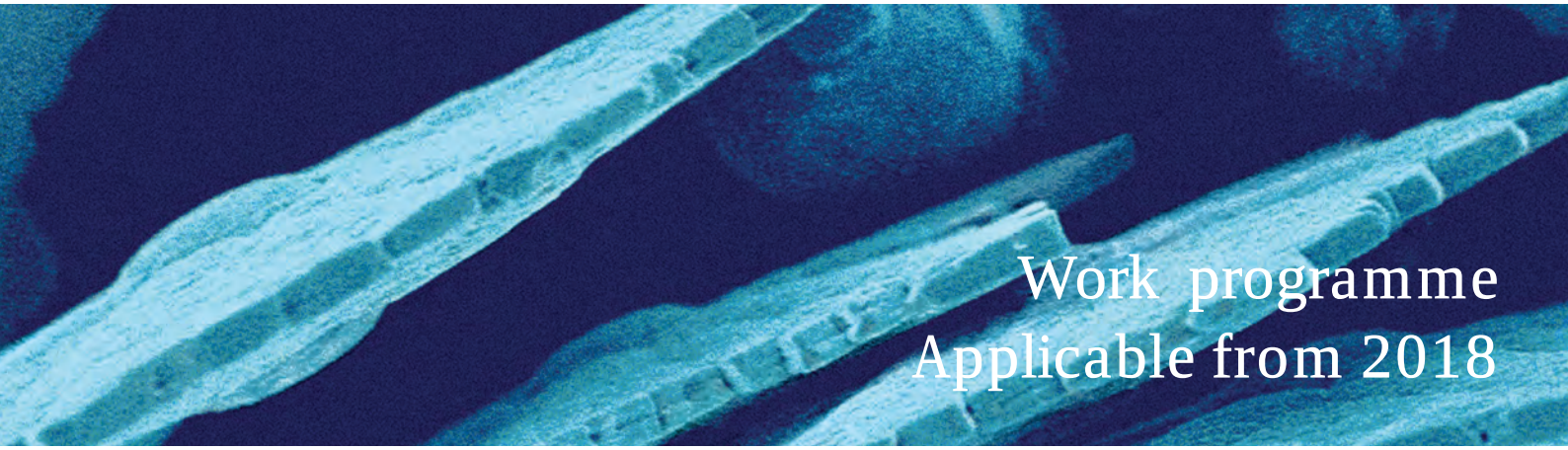
The Research Council of Norway



Work programme Applicable from 2018

Large-scale programme

Nanotechnology, Microtechnology and Advanced Materials – NANO2021

Large-scale Programmes

The RCN initiative to meet national research priorities

The Research Council of Norway

Work programme
Applicable from 2018

Nanotechnology, Microtechnology and Advanced Materials (NANO2021)

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Contents

1 Summary

This revised work programme is a result of the experience and results drawn primarily from the period 2012–2017 and the implementation of the Research Council of Norway's new model and guidelines for research programmes. In keeping with the new guidelines, the NANO2021 programme has become an open-ended activity with no set concluding date. The programme plans to issue annual calls for proposals based on the scientific and strategic priorities and priorities for structuring the research effort set out in the work programme. The Research Council's main strategy *Research for Innovation and Sustainability* points to the need to expand Norway's innovation capacity in the private and public sectors, and to find new, more sustainable solutions for society. The NANO2021 programme is designed to help to fulfil this main strategy. Another part of the programme's underlying framework is the *Strategy for the Research Council of Norway for an innovative business sector 2016–2020*. The programme will contribute to achieve the innovation strategy's objectives by investing in research with a positive effect on societal development, and by enabling companies to take advantage of the opportunities inherent in addressing societal challenges. The programme will also fund high-quality research at educational and research institutions that is targeted in the long term towards the application of research results and thus enhanced innovation and value creation in society.

2 Background and challenges

Definition of the technology area

The NANO2021 programme encompasses research and innovation based on nanotechnology, microtechnology and advanced materials. Nanotechnology involves the design, characterisation, production and application of materials, structures, units and systems whose nanoscale dimensions, typically 1–100 nanometres, are critical, and whose shape and size are typically controlled at the nanoscale. Advanced materials are materials that have special properties, such as electrical, mechanical, photovoltaic, magnetic, thermal or optical properties. There is no exact distinction between advanced materials and more conventional materials, but advanced materials have special properties that can be utilised for applications in e.g. data technology, production of renewable energy, sensor technology and medical technology. Structural materials are not considered advanced materials in this context.

