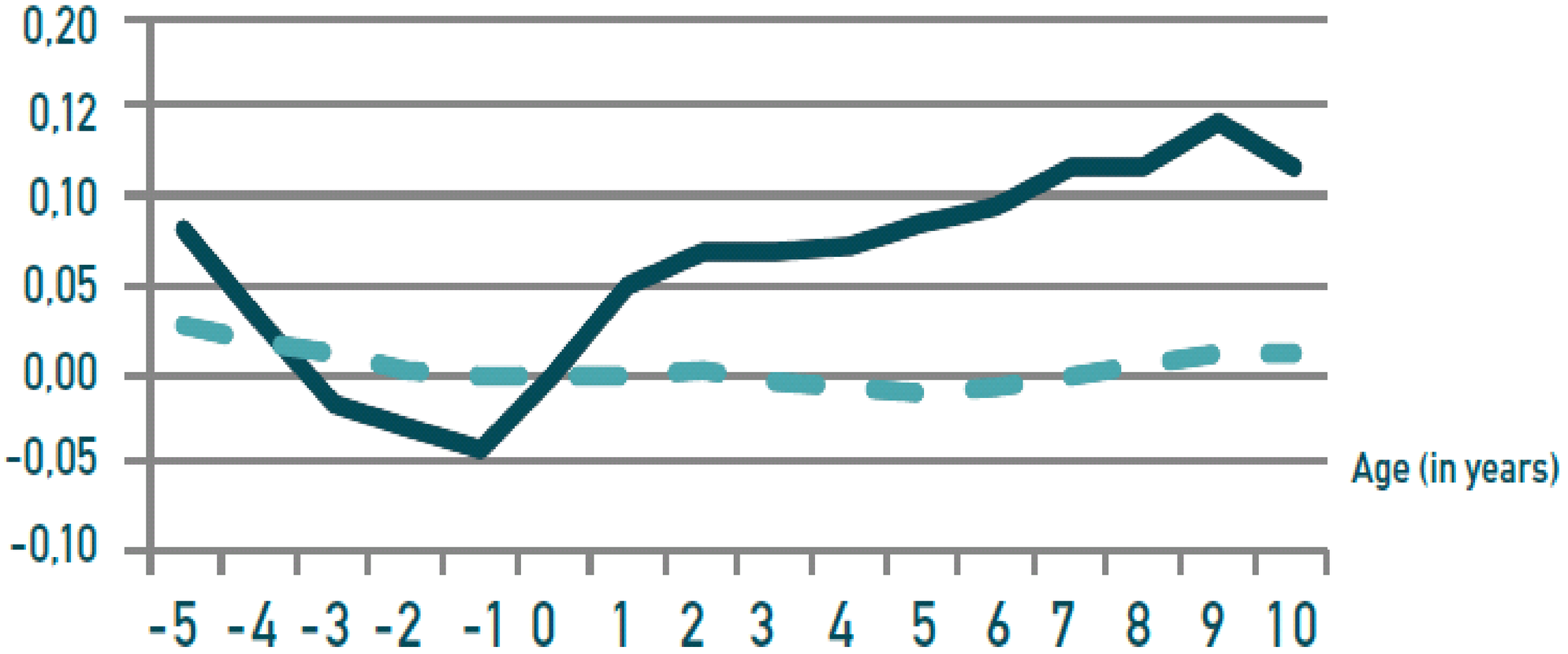
Export growth of participants in international programmes compared to similar Danish companies not participating

Source: DAMVAD 2011

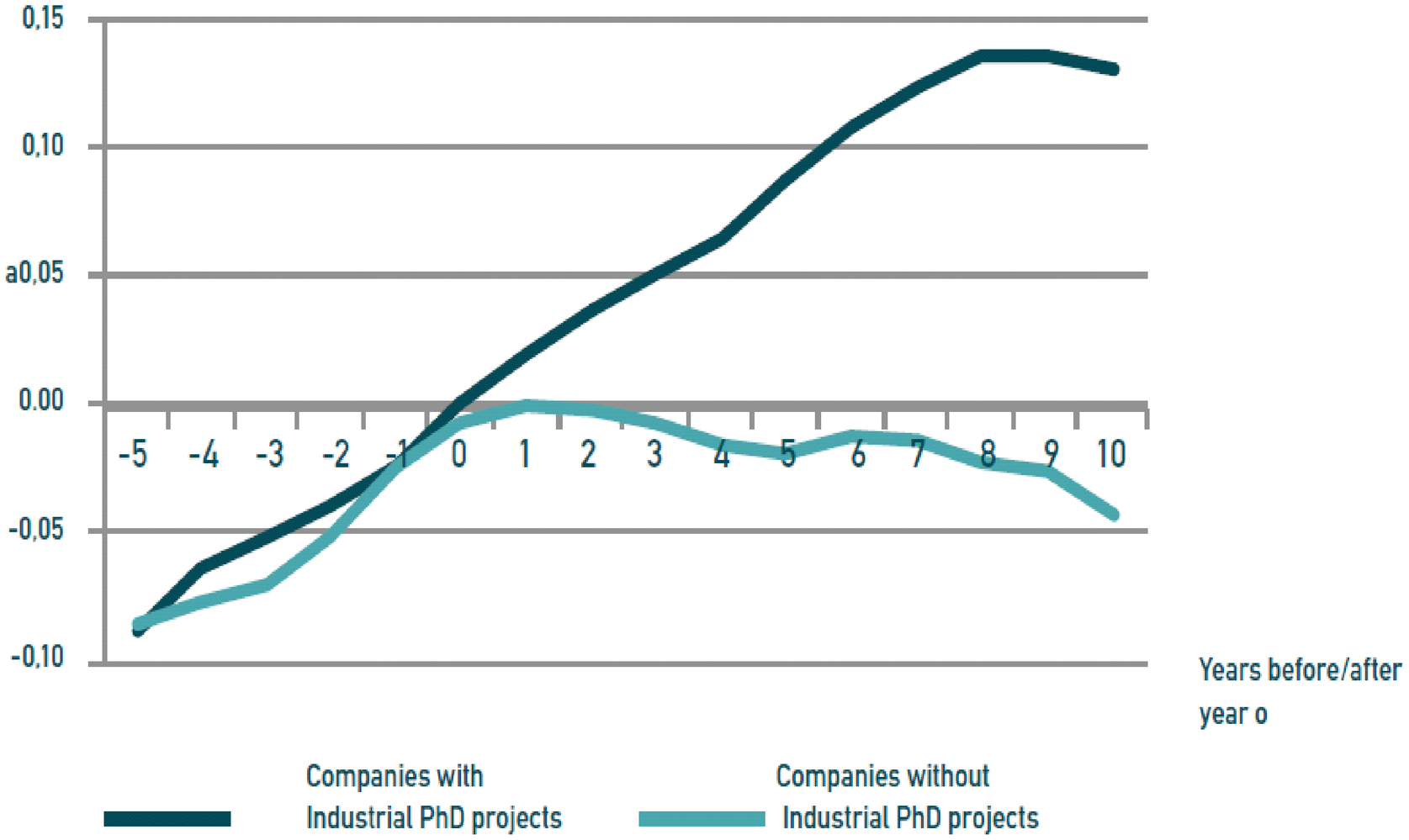
Gross profits in companies with or without Industrial PhD projects



Number of patent applications



Development in employment



Impact of Science philosophy

Supply side

Funder/investor

The level of funder intent and input resources to create real-world impact via.....

