The Research Council of Norway

Evaluation of Mathematics, ICT and Technology 2023-2024

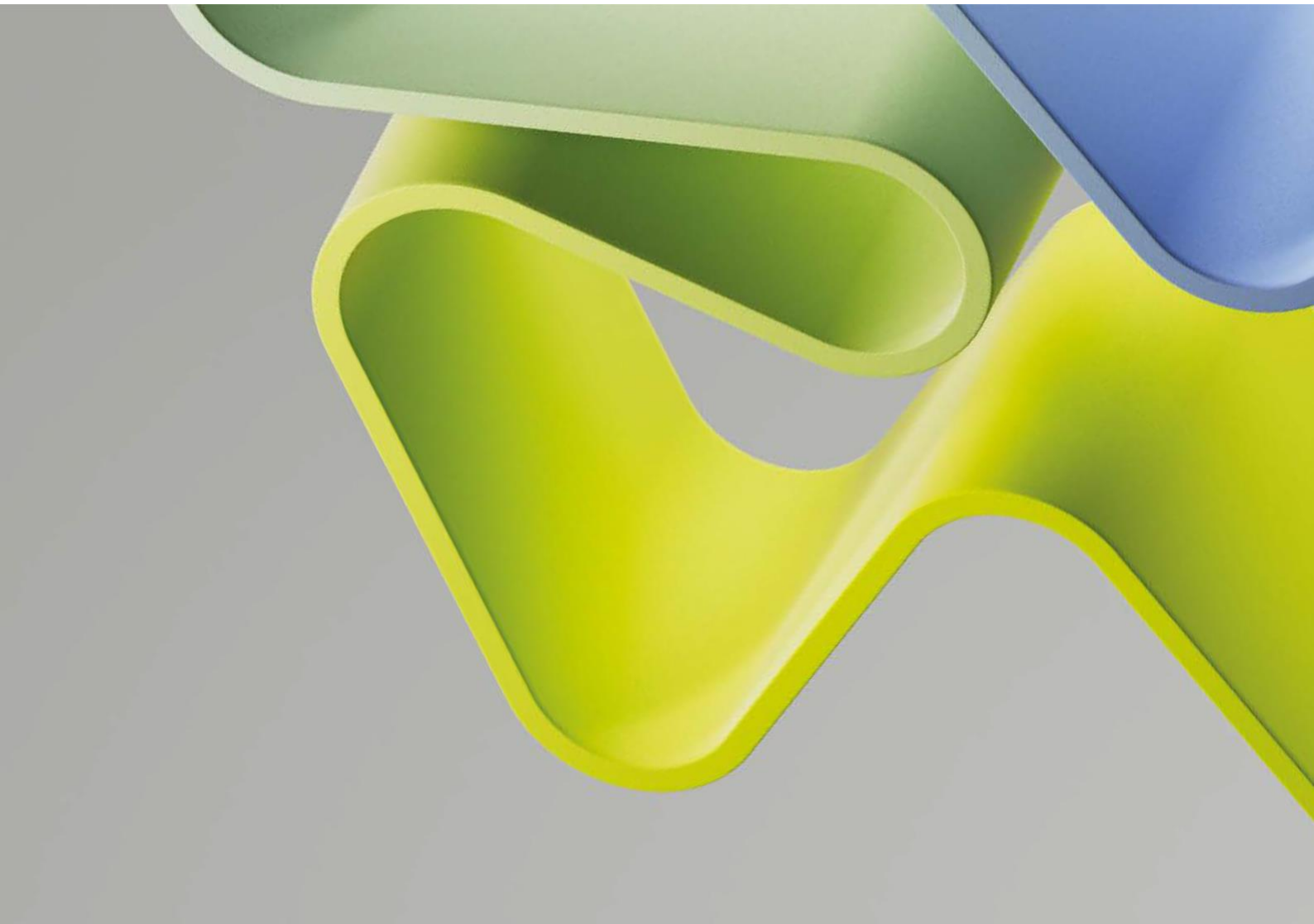
Evaluation Report for Administrative Unit

Administrative Unit: **SINTEF Ocean**

Institution: **SINTEF Ocean**

Evaluation Committee Institutes

December 2024



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Statement from Evaluation Committee Institutes

The members of this Evaluation Committee have evaluated the following administrative units at the research institutes within Mathematics, ICT and Technology 2023-2024 and has submitted a report for each administrative unit:

- NORCE Energy and Technology, NORCE Norwegian Research Center (NORCE)
- SINTEF Community, SINTEF Community
- SINTEF Digital, SINTEF Digital
- SINTEF Industry, SINTEF Industry
- SINTEF Energy, SINTEF Energy
- SINTEF Ocean, SINTEF Ocean
- SINTEF Manufacturing, SINTEF Manufacturing
- Norwegian Computing Center (NR), Norwegian Computing Center (NR)
- Energy and Energy Technology (ENET), Institute for Energy Technology (IFE)
- Simula Research Laboratory (SIMULA), Simula Research Laboratory (SIMULA)
- Human and organisational factors (HOF), Institute for Energy Technology (IFE)

The conclusions and recommendations in this report are based on information from the administrative units (self-assessment), digital meetings with representatives from the administrative units, bibliometric analysis and personnel statistics from the Nordic Institute for Studies of Innovation, Research, and Education (NIFU) and Statistics Norway (SSB), and selected data from the National survey for academic staff in Norwegian higher education and the National student survey (NOKUT). The digital interviews took place in the autumn 2024.

The members of the Evaluation Committee are in collective agreement with the assessments, conclusions and recommendations presented in this report. None of the committee members has declared any conflict of interest.

The Evaluation Committee consisted of the following members:

Professor Krikor Ozanyan (Chair),
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Professor Camilla Hollanti,
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Professor Deborah Greaves,
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Professor Angele Reinders,
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Description of the Administrative Unit

SINTEF Ocean is one of six applied research institutes within the SINTEF Group. SINTEF Ocean is organised as a limited company, and its owners are: The SINTEF Foundation (71.6%), The Norwegian Shipowners' Association (16.2 %), DNV (5.4 %) The Federation of Norwegian Industries (2.7%), The Norwegian Maritime Directorate (2.7 %), The Norwegian Fishermen's Association (0.8 %), and NHO Shipping (0.5 %). SINTEF Ocean is a not-for-profit organisation and does not distribute dividends to its owners. The resources generated by the research activities are exclusively used to fulfil the purposes of the institute. SINTEF Ocean is overseen by the institute management, CEO and board. SINTEF Ocean consists of five research departments led by a Research Director. Departments are split into several research groups, with up to 25 employees, each with a Research Manager and a diverse set of staff. As of 2022, they had 389 employees, of which 287 were research staff, 36 were engineers, 30 were technical staff and 36 were administrative support staff.