The NANO2021 programme in the period 2012–2017

In 2012 the Norwegian Government launched a national R&D strategy for nanotechnology for 2012–2021[1]. The objective of the strategy is to promote the responsible development of nanotechnology that can contribute significantly to Norwegian industrial and commercial development and that will be of relevance and benefit to society. R&D effort in nanotechnology aims to enhance the competitiveness of Norwegian trade and industry and the capacity to deal effectively with global societal challenges, primarily in the areas of energy and the environment, the oceans, food and health, without generating undesirable impacts for human health, the environment and society at large.

Since 2012 the Research Council has employed targeted efforts through the NANO2021 programme to follow up the national strategy for nanotechnology. In 2016, allocations from the NANO2021

[1] *Regjeringens FoU-strategi for nanoteknologi 2012-2021* [National R&D strategy for nanotechnology 2012–2017]

programme constituted roughly 30 per cent of the Research Council's total investment in this area of technology. Programme activities comprise a focused, strategic effort to enable Norwegian research and innovation actors to stay at the forefront of international developments in nanotechnology. Programme activities are designed to complement the Research Council's other activities in this technology area.

In 2017 a mid-term evaluation of the NANO2021 programme[2] concluded that the programme has made good use of its available instruments and is on the right track to achieving the objectives and ambitions set out in the work programme. Programme activities targeting and implementing Responsible Research and Innovation (RRI) were highlighted as particularly interesting and successful, and seen as a potential case of best practice for other funding bodies internationally. The evaluation also included concrete recommendations for adaptation of the work programme, for example to consider removing the boundaries between the thematic priority areas and distinguishing more clearly between RRI as a thematic area for research and RRI as an integral part of research practice. It was also recommended to continue involving industry and to explore new measures for increasing the involvement of major companies in programme activities.

Innovation Projects for the Industrial Sector, where the project owners are private-sector companies/organisations, comprised one-fourth of the programme's project portfolio in 2017. In addition, companies are involved as partners or in other ways in a significant proportion of other projects in the portfolio. Norwegian trade and industry is increasingly able to translate interdisciplinary knowledge of materials and structures at the micro- and nano-levels into competitive advantages and industrial applications. Despite an increase in the number of companies directly seeking programme funding or otherwise involved in grant applications and projects since the launch of the programme, it is still challenging to encourage participation from a broader segment of Norway's private sector, and major companies in particular.

Competition for funding for Researcher Projects has been especially fierce. As a result, the scientific quality of the funded proposals is very high. The dominant research institutions as of 2017 are the large actors in the higher education and research institute sectors, several of which have their own strategies, research priorities and educational programmes in nanotechnology, microtechnology and advanced materials. At the same time, statistics show that far more R&D actors are now active and establishing competency of relevance to this technology area than was the case a few years ago. National research activities in the field have historically been centred around the disciplines of physics, chemistry, materials science and microtechnology. In recent years, significant nano-related research activities have emerged in biotechnology, medicine, the ethical, legal and social aspects of technology development (ELSA) and challenges related to health, safety and (the indoor and external) environment (HSE). Digitalisation has played and will increasingly play an important role in the development of this technology area. Among other things, access to new digital tools is opening opportunities for much more advanced modelling of materials' properties. Many Norwegian research groups are at the forefront of the European competitive arena, particularly with regard to applications targeting renewable energy. The programme has also helped to increase research capacity. During 2016 nearly 100 research fellows were involved in various projects funded under the programme.

Significant national investments have been made in the period from 2012 to 2017 in scientific infrastructure such as clean rooms and equipment for fabrication and characterisation. The technology area will have continuous needs for upgrades and new investment in scientific

[2] Evaluation of the RCN's NANO2021 programme (Technopolis group, 2017)

infrastructure in order for Norwegian research groups to keep pace with the research front and contribute to R&D-based innovation. The NANO2021 programme has a responsibility to help to allocate funding to research that productively utilises these national investments. Starting in 2018 the NANO2021 programme is taking over parts of the basic research Programme on Synchrotron and Neutron Research (SYNKNØYT). The NANO2021 programme will thus help to expand the expertise and capacity needed for Norwegian research groups and companies to take full advantage of Norway's membership of the European Synchrotron Radiation Facility (ESRF), including the Swiss-Norwegian Beam Lines (SNBL) and the European Spallation Source (ESS).