Strategy, vision, missions, themes & key objectives

- Align funding with the NNFs strategy, vision, three focus-missions and nine impact principles
- Funding is directly linked to one of NNFs 12 themes and one or more of the NNFs 49 key objectives

Impact mechanisms: Grant-giving models & instruments to optimise impact

- Contribute with non-financial support and co-development of initiatives in project centric organisation
- Contribution with financial support, funding instrument, impact framework and KPIs signaling signal that societal impact matter

Demand side

Grantee/investee

activities that the grantee carries out which result in production of ....

- ❑ Operations of initiative and project intervention
- ❑ Monitoring of activities initiated and in progress
- ❑ Full control over initiated activities by recipient
- ❑ Monitor critical success criteria ("impact markers)

the **outputs** that the grantee generates...

- ➢ Direct and immediate results of activities in terms of products or operations that intend to deliver future changes
- ➢ Very high degree of influence over direct results from activities by recipient

to achieve the desired medium and long term **outcomes** and tangible short-term results ....

- ❖ Changes in outcomes as result of activities
- ❖ Evaluate critical success criteria ("impact markers)
- ❖ Reduced or minimal control by recipient of grants

Society

Equilibrium for People/citizens

so they create the **strategic impact changes** that we ultimately seek

- ✓ Changes in long-terms outcomes caused by activities, interventions and outputs
- ✓ Verify or reject long-term impact goal hypothesis
- ✓ Very little or no influence over medium and long-term outcome
- ✓ Evaluate strategic objectives and critical success criteria ("impact markers")

in order to fulfill our **vision** and **long-term objective**

Societal change measured (additionality for society) in terms of before and after situation or in terms of differences for treatment group versus control group

The logic model for societal impact

We collect data and analyse chains of **Critical Success Factors and KPIs** from **inputs** via **output** to **impacts**

Biomed: Logical Impact Model

Biomedical and health science research and applications

LOGICAL IMPACT MODEL: Chain of Critical Success Factors from inputs to impacts that link the grants, step-by-step, to the long-term objectives of our strategy

Inputs: We facilitate research within four key themes of our strategy

- **HEALTH-RELATED DATA SCIENCE**
- **INNOVATIVE THERAPIES**
- **COHERENCE IN HEALTH CARE**
- **BREADTH IN BIOMEDICAL RESEARCH**

The **activities** that our grant recipients carry out

- Creating high-class research environments and conducting research
- Developing research talent
- Establishing national and international research collaborations
- Developing cutting-edge research infrastructure

and the **outputs** that they generate

- Creating knowledge
- Delivering research-based education

to achieve the desired **outcomes**

- Use of knowledge within the research environment
- Use of knowledge within the health care sector
- Creating the basis for innovation and new products

and create the **impact** that we ultimately seek, which is to

- Create cohesive health care and a more efficient use of resources in the health care sector
- Accelerate the translation of new discoveries into new therapies
- Develop patient-centred care and world class clinical treatment
- Create scientific breakthrough within the breadth of biomedical research

in order to fulfil our **long-term objective**

Enable people to live healthier and better lives by facilitating research that advances knowledge of human health and disease, solves health challenges and develops the health care system

Example of Performance indicators (KPIs) for science: KPI's and application data for all research projects (BBM, Biotech, Nat-tech)	Data collection: Researchfish® (RF), NORMA, NNF Impact
# applicants (gender, age, institution, and research, educational and international background etc.)	NORMA [application system of NNF] (Grant holder)
# applications (evaluationscriteria and scores, grants, declines, winners in the lottery etc.)	NORMA
# additional funding after grant start	NORMA (Grant holder)
# grant and payout from Novo Nordisk Fonden	NORMA
# Basic research projects, applied research projects and translational research projects	NORMA
# Team members (MA-students, PhD, Postdoc, professors, assistents etc.)	RF (Grant holder)
# Education activities (courses, lectures, digital activities, mentoring etc.)	RF (Grant holder)
# Relevant collaboration partners (national, international, interdisciplinary, industry)	RF (Grant holder)
# Publications (all types)	RF (Grant holder)
# Journal articles in journals ranked according to SNIP	NNF Impact
# Co-authorship with academia and industry, and interdisciplinary co-authorship	NNF Impact
# Databases, software and other IT-products	RF (Grant holder)
# Research methods and models	RF (Grant holder)
# Products, services, therapheitic interventions, medtech, etc.	RF (Grant holder)
# Engagement activities (speeches, keynotes, presentations, media, conferences, etc.)	RF (Grant holder)
# Publications in PP(top 1%) og PP(top 10%)	NNF Impact
# Clinical trials	RF (Grant holder)
# Field trials	RF (Grant holder)
# Patents, patent applications and licences	RF (Grant holder)
# Citations in patent documents	NNF Impact
# Citations in clinical guidelines	NNF Impact
# Influence on policies	RF (Grant holder/NNF Impact)
# People in clinical trials	NNF Impact
# New technologies applied outside academia (in industry/public sector)	NNF Impact
# Products and services arrived at the market	NNF Impact

Biomed: Impact Assessment Framework

Biomedical and health science research and applications

Key Performance Indicators linked to the inputs, activities, outputs and outcomes of our grant recipients

Critical Success Factors	Key Performance Indicators
Resources used to establish activities	→ # of grants, amount awarded and payouts (by key themes in strategy) → # of grants in collaboration with other GGAs
Creating high-class research environments and conducting research	→ # of people fully or partly supported by the Foundation
Developing research talent	→ # of PhDs and postdocs fully or partly supported by the Foundation
Establishing national and international research collaborations	→ # of self-reported collaborations → % of articles with co-authorship (international, industry, or other national research institutions)
Building cutting-edge infrastructure	→ # of users of infrastructure supported by the Foundation → # of papers acknowledging the infrastructure or resulting from using the infrastructure
Creating knowledge	→ # of journal articles published → Median (and 90th percentile) Impact Factor of journals in which articles are published
Delivering research-based education	→ # of students participating in a course or activity organized by the grant recipients at BSc, MSc and PhD level (including number of courses with course responsibility or contribution)
Use of knowledge within the research environment	→ % of publications that belong to the top 10% most frequently cited worldwide → Novelty score of how frequent referenced journals in an article are paired historically
Use of knowledge within the health care sector	→ # of guideline documents that cite Foundation-funded journal articles
Creating the basis for innovation and new products	→ # clinical trials → # products and medical interventions → # of patent documents → # of spinouts (including additional investments in spinouts)

In-depth evaluations of the long-term societal impact of our grant giving

Enable people to live healthier and better lives	→ Degree to which people and patients live healthier and better lives as a result of products or interventions that are based on Foundation-funded research → Extent to which Foundation-funded publications are cited in patents that benefit people

Reporting in Researchfish®/Foundgood

IT-platforms help us collect data on the output and outcome

Questions

- Publications
- Collaborations & Partnerships
- Further Funding
- Next Destination
- Engagement Activities
- Influence on Policy, Practice, Patients & the Public
- Research Tools & Methods
- Research Databases & Models
- Intellectual Property & Licensing
- Medical Products, Interventions & Clinical Trials
- Artistic & Creative Products
- Software & Technical Products
- Spin Outs
- Awards & Recognition
- Other Outputs & Knowledge/Future Steps
- Use of Facilities & Resources

Questions

- Education and Professional Training
- Research-Team Information
- Supervisor and Mentor Activities
- Project Summary and Reflection
- Invention Disclosure & Ownership