SINTEF Ocean consists of five departments: Energy and Transport, Fisheries and New Biomarine Industry, Aquaculture, Climate and Environment and Ships and Ocean Structures. Each of these departments contains between four and six Research Groups. The administrative unit has put forward nine research groups for evaluation under EVALMIT.

SINTEF Ocean state that their main aim is to maintain Norway's leading position in marine technology and biomarine research, by working together with industrial and public institutions to develop forward-thinking solutions for the sustainable use of ocean resources. Their projects range from basic to applied research, with a balanced portfolio of contract and collaborative research. SINTEF Ocean has defined eight prioritised research areas, in which through which they aim to further the market potential and/or scientific competence in said area for the whole institute. A significant portion of their basic funding is allocated to common corporate initiatives and priority research areas.

SINTEF Ocean are partners with industry, other research institutes and academia. They work closely with NTNU and share infrastructure facilities to support mutually beneficial research and teaching. They are also actively engaged in centre schemes financed by the RCN, including the Centre for Research-Driven Innovation, Centre for Environmentally Friendly Energy and Centre of Excellence. They are also participants in the EU's research and innovation programs, enabling them to be central in shaping policy and research direction. They have also entered into several consortia and formal cooperation agreements with industrial partners. SINTEF Ocean hosts a wide range of infrastructure that are used by research scientists and clients. These include several marine, biomarine and environmental technology laboratories, as well as large hydrodynamic laboratories.

In addition, they are working to plan, develop and build the Norwegian Ocean Technology Centre which will become one of the world's most advanced facilities for research and education within the field of marine technology, and provide NTNU and SINTEF with access to world-class facilities and premises. The centre will contribute to the development and restructuring of the ocean-based industries locally, nationally, and globally, and to the green shift taking place in ocean-based industries and secure Norway's position as a leading maritime nation.

In their self-assessment form, SINTEF Ocean identify a number of internal strengths to better position themselves in the future. These include their broad competency, strong ties to industry, increasing successful EU finding schemes, perception as an attractive employer and strong media profile. They also highlight the upcoming Norwegian Ocean Technology Centre in collaboration with NTNU, although point out challenges in being part of such a large construction project whilst also running other laboratories and maintaining normal

operations. As for external opportunities, they mention the growing demand for sustainable maritime and energy solutions, and Norway's presence as a leading ocean nation. SINTEF Ocean also highlight increasing pressure on research funding, and low basic funding for institutes such as themselves. They also point out their market prospects being exposed to geopolitical factors, polarisation, supply chain shocks, energy crises and inflation.

Overall Assessment

There is a growing demand for research in the SINTEF Ocean arena. The Norwegian coastline is one of the longest in the world, and the petroleum, seafood and maritime industries account for nearly 70 % of Norwegian export earnings. The SINTEF group have a good high level strategy focusing on decarbonisation and green shift. This strategy is followed by the administrative unit, and the SINTEF Ocean management also have a function to develop a local strategy and actively steer the research groups.

There is potential for growth in decarbonisation of maritime transport, offshore wind, hydrogen and carbon capture and storage. There is also potential environmental work in genetics research and implications for food security.

There are international collaborations with Canada, Australia and Singapore, and the potential to grow further networks and collaboration in the EU. SINTEF Ocean engages with Horizon Europe funding calls and networking.

There is also good potential to grow research and industry collaboration through the Norwegian Ocean Technology Centre development in collaboration with NTNU. University collaboration will also potentially unlock growth in research staff and competency through staff exchanges and joint supervision of PhDs and Masters students.

Strengths of the unit include:

- Broad competency and expertise in marine and maritime research, with opportunity for collaborative and innovative research as part of the wider SINTEF group.
- SINTEF Ocean hosts or has access to advanced laboratories, testing facilities, and equipment, including the new Norwegian Ocean Technology Centre under construction, that enhances research capabilities and competitive advantage.
- SINTEF Ocean has strong ties with industries and businesses and cooperates well with NTNU and other research partners.
- SINTEF Ocean is increasingly successful in the EU funding schemes, and several research groups/environments are internationally recognised and leading in their fields, which has been so for many years.
- SINTEF Ocean is part of the SINTEF group, which has a strong brand and a high media profile, both when it comes to specific news on the research front and contributions to the public debate on policy development.

Weaknesses identified in the review process include:

- Research infrastructure is cost-heavy, and parts of the infrastructure need renewal.
- The Norwegian Ocean Technology Centre is under construction and scheduled for completion in 2028-2029. This large construction project is demanding for SINTEF Ocean to manage, while also maintaining operations in the other laboratories.
- Energy transition is challenging, with much of the research and clients being in the oil and gas sector and requiring major changes to achieve sustainable development. Sustainability-related dilemmas are therefore high on SINTEF’s agenda, both in specific cases and in its role as a research institute in the transition.
- The increasing requirements for compliance and security in many areas increases the pressure on many roles in the organisation and can make recruitment challenging.

Clear opportunities exist for the unit:

- There is a growing demand for sustainable maritime and energy solutions, which presents opportunities for SINTEF Ocean to contribute to innovation and technological advancements in the sector nationally and internationally.
- Norway is a leading ocean nation; the coastline is one of the longest in the world, and the petroleum, seafood and maritime industries account for nearly 70 per cent of Norwegian export earnings. Norway continues to invest in research, innovation and technological development to support these industries, promising new areas and the sustainable use of the ocean. SINTEF Ocean has the opportunity to play a central role in this commitment, and benefit from national resources and strategies.
- With a strategic focus, SINTEF Ocean could take part in initiatives in the EU and other international networks concerned with sustainable oceans, aquaculture and fisheries, marine biodiversity, marine renewable energy, maritime spatial planning, ocean governance, etc.

The table below addresses each of the questions raised by the admin unit in the Terms of Reference (ToR) for the evaluation.