Key challenges for the programme ahead
International knowledge development in this technology area is advancing rapidly, and it is essential for Norway to keep pace with the international research front. A strong R&D sector is vital in an area where the research carried out by and for the business sector often lies in the interface between basic and applied research. Norwegian companies need dynamic research groups with appropriate research infrastructure, as well as access to new personnel with sound, up-to-date knowledge about nanotechnology, microtechnology and advanced materials.

The development pathway from research results to technology and applications is typically lengthy, and a span of 10–15 years is not unusual. Nationally and especially internationally there are a growing number of products about to reach the market; for instance, cancer treatment medications based on results from nanomedical research have recently received international approval. The number of "nano-products" and "nano-companies" is expected to rise in the years to come, but nanotechnology will continue to serve as an enabling technology integrated into products and processes, where it is not visible as a "nanotechnology industry" per se. Increased use and commercialisation of nanotechnology, microtechnology and advanced materials must be accompanied by research related to risk assessment, life cycles, toxicity and ecotoxicity, which are also important parts of the knowledge base for future regulation.

The NANO2021 programme's challenge lies in creating adequate balance in the funding to various areas and sectors. The investments are to result in desired impacts and long-term effects for addressing major societal challenges, as well as to promote sustainable innovation and value creation.

3 Objectives for the programme

3.1 Primary objective

The programme seeks to develop outstanding knowledge and sustainable solutions and innovations based on nanotechnology, microtechnology and advanced materials to meet the needs of society at large.

3.2 Secondary objectives

1. The programme will enhance innovation and national value creation based on the application of nanotechnology, microtechnology and advanced materials.
2. The programme will work to enable Norwegian R&D groups to achieve a position in the international forefront, and will promote high quality in addition to scientific development and renewal.
3. The programme will promote responsible research and innovation in this technology field.

4. The programme will work to increase the attractiveness of Norwegian research groups to encourage national and international companies to establish R&D activities in Norway.
5. The programme is responsible for monitoring and facilitating the use of Norway's membership of the European Synchrotron Radiation Facility (ESRF), including the Swiss Norwegian Beam Lines (SNBL) and the European Spallation Source (ESS), and works in general to promote optimal use of national infrastructure and expertise.

Secondary objectives 1–5 are designed to support the achievement of the programme's primary objective. All the secondary objectives apply to nanotechnology, microtechnology and advanced materials, but exceptions to the scientific delimitations will be allowed for secondary objective 5.

4 Thematic and scientific priority areas

Thematic priority areas

The programme seeks to enhance knowledge and technology development to address societal challenges, primarily in the areas of renewable energy, reduce negative impact on the environment and climate and improve health and medical technology. The programme also works to increase value creation and innovation based on Norwegian natural resources, and to expand insight into the impacts of nanomaterials on human health and ecosystems.

The thematic priority areas of the NANO2021 programme entail an interface with various other Research Council activities. The programme will give priority to projects where the application of nanotechnology, microtechnology and/or advanced materials will have a significant enabling effect on the research to be performed.

Scientific priorities

Researcher Projects for future applications

The NANO2021 programme will give priority to expanding scientific expertise in high-quality R&D environments that are of clear relevance for future applications and innovations. The programme will give priority to research-initiated projects at Technology Readiness Level (TRL) 2 and higher[3]. TRLs are indicators of the maturity level of particular technologies, from basic principles observed (TRL 1) to technologies that are commercially available and in use (TRL 9).

Research for innovation and value creation

The NANO2021 programme is part of the set of instruments that the Research Council offers to the business sector. The programme focuses on promoting research-based innovation and value creation for projects with a strong technology foundation in nanotechnology, microtechnology and advanced materials. The programme will work to build the expertise and capacity that Norwegian industry needs to fully exploit the enabling potential that this technology area represents for achieving increased innovation and value creation. The programme will primarily provide funding for projects up to and including TRL 5. A technology at TRL 5 has been verified and documented under relevant conditions/surroundings.