Selected results within our nine principles for societal impact

Fostering the development of research talent

Investing in infrastructure

Supporting research collaboration

Promoting excellent research

Developing innovative products and solutions

Creating jobs and growth

Developing healthcare and new medicine

Developing world-class education

Empowering vulnerable groups in society

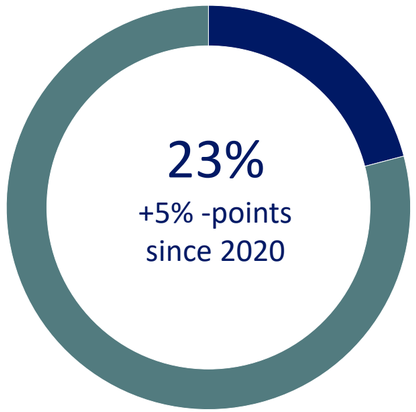
The Novo Nordisk Foundation Group

finances approximately **20%** of all research and development in Denmark (2021)

Public sector

of research and development expenditure
in the public sector financed by
Novo Nordisk Foundation
(DKK 3.6 billion in 2021)

Private sector



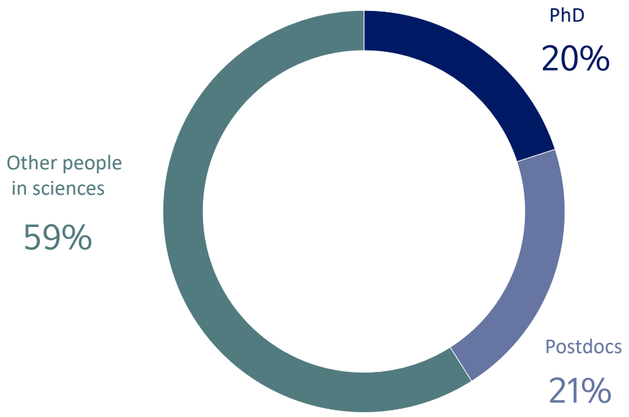
of research and development expenditure
in the private sector from
Novo Nordisk Foundation Group companies
(DKK 9.8 billion in 2021)

40% increase in number of people in science

fully or partly supported by the Foundation in 2021

PhD and Postdocs

in science



Gender distribution

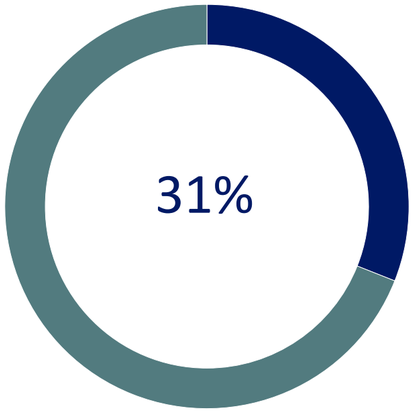
+1% - points
since 2020

6,400 people in science
+40% since 2020

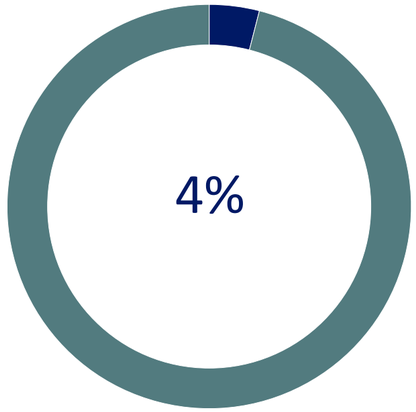
The grant-giving finances **31%** of public research

in medical and health sciences and **4%** in natural sciences in Denmark (2021)

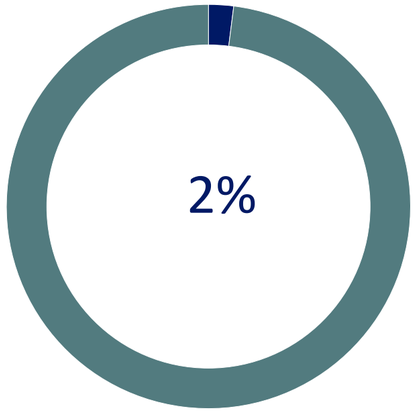
Medical and health sciences



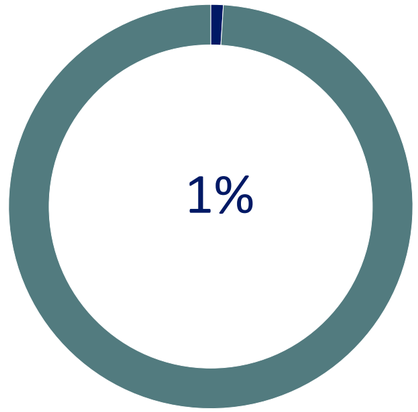
Natural sciences



Engineering and technical sciences

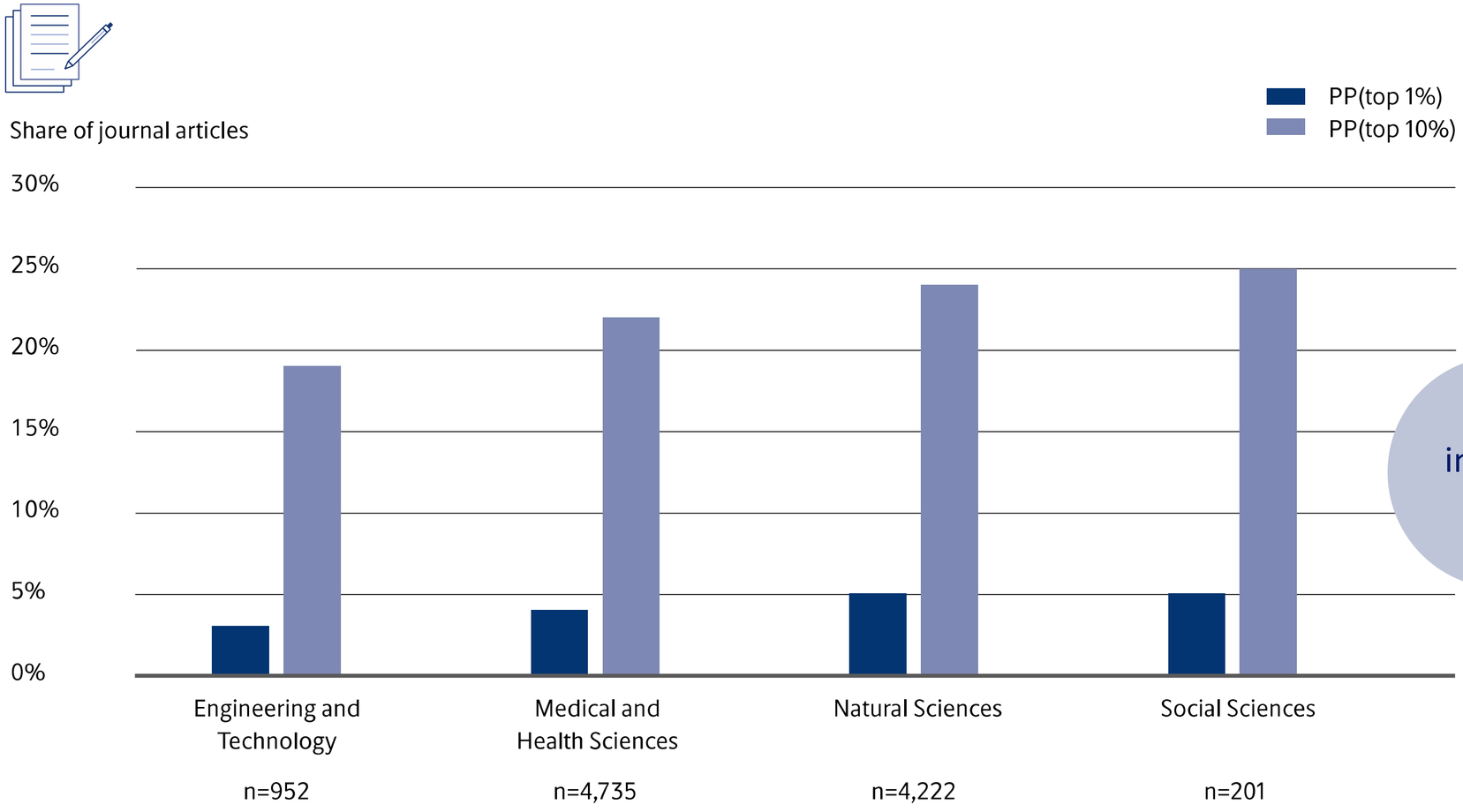


Humanities and social sciences



4% and **23%** of NNF funded articles are among World´s top **1%** and **10%** most cited