Table 1 Table 1 Evaluation Committee response to specific questions from the ToR

Specific request from the ToR	**Evaluation**
1. Relevance of research for ocean industries (maritime, aquaculture, offshore wind, oil & gas) (applicable to all research groups)	Comments and recommendations on research strategy are given in Section 1 and specific feedback on research groups is summarised in Section 2. The relevance of the research to industry is reflected in the grant success and collaboration partnerships, and should be monitored. The admin unit is not hitting their SINTEF target of 1 publication point per researcher. SINTEF Ocean therefore need to consider how they will effectively support and encourage their researchers to meet this target and implement practical tools for doing so. Academic publication is a valuable route for ensuring researchers maintain cutting edge expertise and have leading international reputations, which in turn will increase the research profile of the unit. The citation scores of the publications associate to SINTEF Ocean demonstrate that they are producing high-quality work.
2. Contribution and relevance of our research towards reduction of GHG emission from maritime transport (applicable to research group Maritime Energy systems, Ship Hydrodynamics and Marine CFD)	Comments and recommendations on research strategy are given in Section 1 and specific feedback on research groups is summarised in Section 2. Some of the areas of research are in established fields, and there is a danger that the activity is incremental in research with diminishing returns. For example, in the area of maritime transport, SINTEF research on better design of ship hulls and of propellors appears to be incremental.
3. Contribution and relevance of our research to enable offshore floating wind (applicable to research group Marine Structures, Structural engineering, Experimental Hydrodynamics, Marine Operations, Ship Hydrodynamics and Marine CFD)	Comments and recommendations on research strategy are given in Section 1 and specific feedback on research groups is summarised in Section 2. Within the energy area, the transfer of technology from oil and gas expertise to offshore wind and wave energy has scope and there is potential for transferrable research expertise and activities to be repurposed into this area.

4. Contribution and relevance of our research for more precision and control in fish farming (applicable to research group on Aquaculture Robotics and Automation)	Comments and recommendations on research strategy are given in Section 1 and specific feedback on research groups is summarised in Section 2. There appears to be major opportunities in food supply including seafood processing, with a need for more precision and control in fish farming.
5. International excellence in marine hydrodynamics and marine structures (applicable to research group Marine Structures, Structural engineering, Experimental Hydrodynamics, Ship Hydrodynamics, Marine Operations and Marine CFD)	Comments and recommendations on research strategy are given in Section 1 and specific feedback on research groups is summarised in Section 2. Some of the areas of research are in established fields, and there is a danger that the activity is incremental in research with diminishing returns. For example, in the area of maritime transport, SINTEF research on better design of ship hulls and of propellors appears to be incremental. Within the energy area, the transfer of technology from oil and gas expertise to offshore wind and wave energy has scope and there is potential for transferrable research expertise and activities to be repurposed into this area.

The Terms of Reference for the administrative unit is attached to the report.

Recommendations

1. Develop SINTEF Ocean specific strategy with quantified success metrics and progress monitoring.

2. A stronger role for the SINTEF Ocean management team to actively steer the research groups against the strategy and monitor progress. The admin unit needs to establish metrics in order to measure its effectiveness in steering the quality and quantity of its research groups.

3. Maintain Norway's leading position in marine technology and biomarine research by working with industry, universities and the authorities, developing future-oriented solutions for the sustainable utilisation of ocean space making use of new technologies and co-location with other activities such as offshore renewable energy.

4. Restructuring of the ocean sector for energy transition is underway – SINTEF Ocean should consider how the funding landscape will change and whether SINTEF Ocean is well-connected to prepare and support the sector.

5. Benchmarking of strategic goals against global leaders will facilitate meaningful self-evaluation.

6. There is a wide range of research group size within SINTEF Ocean. It is recommended that a strategy is identified for research group size and an impetus is given for small groups to enable them to grow on a short time scale.

7. The ratio of support staff to research staff is 0.36 to 1. It is important to keep the organisation lean in order to maintain a low overhead rate.

8. Research infrastructure is cost-heavy, and parts of the infrastructure need renewal, so cost structures or funded projects need to cover overheads.

9. Put in place a business model for facilities to allow for strategic investments in collaboration with partners to help cover the costs of renewal of research infrastructures

10. Ensure there is a clear strategy for facilities maintenance, use and development to ensure funding covers overheads

11. SINTEF Ocean should consider its positioning within national and international infrastructure roadmaps.

12. Clarity is needed in how international collaborations aid cash flow; many collaborations are described in terms of a Memorandum of Understanding.

13. Career advancement should not be overly reliant on the review by an immediate supervisor. SINTEF Ocean should actively encourage Masters levels researchers to gain a PhD.

14. Maintain and strengthen collaborations with universities in addition to the existing collaboration with NTNU.

15. Encourage internal mobility within SINTEF through participation in research projects led by other groups, by moving from one research group to another one within SINTEF Ocean or between SINTEF institutes.

16. Considerations of restructuring should be within the overall SINTEF context

17. Develop unified policy on open-source access and development of software.

18. Maintain goals for number of peer-reviewed papers per Scientist per year.

19. Data ownership should be stated in all contracts: this avoids problems in the future over IP.

1. Strategy, Resources, and Organisation of Research

SINTEF is an independent, not-for-profit research foundation. It is the largest research foundation in Norway and one of the largest in Europe, with multidisciplinary expertise within technology, natural sciences and social sciences. SINTEF's vision is "Technology for a better society", and the UN's Sustainability Goals guide activities and corporate strategy. SINTEF carries out research and innovation projects for, and with, industry in Norway and abroad, with an emphasis on applied research. Given that SINTEF is an independent not-for-profit foundation, all surplus funds are reinvested into research and infrastructure.

SINTEF Ocean is one of the six research institutes or Administrative Units (AU) within SINTEF. The organisation of research within SINTEF Ocean facilitates compliance to corporate policies, as well as career development of staff and education, e.g. recruitment of students and continuing education of staff. SINTEF's strategy is structured with SINTEF's strategic objectives, common corporate initiatives and priority research areas.

SINTEF Ocean works on research and innovation in the ocean space for both national and international industry. SINTEF Ocean has defined eight priority research areas: sustainable feed, digital ocean, fisheries, aquaculture, renewable energy, sustainable ocean, coastal infrastructure and maritime transport. These are areas where SINTEF Ocean considers it is, or can become, world-leading, based on market potential, scientific competence and the competitive situation.

1.1 Research Strategy

SINTEF is an independent foundation with an emphasis on applied research. SINTEF Ocean is organised as a limited company, whose owners are the SINTEF Foundation (71,6 %), the Norwegian Shipowners Association (16,3 %), DNV GL (5,4 %), the Federation of Norwegian Industries (2,7 %), Norwegian Maritime Authority (2,7 %), the Norwegian Fishermen's Association (0,8 %) and the Federation of Norwegian Coastal Shipping (0,5%).

SINTEF Ocean is organised into five departments dedicated to pivotal areas within marine and maritime sciences, that are named "Aquaculture", "Climate and Environment", "Energy and Transport", "Fisheries and New Biomarine Industries" and "Ships and Ocean Structures". Each department consists of several specialised research groups, that both

operate within their respective domains and market areas and collaborate across disciplines to address complex challenges and common goals of the institute.