Responsible Research and Innovation (RRI)

Responsible Research and Innovation (RRI) is a scientific priority under the NANO2021 programme. A distinction is made between RRI as a *thematic area for research* and RRI as an *integral part of research practice*. RRI as a thematic area for research entails the thematic prioritisation of research that expands insight into the impacts of nanomaterials on human health and ecosystems. RRI as an

[3] TRLs are defined in the Horizon 2020 - Work programme 2018–2020.

integral part of research practice involves ensuring that the project focuses not only on yielding positive and desirable effects and impacts to the benefit of society, but also on potential problematic and/or unintended impacts and risks in both the short and the long term. Thus, the programme seeks to further develop the concept of RRI as an integral part of research practice through concrete guidelines in connection with various funding announcements. It is important to develop assessment criteria as well as the competency to assess RRI perspectives. Applicants for funding under the NANO2021 programme are expected to provide a description of the ramifications of future scaling-up of production. Applicants must also provide an assessment of whether this may entail any potentially undesirable impacts on human health, the environment and society at large. Other relevant research questions to be addressed relate to health, safety and environment (HSE) and/or ethical, legal and social aspects (ELSA) of the research or other RRI perspectives. Projects under the NANO2021 programme should preferably involve actors with particular expertise related to RRI, when relevant. Four key elements of risk assessment are:

- risks associated with the extraction/production of or limited access to raw materials;
- risks during the research, scaling-up and/or production phases;
- risks during the user phase;
- risks during the demolition/recycling phase.

The programme has a target of allocating 15 per cent of its R&D budget to RRI activities.

Synchrotron and neutron research
Starting in 2018 the NANO21 programme has taken over some responsibilities previously addressed under the basic research Programme on Synchrotron and Neutron Research (SYNKNØYT). The NANO2021 programme will help to build the expertise and capacity needed to enable Norwegian research groups and companies to take full advantage of Norway's membership of the ESRF, including the SNBL and ESS. This entails, among other things, development of advanced methodology expertise that is relevant for photon and neutron scattering. The NANO2021 programme will ensure that the annual project portfolio includes activities for building relevant expertise and capacity related to these infrastructures commensurate with the budget transferred from the SYNKNØYT programme. Within this earmarked budget, the requirements regarding relevance to thematic priority areas and TRLs may be adjusted.

5 Priorities for structuring the research effort

Researcher Projects and Innovation Projects for the Industrial Sector are the key application types that the NANO2021 programme will use to achieve its objectives. Other application types will also be used as needed to achieve specific programme goals.

The programme will largely fund doctoral and post-doctoral fellowships through the projects in its portfolio. Research fellowships increase national expertise and capacity at research institutions and provide an important source of recruitment for trade and industry. Nanotechnology paves the way for greater Norwegian competitiveness through restructuring and renewal of existing industry and through industrial development in new areas still on the horizon.

The programme seeks to achieve a gender balance in R&D projects of at least 40/60 (measured as proportion of female and male project managers). As long as this target remains unmet, the programme will attach importance to measures to increase participation of the underrepresented gender.

When funding projects initiated by the R&D groups, the NANO2021 programme will stress the importance of establishing a dialogue at an early stage with future users or other parties interested in the research results. These include companies that produce or sell products based on nanotechnology, microtechnology and advanced materials, or consumers and users of these technologies and products. Such dialogue and contact also promotes RRI as an integral part of research practice and can be organised in a variety of ways, for example by establishing advisory groups with participation from users and the business sector, creating customised meeting places, publication and dissemination of results via suitable channels, and more. For Innovation Projects for the Industrial Sector, whose applicants come from the business sector, it will be important for the applicant company to cooperate with other actors in the Norwegian business or public sectors and/or one or more national R&D environments.

In keeping with the Research Council's strategy on increased commercialisation from research and Researcher Projects, up to five per cent of the programme's annual budget for Researcher Projects will be set aside as support for commercialisation activities.