The share published with industry, international researchers and in interdisciplinary teams is high



68% international

12% industry

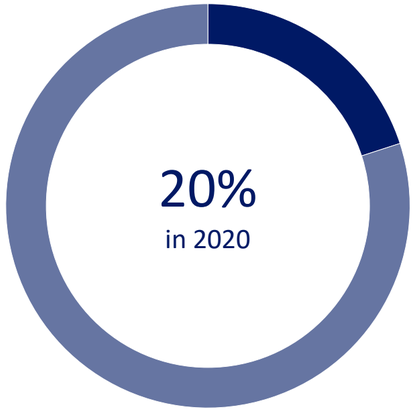
64% interdisciplinary

The companies in the Novo Nordisk Foundation Group

account for **20%** of Danish patent applications and **20%** of Danish granted patents

Share of Danish

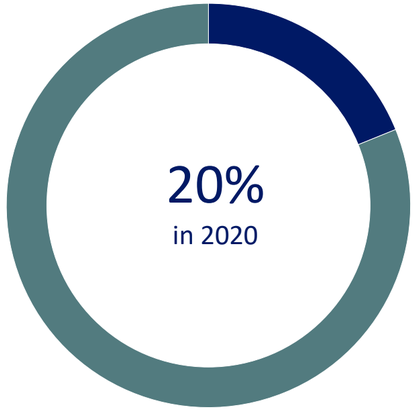
patent applications



More than 13,800 patent applications
worldwide since 2018

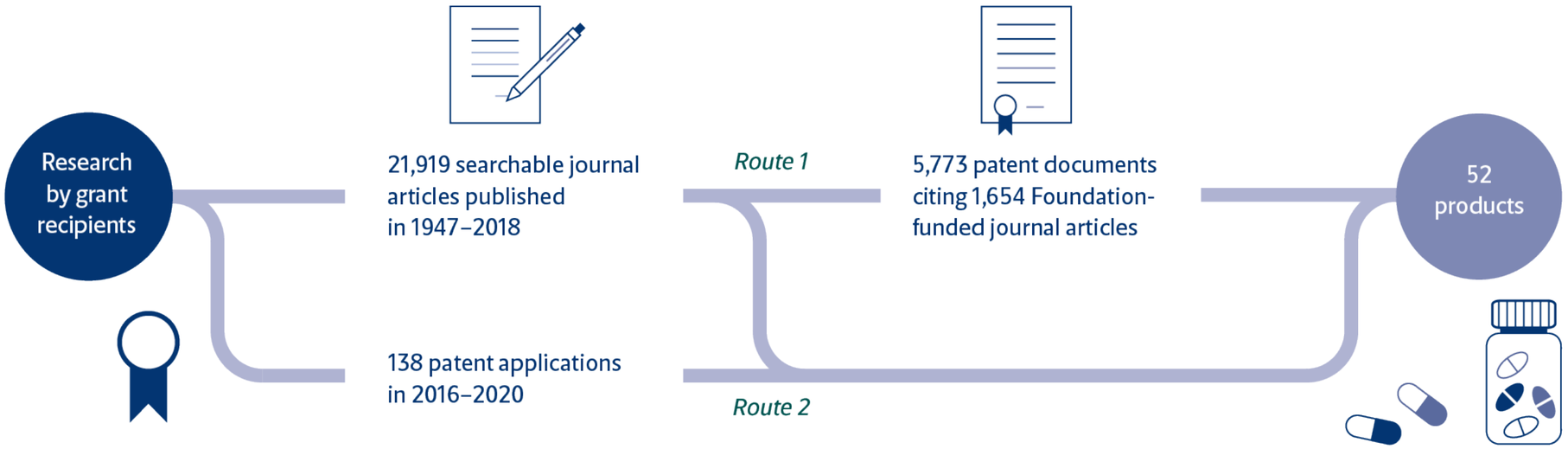
Share of Danish

granted patents



More than 2,500 patents granted
worldwide since 2018

Patent activity citing the Novo Nordisk Foundation grants links research to products



Fostering the development of research talent

Investing in infrastructure

Supporting research collaboration

Promoting excellent research

Developing innovative products and solutions

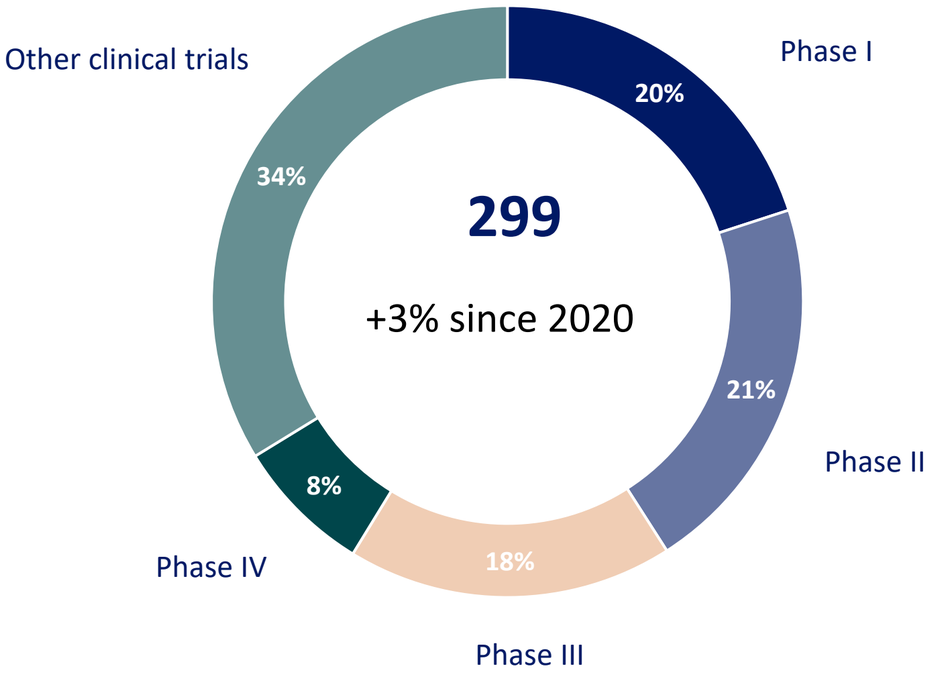
The Novo Nordisk Foundation Group contributed to translation of research to medicines through 299 clinical trials in 2021