These areas of activity are of clear national importance for Norway, and those areas aligned with sustainability and the environment are also aligned with international priorities.

SINTEF Ocean's main activity is in Trondheim, but the company also has operations in Ålesund, Tromsø, Oslo, Bergen and Frøya.

SINTEF Ocean has strong ties with industries, businesses, and public bodies, both in Norway and internationally. Partners are primarily research institutes and universities, as well as organisations. SINTEF Ocean and NTNU work closely together and share several infrastructure facilities, to support the research and teaching that is connected to the institute's activities. SINTEF Ocean also collaborates with other SINTEF divisions, including SINTEF Digital and Energy.

SINTEF Ocean's market areas are food, energy, the environment and transport. It is noted that the green transition will require significant restructuring of the Norwegian Ocean industry, which in turn will require knowledge and innovative solutions. This is a major opportunity for SINTEF Ocean.

The ambition of SINTEF Ocean is to maintain Norway's leading position in marine technology and biomarine research working with industry and the authorities, developing future-oriented solutions for the sustainable utilisation of ocean space. This assumes that Norway is world-leading, yet no evidence has been presented for this in the self-assessment report.

A significant portion of SINTEF's basic grant is allocated to common corporate initiatives and priority research areas. It is unclear to the evaluation committee how these eight priority research areas fit within the research groups, and whether new groups are needed to address these priority areas.

No specific strategy document for SINTEF Ocean was submitted for evaluation, and so the strategy for growth or rebalancing across the research groups within SINTEF Ocean was not clear to the evaluation committee. Having a strategy at the admin unit level would be invaluable for setting and guiding the direction of SINTEF Ocean and provide a platform for the management team to actively steer the research groups.

Such a strategy would also consider the specific challenges and context for SINTEF Ocean (e.g. trends in customer organisations, funding landscape, situation for partners etc.) and provide a framework for the unit to effectively anticipate and respond to changes. As the energy transition is underway, so too is the oceans sector and SINTEF Ocean should take a longer-term and more proactive view on how it will support this transition and the sector in future.

Based on the information provided in the self-assessment report, it is not clear how the admin unit measures and monitors its progress. This would be invaluable for the admin unit to measure progress against their objectives, but also to measure the progress of their constituent research groups.

Recommendations to the administrative unit.

- Strategy follows SINTEF, but a specific strategy for SINTEF Ocean, along with quantified success metrics and progress monitoring would be useful.
- A stronger role for the SINTEF Ocean management team to actively steer the research groups via the strategy and monitor progress. The admin unit needs to establish metrics

in order to measure its effectiveness in steering the quality and quantity of its research groups.

- Maintain Norway's leading position in marine technology and biomarine research by working with industry, universities and the authorities, developing future-oriented solutions for the sustainable utilisation of ocean space making use of new technologies and co-location with other activities such as offshore renewable energy.
- Restructuring of ocean sector for energy transition is underway – SINTEF Ocean should consider how the funding landscape will change and whether SINTEF Ocean is well connected to prepare and support the sector.
- Benchmarking of strategic goals against global leaders will facilitate meaningful self-evaluation.

1.2 Organisation of Research

SINTEF Ocean is organised into five departments dedicated to pivotal areas within marine and maritime sciences, that are named "Aquaculture", "Climate and Environment", "Energy and Transport", "Fisheries and New Biomarine Industries" and "Ships and Ocean Structures". There are nine research groups: Aquaculture Robotics and Automation, Experimental Hydrodynamics, Marine CFD, Marine Operations, Marine Structures (MS), Maritime Energy Systems, Maritime ICT and Cybernetics, Ship Hydrodynamics, Structural Mechanics (KT).

At the end of 2022, SINTEF Ocean had 389 employees, of which 287 were research staff, 36 engineers, 30 technical staff and 36 administrative support staff: the ratio of support staff to research staff is 0.36 to 1. It is important to keep the organisation lean in order to maintain a low overhead rate. Of the research staff about 1/3 are Research Scientist and 1/3 are Senior Research Scientist: these are healthy proportions for a mature research organisation.

The size of the research groups varies between 5 to 20 employees, and they typically include a diverse set of roles ranging from scientific/academic positions to engineers and technicians at different levels. The evaluation committee recommend the admin unit identify a strategy for research group size and to provide impetus for small groups in order for them to grow on a short time scale.

Each department consists of several specialised research groups, that (i) operate within their respective domains and market areas and (ii) collaborate across disciplines to address complex challenges and common goals of the institute.

In addition, SINTEF Ocean has its own administrative staff with different functions, including HSE, economy, quality, communication, HR, and managerial support. They work closely with the research groups to provide help with administrative tasks, equipment, questions, and other needs. Each research group has its own Research Manager, and the institute is overseen by the institute management, CEO and board. Together, this forms the leadership structure at SINTEF Ocean.

Some researchers have adjoint positions as professors or associate professors at NTNU or other universities, and thereby contribute to teaching and supervision. In addition, SINTEF develops and runs research infrastructure, which makes it an attractive partner for industrial and academic research.

SINTEF researchers also have the opportunity to work in other SINTEF departments, either through collaborative projects or through internal mobility.

Recommendations to the administrative unit.

- Identify a strategy for research group size and to provide impetus for small groups in order for them to grow on a short time scale.
- Maintain the current ratio of support staff to research staff is (approx. 0.36 to 1).

1.3 Research Funding

SINTEF is an independent, not-for-profit research foundation. About 92% of SINTEF's income comes from open competitions, while core funding constitutes about 8%. Though low, this level of core funding is in line with the wider institutes sector.

For SINTEF Ocean, the share for research is approximately 95% of the total budget/income each year, reflecting their lean organisation as noted above.

Approximately 60% of the income is non-economic activity (i.e. not industry funding) and is primary funding from national and international grants. For SINTEF Ocean, the Research Council of Norway is the largest single funder, but EU project funding is increasing.

Direct projects with business accounted for approximately 38% of gross income in 2022, mostly Norwegian clients, but SINTEF Ocean also had clients in 34 different countries in 2022, both in and outside of Europe. There are strong national and international ties with industry, business and public bodies nationally and internationally.

SINTEF Ocean report their experience of increasing pressure on research funding and framework conditions, and a demanding environment that affects SINTEF Ocean clients' room for manoeuvre with respect to engaging in research and innovation.