Internationalisation

The NANO2021 programme will provide funding for Personal Overseas Research Grants and Personal Visiting Researcher Grants within projects receiving ongoing funding. In addition, the programme will create a framework to enable Norwegian R&D stakeholders and companies to build up the expertise and capacity they need to successfully compete in relevant calls under the EU framework programmes. Participation in the European Research Areas Networks (ERA-NET) is a typically well-suited measure for helping Norwegian actors to build networks that lead to targeted internationalisation. The programme will consider announcing funding for targeted *incentive schemes* and/or *positioning activities* to increase the number of Norwegian applicants seeking relevant funding under the Horizon 2020 programmes FET[4] and NMBP[5]. The FET Open line of action (for thematically open technology projects) is expected to become part of the European Innovation Council (EIC) in the final phase of Horizon 2020 (2018–2020). These are interdisciplinary activities and ground-breaking R&D projects which are viewed as good role models for innovation under Horizon 2020. Several planned calls under the FET Proactive line of action also appear to be highly relevant for NANO2021 programme activities. The NMBP programme is introducing "Open Innovation Test Beds" in the 2019–2020 period to increase European industrialisation of e.g. nanotechnologies, advanced materials and biotechnology (NMB). The Test Beds are primarily aimed at helping small and medium-sized enterprises (SMEs) to commercialise their ideas in the area of NMB through pilot lines and a system for support relating to the statutory framework and financing. The NANO2021 programme will take steps to encourage Norwegian SMEs to utilise the Open Innovation Test Beds. Other internationalisation measures through e.g. bilateral cooperation with priority partner countries will be considered on an ongoing basis.

Social dialogue and meeting places

Responsibility for dissemination of research results is primarily delegated to those carrying out the research. The programme will have open-ended calls for support for events and network establishment to enable actors to design targeted meeting places. The programme and the Research Council will facilitate or organise measures for social dialogue and meeting places related to this technology area as needed, but preferably with a focus that extends beyond the scope of the programme.

[4] FET- Future and Emerging Technologies

[5] NMBP - Nanotechnologies, Advanced materials, Biotechnology and Advanced Manufacturing and Processing.

6 Cooperation with related instruments

Nanotechnology, microtechnology and advanced materials have applications in many areas, and the NANO2021 programme has stipulated certain thematic priority areas for its focus area. The programme shares interfaces with many other Research Council programmes that focus e.g. on an industrial sector (such as the Large-Scale Programme for Energy Research (ENERGIX), the Large-scale Programme for Petroleum Research (PETROMAKS 2) and the Research Programme on Sustainable Innovation in Food and Bio-based Industries (BIONÆR)), a specific sector of society (the health-related programmes) or more generalised basic research, innovation and commercialisation (the funding scheme for independent projects (FRIPRO), the Programme on User-driven Research-based Innovation (BIA) and the Programme on Commercialising R&D Results (FORNY2020)). Furthermore, advances in technology areas do not usually occur in isolation but rather through interdisciplinary cooperation, such as collaboration between the fields of nanotechnology, biotechnology and ICT. Thus, the programme will participate in constructive collaborative efforts within the Research Council based on concrete aims that help to achieve the primary and secondary objectives set out in this work programme.

Cooperation with other public agencies in the research and innovation system will be addressed primarily through other Research Council activities.

7 Anticipated results, impacts and societal outcomes

The NANO2021 programme will seek to create a research portfolio that incorporates its current thematic priority areas and scientific fields. The aim is not necessarily to fund an equal number of projects for each area, but rather to ensure that the programme funds relevant activities that as a whole will achieve the work programme objectives. This will be followed up through regular analyses of the project portfolio.

The different application types are targeted towards different secondary objectives. The number of grant applications, percentage of applications granted funding and quality of grant applications under the various calls are indicators showing how the research community and business sector are developing in the thematic priority areas and scientific fields as well as how relevant the programme's callsare for applicants from different sectors.

To facilitate achievement of the work programme objectives, indicators have been developed to assist in analysing whether input factors used in the programme can be expected to yield the desired effects and impacts in the shorter and longer term. Figure 1 is a diagram showing the connections between the primary objective, secondary objectives, thematic priority areas and priorities for structuring the research effort and the anticipated results, effects and societal outcomes (programme logic model). Access to adequate resources via the annual budgets will be critical for the programme's potential to achieve its desired results, impacts and societal outcomes.