~119,000

People participated in clinical trials in 2021

-6% since 2020

Active clinical trials 2021

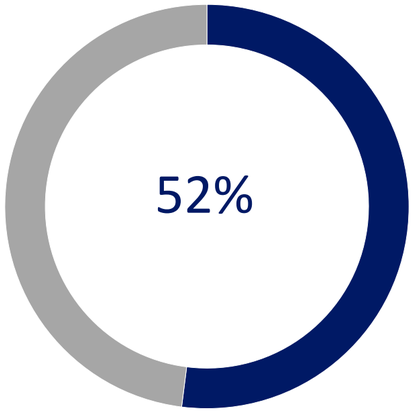


18% of 991 national and international clinical guidelines

and treatment recommendations cite Foundation-funded research

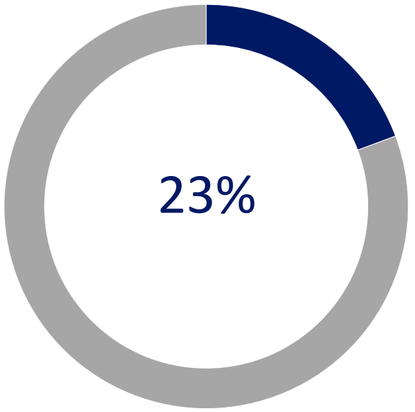
Diabetes

113 guidelines (2011–2021)



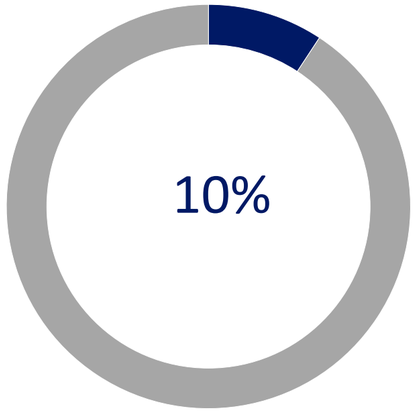
Cardiology

339 guidelines (2011–2021)



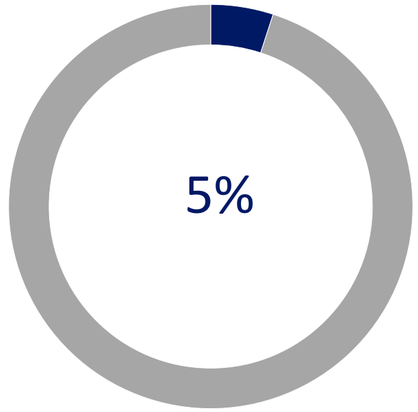
Cancer

371 guidelines (2011–2021)



Respiratory diseases

169 guidelines (2011–2021)



Thank you

for your attention

Thomas Alslev Christensen
Senior Vice President
Impact

novo nordisk fonden

Selected results within our nine principles for societal impact

Fostering the development of research talent

Investing in infrastructure

Supporting research collaboration

Promoting excellent research

Developing innovative products and solutions

Creating jobs and growth

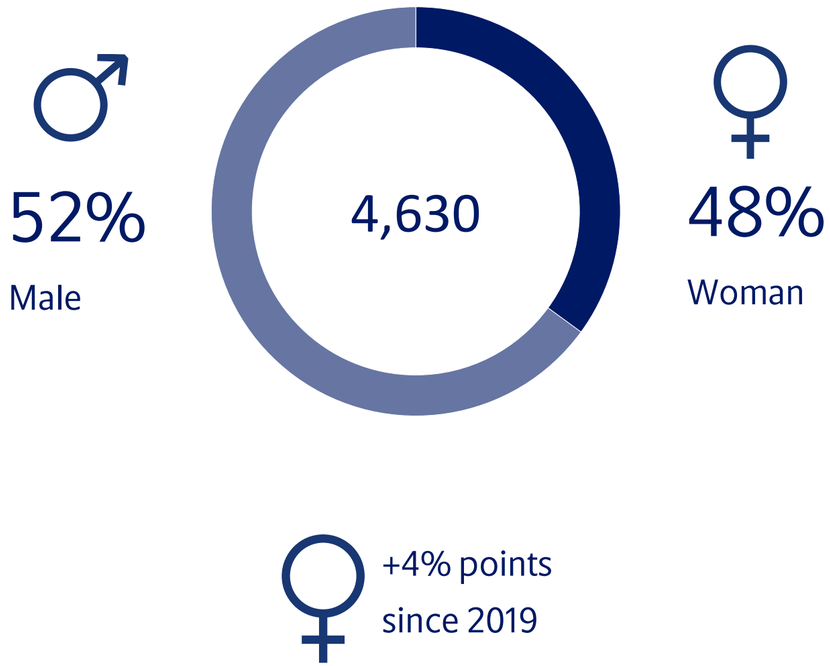
Developing healthcare and new medicine

Developing world-class education

Empowering vulnerable groups in society

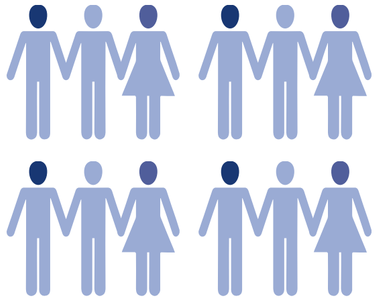
22% increase in number of people fully or partly supported by the Foundation in 2020

People supported in science



+4% points
since 2019

2,200



PhD students &
postdoctoral fellows

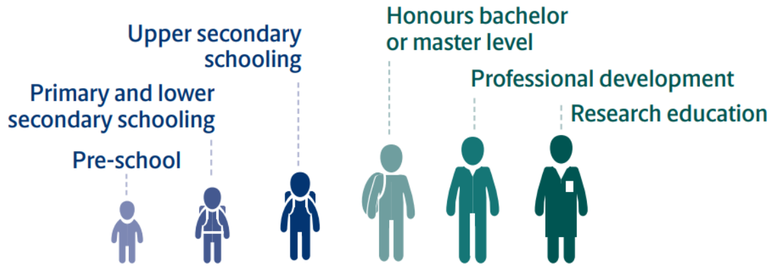
24% of PhDs in Denmark within health sciences is funded by NNF

Novo Nordisk Foundation has awarded EUR 2.5 billion to infrastructure initiatives