Public calls for proposals, including for national funding for EU programmes, determine the amount of research-based transition work that the institutes can contribute to. The Norwegian research model, with its very low basic grants for technical-industrial institutes, means that available funding is limited.

As noted above, restructuring of ocean sector for energy transition is underway and SINTEF Ocean will need to ensure their strategy and research capabilities are able to adapt and support this change. SINTEF Ocean will therefore need to consider the implications of this on their funding sources and how they're planning to adapt to ensure sustainability of the admin unit. This could include for example taking part in initiatives in the EU and other international networks concerned with sustainable oceans, aquaculture and fisheries, marine biodiversity, marine renewable energy, maritime spatial planning, ocean governance, etc.

Recommendations to the administrative unit.

- Consider how the funding landscape will change and whether SINTEF Ocean is well connected to prepare and support the sector.

1.4 Research Infrastructures

SINTEF Ocean is the host institution for three national infrastructures listed in the roadmap from 2018, including (i) PLANKTONLAB (The Norwegian Centre for Plankton Technology), (ii) The Marine Technology Centre, and (iii) OceanLab (Ocean Space Field Laboratory). Considering each in turn:

(i) PLANKTONLAB is operated by SINTEF Ocean and NTNU, in order to contribute to new knowledge about bio marine production/biomass production and harvesting of plankton from the sea and offer relevant expertise to users of the infrastructure.

(ii) The Marine Technology Centre at Tyholt has long been important for SINTEF Ocean and NTNU to perform research and develop technology for shipping, marine equipment, ocean energy, petroleum and other ocean industries. The marine technology laboratories are used for clients within maritime industry, oil/gas and renewable energy, and include the world's largest ocean basin, a cavitation tunnel, marine cybernetics laboratory, a towing tank, energy and machinery laboratory, and more, located in Trondheim.

(iii) The goal with the OceanLab-infrastructure is to contribute to technological developments and digitalization of the ocean, and include an ecotoxicology laboratory, environmental and biochemical analysis, and oil laboratory.

Several of the laboratories are now undergoing major upgrades, and this combines with significant investment into the construction of The Norwegian Ocean Technology Centre in collaboration with NTNU and scheduled for completion in 2028-2029. Research infrastructure is cost-heavy, and parts of the infrastructure need renewal, so cost structures or funded projects need to cover associated costs. The business model for facilities should allow for strategic investments in collaboration with partners, such as the Norwegian Ocean Technology Centre in collaboration with NTNU, without detriment to other activities. This will enable SINTEF Ocean to maintain its activity to develop and run research infrastructure, which makes it an attractive partner for industrial and academic research.

In line with this, SINTEF Ocean will need to have in place a clear strategy for facilities maintenance, use and development to ensure funding covers future overheads. The evaluation committee note that whilst this degree of detail was not requested from the self-assessment reports, the strategic importance of these infrastructures mean it is essential SINTEF Ocean have plans in place to support their continuation.

Also not clear from the self-assessment report was how SINTEF Ocean positions their infrastructure in the context of national and international roadmaps. The unit should clarify the positioning and ambition for the facilities in order to ensuring alignment with wider national and international needs, raise the profile of the facilities to support continued use and raise awareness of SINTEF Ocean more widely.

SINTEF Ocean uses the national supercomputing system Sigma2 (https://www.sigma2.no/systems), based at NTNU in Trondheim.

Recommendations to administrative unit.

- Put in place a business model for facilities that allow for strategic investments in collaboration with partners to help cover the costs of renewal of research infrastructures
- Ensure there is a clear strategy for facilities maintenance, use and development to ensure funding covers overheads
- SINTEF Ocean should consider its positioning within national and international infrastructure roadmaps

1.5 National and international collaboration

SINTEF Ocean has strong ties with industries, businesses, and public bodies, both in Norway and internationally.

The extent of collaborations with universities was less clear from the self-assessment reports. SINTEF Ocean and NTNU work closely together and share several infrastructure facilities to support the research and teaching that is connected to the institute's activities. However the extent and depth of collaborations with other universities, in Norway or

internationally, is less clear and likely an area that could be improved to ensure SINTEF Ocean has access to a breadth of expertise.

A significant number of projects for clients are carried out across SINTEF, collaborating with other divisions, in particular SINTEF Digital and Energy. Common corporate initiatives across SINTEF divisions help foster collaborative and interdisciplinary research across institutes, departments, and fields. In 2022 there were fifteen common SINTEF corporative initiatives, on the themes circular economy, new climate positive measures, wind and sun, batteries, hydrogen, food and agriculture, smart societies, biodiversity, global sustainable development, manufacturing, societal security, health and welfare, EU, mobility, and digitalisation.

SINTEF Ocean is actively engaged in various collaborative programmes and center schemes financed by RCN, including Centers for Research-Driven Innovation (SFI), Centers for Environmentally Friendly Energy (FME), and Centers of Excellence (SFF). This demonstrates that SINTEF Ocean is engaged in a range of national collaborations and partnerships, offering many opportunities to support the wider Norwegian research system.

It also collaborates in EU research and innovation programs, working with a diverse network of international partners. SINTEF Ocean reported many international collaborations, however most of these were described in terms of holding Memoranda of Understanding and it was less clear how these collaborations function in real terms (e.g. through cash flow, researcher mobility, collaborative projects etc).

SINTEF Ocean has strong engagement with industry organisations, through project consortia and formal cooperation agreements. It contributes knowledge, ideas and recommendations to public debates and policy development by participating in commissions, committees and seminars, both nationally and internationally.

Recommendations to administrative unit.

- Clarify how international collaborations function in terms of cash flow, as many are described in terms of a Memorandum of Understanding.

1.6 Research staff

In 2022, 137 women and 252 men from 36 different countries were employed. The average age was 44 years. The institute continues to work purposefully with recruitment to ensure growth in the organisation and to fulfil its societal mission. The proportion of female researchers has reduced from 22.2% in 2013 to 20.4% in 2021. This should be improved and the admin unit should put in place tangible actions to increase this in future.

The research groups play a pivotal role in researcher training and mobility, offering opportunities for skills development, mentoring, and career progression. New employees at SINTEF Ocean go through an onboarding process, where they receive training from their line manager and an assigned mentor, and complete introductory courses provided by SINTEF and SINTEF Ocean. SINTEF also provides courses for further career development.

Career advancement is assessed by the line management as part of the annual employee appraisal. The evaluation committee recommend that career advancement should not be overly reliant on the review by the immediate supervisor.

Researchers are encouraged to get a PhD and this can be funded as part of larger collaborative research projects or by direct funding from the Research Council of Norway. In 2022, 61% of SINTEF Ocean employees had a PhD. The admin unit should continue to provide opportunities, and actively encourage Masters levels researchers, to gain a PhD.