Primary objective	Secondary objectives	Activities	Indicators	Impacts	Societal outcomes
Develop outstanding knowledge and sustainable solutions and innovations based on nanotechnology, microtechnology and advanced materials to meet the needs of society at large.	Enhance innovation and national value creation based on the application of nanotechnology, microtechnology and/or advanced materials.	Annual calls for Innovation Projects for the Industrial Sector. Calls forPre- Projects for SMEs. Progress reports and Innovation Project follow-up. Follow up companies after Innovation Project completion. Innovation Project calls for proposals that actively encourage cooperation w/major companies. Calls for proof-of-concept funding. Follow up established spin-off companies.	Higher-quality grant applications for Innovation Project calls. Increased involvement of major companies. Innovations in the projects. Enhanced value creation. Entrepreneurship.	Wider application of nanotechnology, microtechnology and advanced materials as enabling technology in industry. Major companies contribute to greater resilience in development and market introduction. Higher-quality applications for Innovation Projects from SMEs. Increased entrepreneurship.	Enhanced value creation and innovation in Norway. The segment of industry using nanotechnology, microtechnology and advanced materials is broader, and activities are of higher quality. Positive benefits for society from research and innovation on societal challenges related to renewable energy, reduced negative effects on environment and climate, improved health and medical technology, better utilisation of national raw materials.
	Increase the attractiveness of Norwegian research groups to encourage national and international companies to establish R&D activities in Norway.	Actively encourage this in calls for Innovation Projects. Fund Researcher Projects w/companies. Fund research fellows. Participate in ERA-NET calls.	National R&D groups are attractive to Norwegian companies. National R&D groups are attractive to companies outside Norway.		
	Enable selected Norwegian R&D groups to achieve a position in the international forefront, and promote high quality in addition to scientific development and renewal.	Annuals calls for Researcher Projects. Progress reports and Researcher Project follow-up. Portfolio analyses.	Selected R&D groups achieve a position in the international forefront. High quality in research. International visibility. Scientific development and renewal. Expanded scientific capacity. Internationalisation of NANO2021 programme's research activities.	Higher quality and relevance in Norwegian R&D activities and increased scientific renewal. Helps to achieve 2% return share from Horizon 2020 funding. Relevant competency in industry. Wider participation in SFI/SFF/FME[6] centre. National R&D groups attractive to companies outside Norway. Higher quality and international ranking of Norwegian R&D. Researcher training school established. Increased national/international cooperation.	
	Promote responsible research and innovation in this technology field.	RRI as an integral part of research practice; RRI as a thematic area for research: • Requirements in calls; • Follow up RRI; • Create surveys for results/indicators. Train applicants and experts.	RRI is well integrated in the project portfolio. Better understanding and implementation of RRI as an integral part of research practice.	RRI is integrated into all projects under the programme (target is 15% of R&D budget allocated to RRI activities). Gender balance (40/60) in portfolio.	RRI – integrated into value chains. Helped to achieve a socially responsible regulatory regime for use of nanotechnology and nanomaterials and in general for technology development in relevant areas.
	Monitor and facilitate the use of Norway's membership of the ESRF/SNBL and the ESS, and promote optimal use of national infrastructure and expertise.	Targeted calls for synchrotron and neutron research. Progress reports, project follow-up and portfolio analysis. Guidelines for using national infrastructure.	Degree of utilisation of ESFR/SNBL. Competence-building in neutron scattering. Development of methodology: • synchrotron • neutron	National infrastructure – utilised for the best Norwegian research. Enhanced competency base for R&D groups to utilise ESS. NANO2021 contributes to research that uses national infrastructure.	Norwegian research groups are well positioned to utilise the ESS and continue utilising ESRF at the highest level.

Figure 1: The NANO2021 programme logic model.

[6] Centres for Research-based Innovation scheme (SFI), Centres of Excellence scheme (SFF) and Centres for Environment-friendly Energy Research scheme (FME)

Indicators:

Secondary objective 1 Enhance innovation and national value creation.

Indicator	**Knowledge base for the indicator**
Higher-quality grant applications for Innovation Projects for the Industrial Sector	Analysis of development of Innovation Project applications over a time span: number of applications, quality, percentage granted funding, micro-/SMEs/major companies.
Innovations	Reporting from Innovation Projects: number of products, processes, prototypes, patents, licenses etc.
Increased value creation	Economic returns on investment measured in developments in turnover and number of company personnel (prioritises analysis for small/micro-companies) that conduct Innovation Projects – per period (from project start-up to completion to two years post-completion).
Increased involvement from major companies	Number of major companies as applicants/partners: Measure increase from 2017 level – Is increased involvement of major companies achieved?
Entrepreneurship	Number of patents. Number of new companies founded. Number of spin-off companies that attract venture capital and risk capital per company (within two years of project completion).

Secondary objective 2 Enable selected Norwegian R&D groups to achieve a position in the international forefront, and promote high quality and scientific development and renewal.