Fostering
the development
of research talent

Investing
in infrastructure

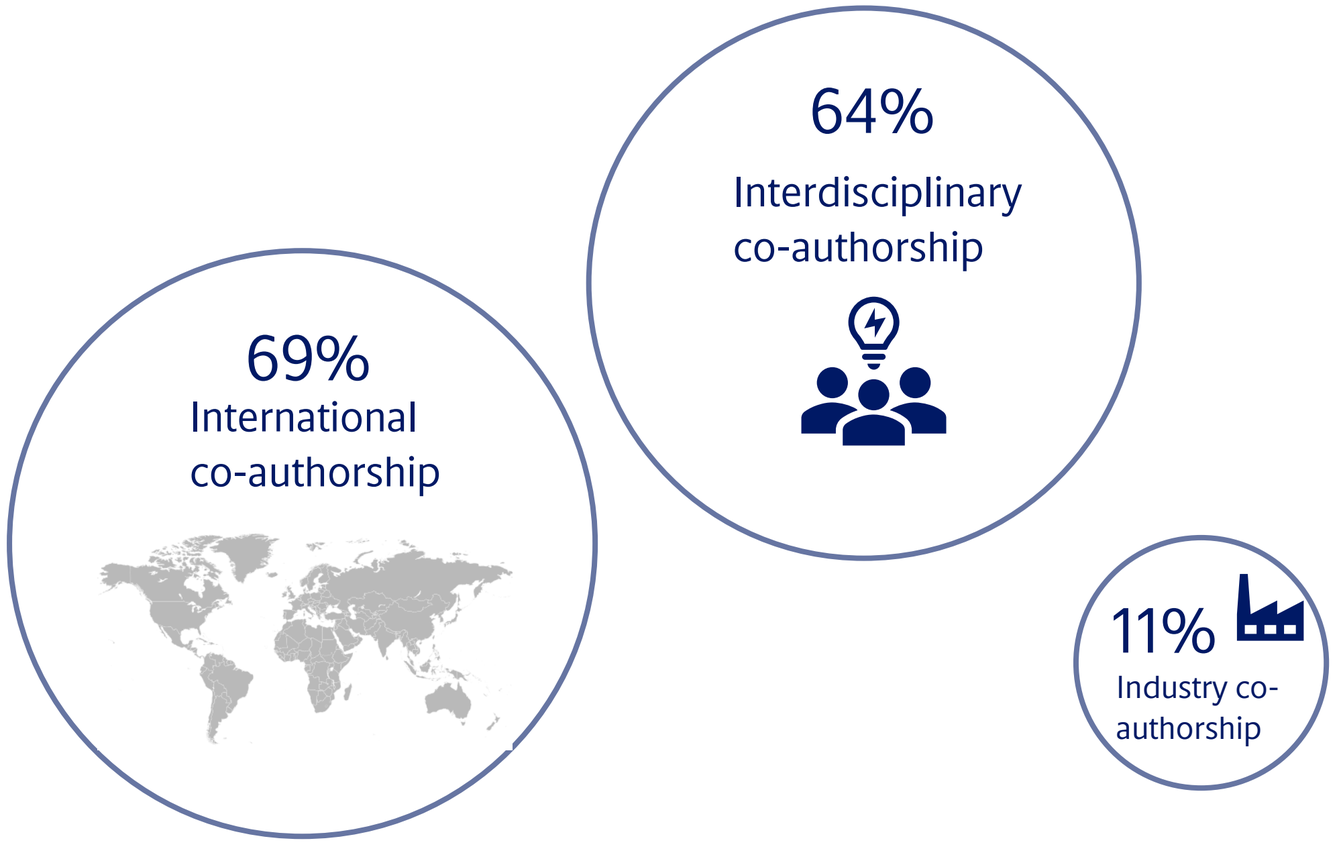
In **education** we support initiatives at all levels



In the **health sector** we support hospital and patient care initiatives on

Within **research and innovation**, we support NNF research centres, build new research facilities, and provide equipment for existing facilities

Research collaboration in **10,000** journal articles funded by NNF since 2016



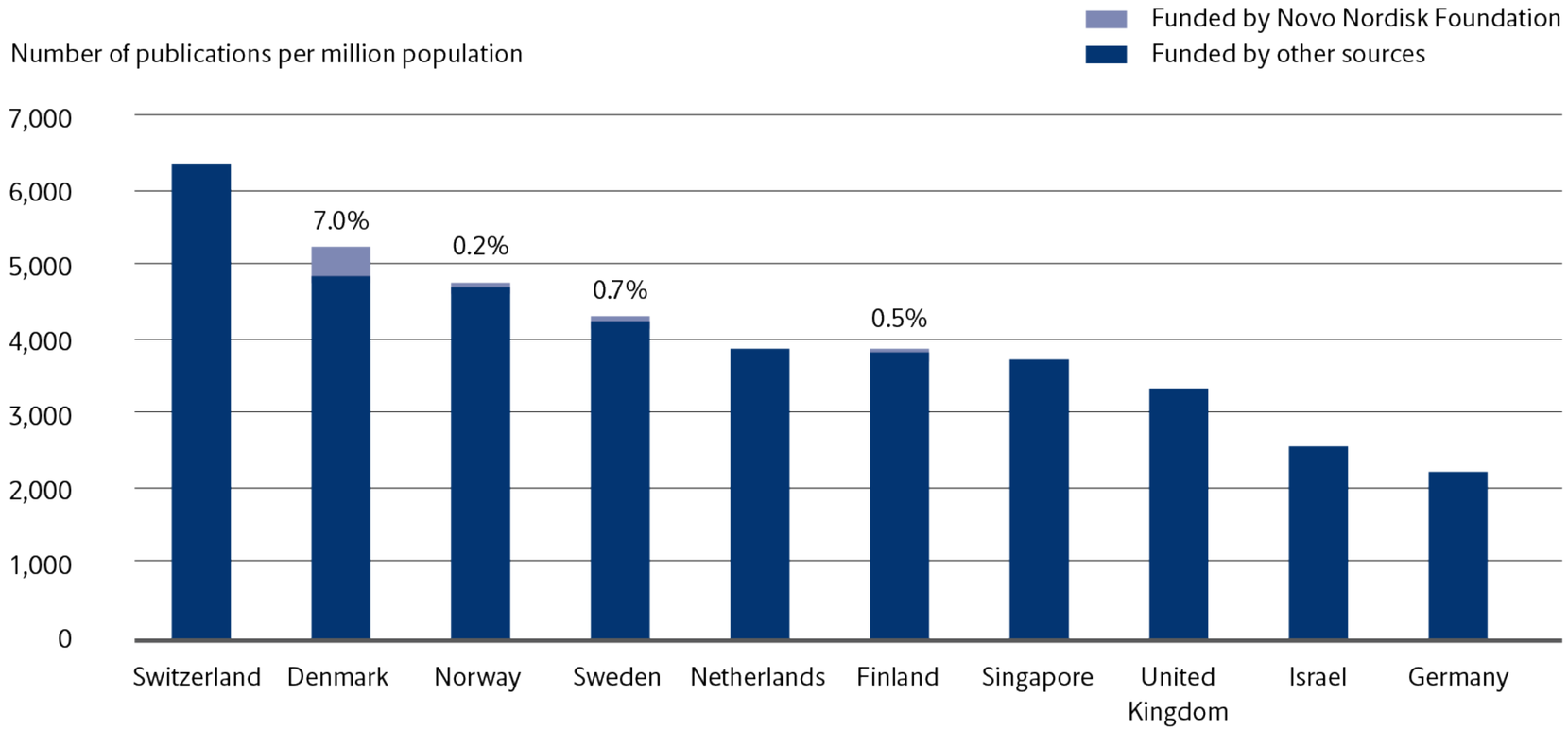
Fostering the development of research talent

Investing in infrastructure

Supporting research collaboration

7% of the journal articles in Denmark are supported by the Novo Nordisk Foundation grants