Research leave is available if external funding secured, and granted following an application process. Mobility internally in SINTEF is possible through participation in research projects in other groups; this is very common and is achieved either by moving to a research group within SINTEF Ocean or within the other institutes of SINTEF. The evaluation committee consider this to be a unique and valuable opportunity within SINTEF and it should be encouraged.

Recommendations to the administrative unit

- Review the process and structure for career advancement such that progress does not overly rely on the immediate supervisor
- SINTEF Ocean should provide opportunities and actively encourage Masters levels researchers to gain a PhD.
- Maintain and strengthen collaborations with universities in order for research staff to develop their careers and to develop research competencies for the unit.
- Encourage internal mobility within SINTEF through participation in research projects led by other groups, by changing research group within SINTEF Ocean or within the other institutes in SINTEF.
- Considerations of restructuring should be within the overall SINTEF context to ensure sufficient provision of research competencies and collaboration between units.

1.7 Open Science

SINTEF Ocean adheres to the publication policies set by the SINTEF organisation as a whole and it follows SINTEF recommendations on open science, which the evaluation committee consider to be appropriate. SINTEF accepts Norwegian and international publication guidelines and complies with open access requirements. SINTEF's publication policy states that SINTEF's scientific results shall generally be published in open access media, and that all scientific publications shall be placed in SINTEF's open scientific archive. SINTEF supports sharing of preprints for open peer review and comments prior to publication. In the event of open publication, SINTEF recommends the use of Creative Commons licenses. On 01.01.23 the Institutional Rights Retention policy was implemented, ensuring that SINTEF retains copyright of author accepted manuscripts.

SINTEF offers support to its research scientists and an infrastructure that facilitates open access publication. Through institutional programs, SINTEF offers courses in academic writing and research method, including open science practices. As a part of SINTEF projects, project participants are given opportunities to contribute to the publication process.

SINTEF complies with the Norwegian guidelines governing open access to research data and makes every effort to adhere to the FAIR principles for data management, as stated by SINTEF's Research Data Management policy. Research data that are wholly or in part owned by SINTEF shall be "as open as possible and as closed as necessary". Open access research data shall be equipped with standardised licences for access, reuse and further distribution.

SINTEF uses standard software development tools and frameworks when collaborating with external partners, and its open software is available via GitHub. Because of the mix of public and privately funded research, SINTEF does not have a unified policy for open-source access and development of software. The decision to use proprietary or open-source development is decided case-by-case and depends upon a set of requirements, including IPR for existing software, demands by clients and collaborative partners, further

development etc. For many researchers within SINTEF Ocean, open source code is another valuable route though which researchers may increase their profile and reputation. Although it is understood that not all privately funded research can be published in open access, a clear policy should be available to researchers to ensure they prioritise the open science approach wherever possible.

Recommendations on how to promote open science

- Develop policy on open-source access and development of software, seeking opportunities for open science in all projects. Data ownership and open science policy should be stated in all contracts to avoid problems in the future over IP.
- Maintain goals for number of peer-reviewed papers per Scientist per year in order to grow research expertise and profile.

2. Research production, quality and integrity

SINTEF Ocean works on research and innovation in the ocean space for national and international industry. Market areas are (i) transport, (ii) energy, (iii) the environment and (iv) food. Each is commented upon in turn.

(i) Maritime transport research is related to both hydrodynamics, energy systems and logistics. Environmental net gain will be the dominant challenge for the maritime industry in the coming years, which must be solved while maintaining safety and cost level requirements. Zero-emission fuels are an important part of the solution, but the supply and price of these fuels will be a challenge. Therefore, it will become even more important in the future to reduce the energy consumption of ships through better design of hulls and propellers, efficient energy systems and optimisation of logistics and operations. These are areas that SINTEF Ocean focuses on, and where we connect technology expertise with expertise in digitalisation and autonomy solutions.

(ii) SINTEF Ocean's contribution to research within energy is largely focused on marine hydrodynamics and marine structures. This includes research within oil and gas, offshore wind and other energy harvesting technologies such as wave energy and tidal energy. Environmental loads (waves, wind and current) on floating and fixed structures including mooring systems and cables, control systems, structural loads and integrity including fatigue testing of flexible pipelines and electric cables, marine operations during installation, service, and decommissioning.

(iii) SINTEF Ocean's contribution to research within the environment has a special focus on the fate and effects of environmental toxins in marine ecosystems and on solutions to reduce environmental risk associated with planned emissions and accidents related to industrial activities. Environmental considerations are generally a prerequisite for sustainable industrial development of the ocean space. SINTEF Ocean has a conceptual and scientific/environmental expertise to create good environmental solutions for its customers.

(iv) SINTEF Ocean's contribution to research within the food market area is related both to fisheries, aquaculture and new biomarine resources. This includes research on catch methods, production facilities and structures, cultivation and harvesting, seafood processing, robotics and automation, and more. SINTEF Ocean works with knowledge needs and innovation for the entire value chain and focuses on the development of sustainable feed resources and optimal interaction between biology and technology. There is a need for more precision and control in fish farming.

SINTEF Ocean bases the research on a combination of laboratory testing, full scale testing and field studies, numerical studies and software development.

Some of the areas of research are in established fields, and there is a danger that the activity is incremental in research with diminishing returns. For example, in the area of maritime transport, SINTEF research on better design of ship hulls and of propellors appears to be incremental. Within the energy area, the transfer of technology from oil and gas expertise to offshore wind and wave energy has scope. There is a focused activity on the environment and on the effects of environmental toxins in marine ecosystems, and on solutions to reduce environmental risk associated with planned emissions and accidents. There appears to be major opportunities in food supply including seafood processing, with a need for more precision and control in fish farming.

Publication bibliometrics are summarised alongside benchmark data of all admin units under EVALMIT in Table 1 below.

Given the size of the unit and the number of staff, the publication rate is too low, even for a research institute (196 publications in 2022). The admin unit is not hitting their SINTEF target of 1 publication point per researcher. SINTEF Ocean therefore need to consider how they will effectively support and encourage their researchers to meet this target and implement practical tools for doing so. Though not a priority of a research institute, the admin unit should acknowledge that academic publication is a valuable route for ensuring their researchers maintain cutting edge expertise and have leading international reputations, which in turn will increase the research profile of the unit. The citation scores of the publications associate to SINTEF Ocean demonstrate that they are producing high-quality work, where the unit has a citation score of 116 and the share of 10% most cited is higher than the benchmark (12% vs 10.4%). The international co-publication rate for the admin unit is slightly below the benchmark of other admin units within EVALMIT (45.4% compared to 53.8%).