Indicator	**Knowledge base for the indicator**
Selected Norwegian R&D groups achieve a position in the international forefront	Share of publications at level 2. Number of Norwegian researchers nominated for or awarded internationally prestigious prizes, etc.
High quality of research International visibility	Number of scholarly publications with good citation frequency and published in high-ranking journals (vs levels 1 and 2)[7]. Number of groups/research groups in the portfolio participating in the SFI/SFF/FME centre schemes. Number of groups/research groups in the portfolio receiving EU funding (Horizon 2020, FET, NMBP, etc.). Number of Norwegian researchers in the portfolio invited to lecture at key international conferences.

[7] Norwegian Register for Scientific Journals, Series and Publishers

Scientific development and renewal	Analysis of scientific development in grant applications and project portfolio. Number of projects with links to R&D users/interested parties.
Build scientific capacity	Number of research fellows funded by the programme.
Internationalisation of programme's research activities	Share of projects with international cooperation. Share of publications with international partners. Number of mobility grants (Personal Overseas Research Grants and Personal Visiting Researcher Grants). Number of ERA-NET grant applications and number of projects awarded funding under these calls.

Secondary objective 3 Promote responsible research and innovation in this technology field.

Indicator	**Knowledge base for the indicator**
RRI is well integrated in the project portfolio	Total of 15 % of R&D budget is allocated for RRI activities. All research projects satisfy minimum requirements for RRI as an integral part of research practice. There is always a project portfolio of RRI as a thematic area for research within relevant topics.
Develop better understanding and implementation of RRI as an integral part of research practice	Develop questionnaire for projects for better analysis of results indicators of RRI as an integral part of research practice. Train applicants and experts in RRI.

Secondary objective 4 Increase the attractiveness of Norwegian research groups to encourage national and international companies to establish R&D activities in Norway.

Indicator	**Knowledge base for the indicator**
National R&D groups are attractive to Norwegian companies	Number of Innovation Projects cooperating with Norwegian R&D environments. Number of co-publications between R&D and companies. Number of new Innovation Project applications based on cooperation in previous research projects. Where are research fellows funded by the programme employed after completing their fellowship (after five years)?

National R&D groups are attractive to companies outside Norway	Number of non-Norwegian companies cooperating with Norwegian R&D groups. Number of ERA-NET projects where Norwegian R&D groups cooperate with international companies.

Secondary objective 5 Facilitate the use of Norway's membership of the ESRF, including the SNBL and the ESS, and promote optimal use of national infrastructure and expertise.

Indicator	**Knowledge base for the indicator**
Degree of utilisation of ESFR/SNBL	Statistics on beamtime at ESRF and SNBL, by Norwegian users and distribution by scientific field.
Competence-building – neutron scattering	Project portfolio covering scientific neutron scattering, number of research fellows and researchers.
Development of methodology • synchrotron • neutron	Portfolio analysis.
Funding of research that uses national infrastructure	Portfolio analysis.

8 Resources and budget

The NANO2021 programme is an open-ended programme without a set conclusion date. The goal is to achieve a programme that can realise its objectives by means of regular and predictable strategic, thematic and financial activity over a period of years.

Allocations to the programme's budget come from the Ministry of Education and Research (KD-SO item 92) and the Ministry of Trade, Industry and Fisheries.

Allocations to the programme in 2017 amounted to approximately NOK 130 million, of which approximately NOK 71 million was cross-sectoral funding from the Ministry of Education and Research and approximately NOK 59 million was from the Ministry of Trade, Industry and Fisheries. The programme will receive an increase in funding for 2018 as a result of a political initiative for enabling technologies, and the work programme is based on this budget.

Starting in 2018, allocations from the Ministry of Education and Research will increase by NOK 7.7 million as a result of the NANO2021 programme's taking over part of the SYNKNØYT programme.

9 Governance and organisation

The NANO2021 programme board is appointed by and reports to the Research Board of the Division for Innovation. The activities of the programme board must comply with the framework documents

approved by the Division Research Board, including the work programme, action plan, long-term budget and schedule for funding announcements. The programme board's activities must also be in compliance with the Research Council's overall principles and guidelines for the operation of research programmes. The programme board is authorised to take the final decision regarding grant allocations to individual projects.

The NANO2021 programme administration is responsible for carrying out the day-to-day tasks of the programme and consists of a team with complementary scientific and administrative expertise under the scientific leadership of a programme coordinator.

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