22% are among world's top 10% most frequently cited



Fostering the development of research talent

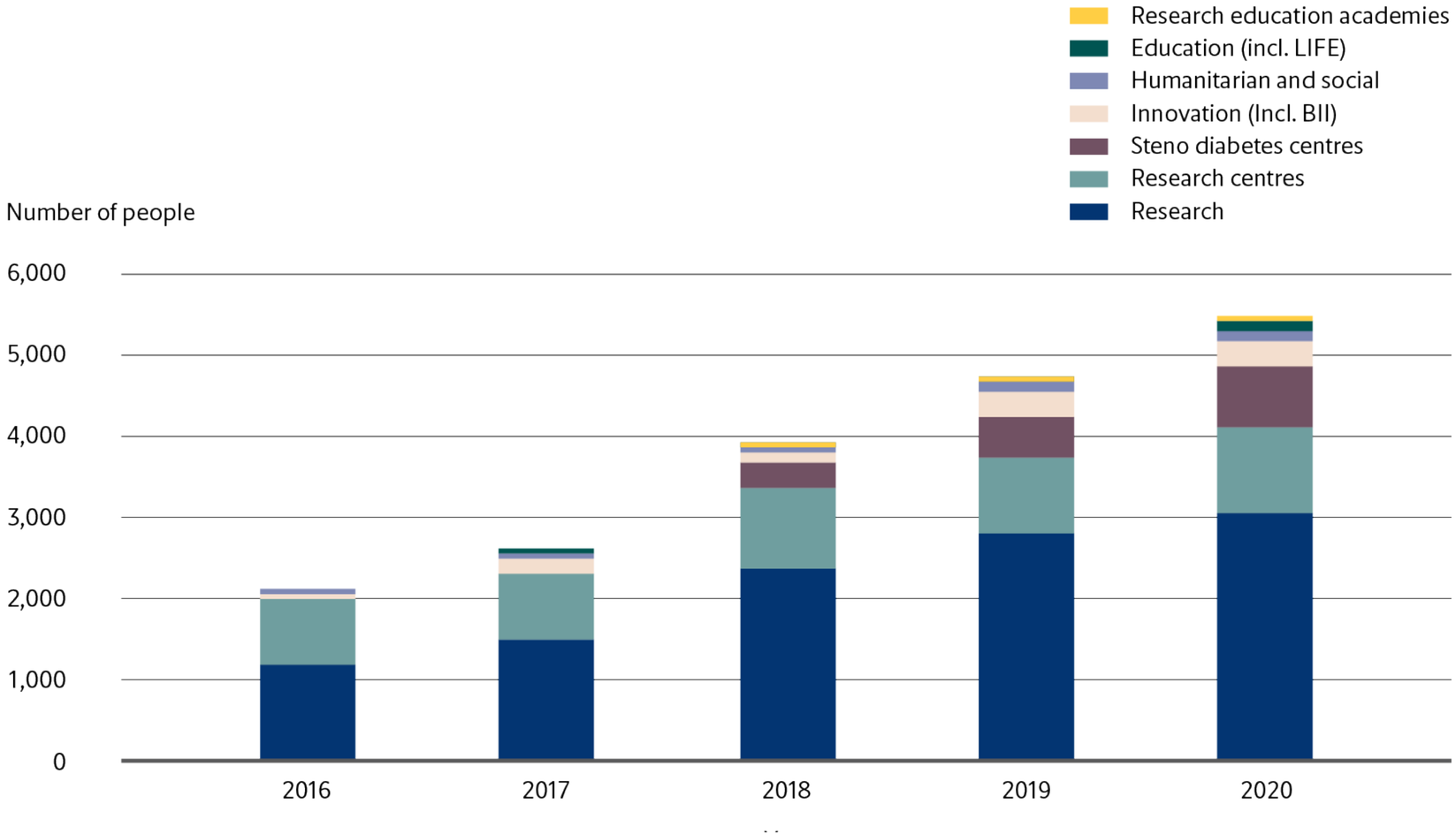
Investing in infrastructure

Supporting research collaboration

Promoting excellent research

novo nordisk fonden

5,500 jobs in Novo Nordisk Foundation funded grant activities in 2020



Fostering the development of research talent

Investing in infrastructure

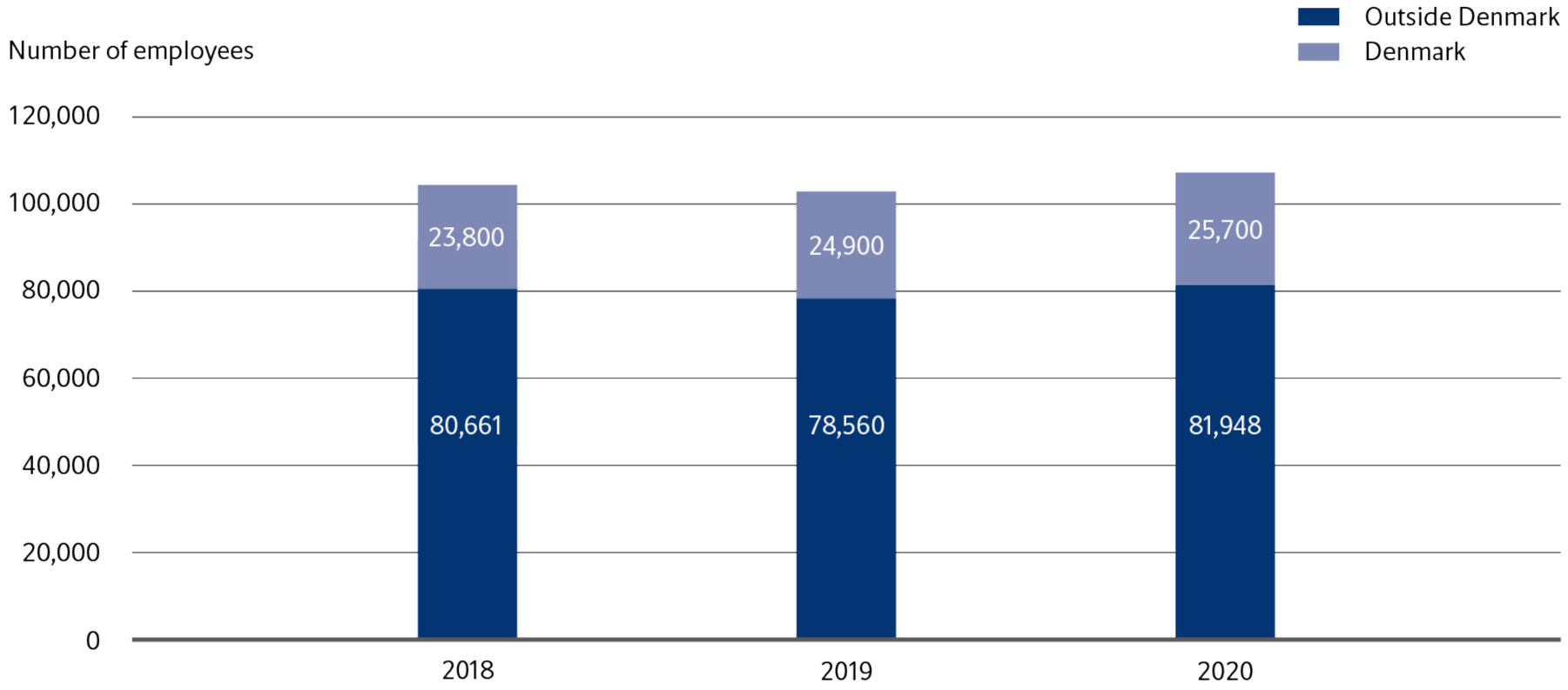
Supporting research collaboration

Promoting excellent research

Developing innovative products and solutions

Creating jobs and growth

Number of people employed in Danish based and foreign based companies controlled or invested in, 2018–2020