2.1 Research quality and integrity

Research group Maritime ICT and Cybernetics overall assessment

The strategic areas of the SINTEF Maritime ICT and Cybernetics research group include maritime digitalisation and automation, including autonomous ships, intelligent maritime transport systems and marine cybernetics. The group consists of eleven employees (after a split in 2021). In the last two years (2021-2022). the research group has approximately 70% funding from EU project (STIM-EU included) and 30% from projects supported by RCN. The focus of the group leans toward applied R It is also involved in standardisation, which is of high societal importance. The group appears to have a good economy from RCN and EU projects. In recent years there is less direct funding from companies. The research areas of maritime autonomous surface ships and maritime intelligent transport systems are very timely, but the area of the research group is between larger successful companies and very strong university research groups. The group has found a strong niche as a partner in external projects. The professional SINTEF organisation supports the research group by being a very attractive partner in larger research projects and in EU projects. Its strength is a long-term commitment to autonomous ship systems, with adequate support. A weakness is the gender unbalance, one woman out of eleven of permanent staff, and the high dependence on external funding and no direct industrial projects. The group’s self-

assessment contains some good quality publications and some more project overviews. Their area of research is important for a sustainable society. Still, the visibility as a group seems limited, as confirmed by the self-assessment. One reason may be that SINTEF Ocean handles communications at a higher level. Being a partner in larger projects is an excellent way to involve users. At the same time, it limits visibility of the group. The group has a unique competence in autonomous ships, but significant development in this area is done in the context of work with larger companies.
• The SINTEF organisation is very strong for supporting the production of excellent research.
• The international academic community would consider the research quality to be good and nationally acceptable, but below world standards in terms of publication quality.
• The group has played a very considerable role in the research process from the formulation of overarching research objectives to publication.
• The contribution of the research to economic and societal development in Norway and internationally is on par with what is expected from groups in the same research field.
• Societal partners have considerable involvement in the research process, from problem formulation to innovation.

Research group Aquaculture Robotics and Automation overall assessment

Although this evaluation comes too soon for this new group to make a thorough assessment, the expert panel tried to formulate opinions and provide recommendations where possible. A major strength is their strategy to focus on aquaculture robotics, a world-wide emerging field, while building up strong expertise in robotics and cybernetics, adding expertise from other disciplines through collaborations and aiming at high-quality publications in journals and conferences. They have access to adequate facilities and external funding. As a weaker point, the report does not highlight collaborations with non-academic partners and the resulting knowledge and technology transfer. SINTEF is very strong for supporting the production of excellent research, but the group could benefit from formulating specific and concrete benchmarks for themselves. The quality of previous research is sufficient to achieve some international recognition. The group has played a very considerable role in the research process from the formulation of overarching research goals and aims via research activities to the preparation of the publications. The group's societal contribution in Norway is on par with what is expected from groups in a similar research field. Detailed information on the role of non-academic partners and on the resulting technology transfer is however missing in the self-assessment report. One of the few groups worldwide dedicated to aquaculture, they are setting up collaborations with leading universities and gaining international visibility, creating opportunities to become a world-leading group in this area.

Research group Structural Mechanics (KT) overall assessment

The research group has strengths in the development of high-fidelity analysis tools for hydrodynamic and structural analysis of subsea pipelines, umbilicals, risers, and flowlines for offshore oil and gas industry, as well as subsea power cables for the offshore wind industry. The Group has access to its own structural testing facility and access to the very well-equipped hydrodynamic testing facilities in MARINTEK and at NTNU. The overall performance across the evaluation criteria and the overall contribution of the research group can be rated as very good. Judging from the number of joint industry projects and the outputs from these projects the research group is strong in an international context With the increase of PhD students, the research group’s organisational environment and the quality of their research output can become outstanding.

Research group Maritime Energy Systems overall assessment

The SINTEF MES research group is a good quality research group, that shows overall more strengths than weaknesses. From the perspective of the organisational dimension, the group is small but well organised, with a good mix of skills and experience. It receives funding from different sources and has a good range of collaborations. From the perspective of the quality dimension, the group focuses on topics that are of high relevance for the industry. Publication quality is good but not in the top standards, and the contribution of the research group to the publications presented is sometimes limited. The group has had an impressive impact on society, with the main contribution coming from the collaborations with industry, but also through teaching and support to institutions. Judging from the number of research projects and the outputs from these projects the group is fairly strong in an international context.

Research group Marine CFD overall assessment

Despite the relatively small number of team members, the research group has made significant national and international contributions. Due to the high proportion of projects initiated by industry, the group's main activity is focussed on improving the propulsion performance of ships. For the further development of the group, it will therefore be important to increase the number of employees and expand the scope of research in order to meet the industry's increasing demand for the development of efficient designs and society's need for environmentally friendly products. The overall performance and the overall contribution of the research group are high in comparison to the other renowned research groups working in the same field. In an international context, the group is relatively successful, based on the number of research projects and publications in scientific journals.

Research group Experimental Hydrodynamics overall assessment

The group is overall in a good position to maintain its position in doing high quality experimental work in relation to a competitive international environment. The research group is vital for Norwegian industry and society and performs experimental work at a high level. Research appears to be primarily performed within client projects, so despite this involving advanced techniques, including new development, the contribution to advancing science is limited, but still judged to be appropriate for an organisation like SINTEF Ocean. The research group is performing at a similar level or higher than corresponding groups internationally. There is an ambition to diversify the research portfolio and increase research funding, which the panel believes is an appropriate action and important for the development of the research group.

Research group Marine Operations overall assessment

The Research Group has created a very substantial funding during the reporting period, including very significant funding from industry shows the societal importance of the group’s research. The Expert Panel is not aware of any other group in marine operation with a similar strength in tools for planning and simulation of operations and possibilities for validation in the ocean basin and in the towing tank. The research group contributes to sectors that are vital for Norwegian economy and the development of society. The research group publish mainly at high quality conferences and has few publications in international journals. One journal article has 280 citations, while all other publications were modestly cited (3-8 cites in the period 2014-22). The research group supports education, but do not have PhD candidates or Postdocs employed, according to the self-evaluation. The gender balance could also be improved. Overall, the Expert Panel finds the level of the group to be at the forefront at the international scene considering methods and technology, but contributions to scientific outreach is modest and could be improved.