Fostering the development of research talent

Investing in infrastructure

Supporting research collaboration

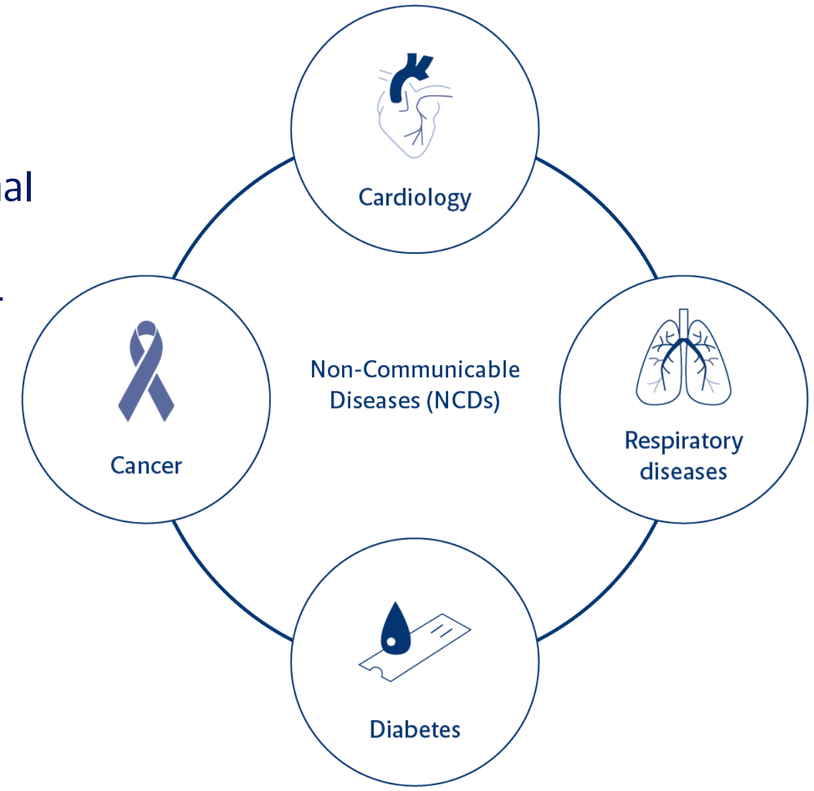
Promoting excellent research

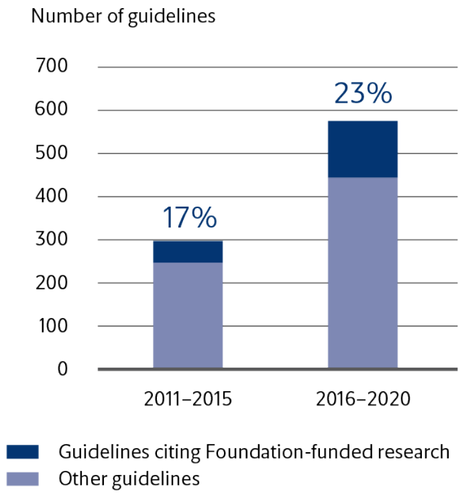
Developing innovative products and solutions

Creating jobs and growth

Foundation-funded journal articles contribute to the treatment of patients within the four Non-Communicable Diseases (NCDs)

21% of 870 national and international clinical guidelines and treatment recommendations cite Foundation-funded research (2011-2020)





Fostering the development of research talent

Investing in infrastructure

Supporting research collaboration

Promoting excellent research

Developing innovative products and solutions

Creating jobs and growth

Developing healthcare and new medicine

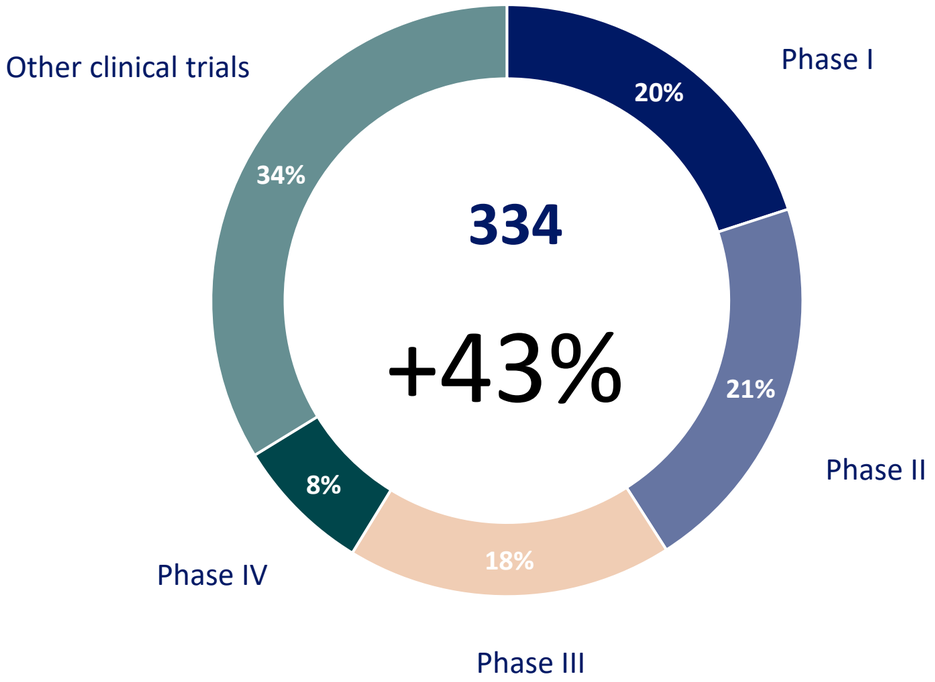
The Novo Nordisk Foundation Group contributed to translation of research to medicines through 334 clinical trials in 2020

162,000

People enrolled in clinical trials in 2020

+14%

Active clinical trials 2020



- **Fostering** the development of research talent
- **Investing** in infrastructure
- **Supporting** research collaboration
- **Promoting** excellent research
- **Developing** innovative products and solutions
- **Creating** jobs and growth
- **Developing** healthcare and new medicine

Number of people using the products from the Novo Nordisk Foundation Group in 2020

Users of
MedTech products

40
million people

Users of
medicine

32.8
million people

+9%

- **Fostering** the development of research talent
- **Investing** in infrastructure
- **Supporting** research collaboration
- **Promoting** excellent research
- **Developing** innovative products and solutions
- **Creating** jobs and growth
- **Developing** healthcare and new medicine
- **Developing** world-class education
- **Empowering** vulnerable groups in society

Example: CO_2 Research Centre for Climate Change Mitigation

LOGICAL IMPACT MODEL: Chain of Critical Success Factors from inputs to impacts that link the grants, step-by-step, to the long-term objectives of our strategy

Inputs: We facilitate basic research and applied research within four **key themes** of our strategy

- **CO_2 CAPTURE**
- **CHEMICAL CO_2 CONVERSIONS**
- **LIFE SCIENCES CO_2 CONVERSIONS**
- **MODELLING**

The **activities** that our grant recipients carry out

Creating research such as,

- integrated microbial electrosynthesis & H2, CO, CO2 fermentations,
- integrated transition-metal catalysis
- amine- and carbonic anhydrase-based CO2 capture,
- homogeneous and

via an interdisciplinary hub and industry.

and the **outputs** that they generate

- Creating and disseminating knowledge and outreach
- Delivering research-based education
- Conducting pilot scaling projects with industry

to achieve the desired **outcomes**

- Discovering innovative technologies for carbon capture, sequestration and utilisation
- Translating knowledge and new solutions into practice in industry
- Translating knowledge into policy and educate the general public

to create the **impact** that we ultimately seek, which is to

- Ground-breaking, interdisciplinary research to generate and advance new science and sustainable solutions for big climate challenges.
- Deliver and use innovative solutions for CO2 capture and conversion for biological and chemical transformation of industrial relevance

and fulfil our **long-term objective**

Mitigate and decelerate the rate of global climate change through reducing emissions and increasing capture of greenhouse gas.

Thank you!