Research group Ship Hydrodynamics overall assessment

The research group is vital for Norwegian industry and society and performs experimental work at a high level. The research group is performing at a similar level or higher than corresponding groups internationally. The group is overall in a good position to maintain its position in doing high quality experimental work in relation to a competitive international environment. The development and research performed are primarily driven by customer projects, which is a limiting factor in advancing science and the competence of the group. There is an ambition to increase international research funding, which the Expert Panel believes is an appropriate action and important for the development of the research group.

Research group Marine Structures (MS) overall assessment

The research group has in combination with other research groups in SINTEF Ocean a competitive advantage, that is, the strong coupling between analyses/studies, development of numerical simulation tools and model scale experiments. The research group MS contributes to both of these goals through research and innovation projects on offshore wind and floating solar together with Norwegian energy and engineering companies. The renewable energy sector is emerging but still the number of customers is limited and the competition between various research groups is increasing. The group is active internationally but there is room for improvement to decrease the risks related to the number of customers. The overall performance across the evaluation criteria and the overall contribution of the Research Group can be rated as very good. The group is active internationally. The listed projects are at the forefront and have high international quality. All their projects involve national and/or international industry partners. As such, they contribute to the development of both Norwegian and international offshore and maritime industry. The group representative has chaired ITTC Specialist Committee on Ocean Renewable Energy during 2018-2021 and has been a secretary during 2022-2024.

3. Diversity and equality

SINTEF promotes gender equality and strives to counter discrimination in accordance with section 26 of the Equality and Anti-Discrimination Act. This activity is anchored in the corporate strategy, HR policy, “People strategy”, and other policies, guidelines and processes. Both leaders/managers and other employees have a responsibility to contribute to a good working environment, as characterised by equality and opportunity. SINTEF’s goal is to increase the proportion of women among research scientists and managers, and SINTEF has approved a Gender Balance Plan. SINTEF is also a large multidisciplinary international environment, with employees from over 80 nations. All international employees are offered an inclusion program that contains common measures and various offers adapted to the individual’s needs.

In addition to the work in SINTEF at large, SINTEF Ocean has established a separate working group, which consists of representatives from the employer side, health and safety representatives, and union representatives. They have investigated risks and possible obstacles, analysed causes and worked on relevant measures. While they found no concrete obstacles to succeed in the work for equality and against discrimination, they found themes to work on proactively, which can be sensitive for employees, and where challenges can potentially arise. These are salary structure, culture for healthy boundary setting and a supportive working environment, export control, varied social activities, acoustics in common areas, and access to rest room/nursing room/prayer room.

The number of researchers has increased from 117 in 2013 to 142 in 2021. Of these 18 were female in 2013 and 36 in 2021: the proportion of female researchers has increased from 15.4 % in 2013 to 25.4% in 2021.

Table 4.13 Personnel statistics for SINTEF Ocean 2013, 2017 and 2021

Indicators	2013	2017	2021
Total researchers	117	133	142
Female researchers	18	31	36
Male researchers	99	102	106
Share of female researchers	15	23	25
Share of researchers with phd-degree	50	60	63
Share of female researchers with phd-degree	50	71	69
Share of male researchers with phd-degree	49	57	60
Share of researchers with foreign phd-degree	13	14	13
Average age, all researchers	44	44	45
Average age, female researchers	39	42	42
Average age, male researchers	44	45	46
Share of researchers 62 years or older	13	7	9

Source: Statistics Norway

4. Relevance to institutional and sectorial purposes

SINTEF Ocean aims to contribute to the knowledge base in general and deliver new solutions and technology to national and international ocean-based industries, contributing to increased competitiveness and benefit to society.

In 2022 there were 184 scientific articles published in peer-reviewed scientific journals, and of these 35 articles were in level 2 channels. In 2022 there were 236 reports to customers, 74 are classified as open and are available to the public.

SINTEF Ocean conducts contract research for both private and public clients with heavy involvement in the ocean space. Clients range from large enterprises and authorities to small businesses, start-ups, and growth companies, that are situated both in Norway and internationally.

5. Relevance to society

Transport, food and energy production represent the backbone of ocean-based industries, and are also core areas for SINTEF Ocean, in addition to environmental technology. Cooperation in the SINTEF group, allows SINTEF Ocean to integrate their expertise with expert technological knowledge from other industry sectors.

SINTEF Ocean was established to help exploit possible synergies between ocean industries and develop the industry in line with principles of sustainability. Norway has natural resources in the form of wind, fish, oil and gas, and SINTEF Ocean aims to be a centre of gravity for marine and maritime research, both in Norway and internationally.

SINTEF Ocean's strategy and activities are consistent with the Norwegian Long-term plan for research and higher education for 2019-2028, the Decade of Ocean and the SDGs 2 (Zero hunger), 7 (Affordable and clean energy), 11 (Sustainable cities and communities), 12 (Responsible consumption and production), 13 (Climate action) and 14 (Life below water).

Impact on society is achieved through the development of new knowledge and modelling tools for research, e.g. Exposed Aquaculture Operations, reports on Reduction of greenhouse gas emissions in maritime transport, and offshore wind design tools, both for numerical modelling and physical experiment methodologies.

5.1 Impact cases

Comments to impact case 1: Exposed Aquaculture Operations

The Norwegian coast, with its remoteness and harsh weather conditions, poses many challenges to fish farming. In the last decades, SINTEF Ocean has brought forward knowledge and technology that increase safety, efficiency and robustness of these operations. In 2015-2023, SINTEF Ocean had a center of research-based innovation dedicated to this: CRI Exposed Aquaculture operations. During these fast-paced times in the aquaculture industry, this was essential to identify and overcome challenges. The activities in EXPOSED and surrounding projects have increased knowledge and resulted in a shared understanding across technological, biological, and societal research disciplines. The credit goes to a long-term partnership of world-leading companies and research institutions.

The impact case has improved safety, efficiency and robustness of fish farming operations in the Norwegian coast. The innovations are underpinned by good academic publications, and the impact appears to be mainly in ongoing research projects. It is not clear how this has had impact more widely into the sector.

Comments to impact case 2: Reduction of greenhouse gas emissions in maritime transport

1. More efficient and accurate early-stage assessment of new ship designs, 2. New validated methods to correlated data from real-life conditions with simulation- and experimental data. 3. More accurate predictions of fuel consumptions and emissions from alternative hull, propulsions and power systems configurations and operational profiles. 4. Improved optimisation of ship performance versus cost profiles at various profiles and sea states. 5. Increased knowledge on the potential energy savings from new and innovative technologies 6. Improved methods and software tools for cost and fuel optimisation on both unit and fleet level. 7. The report ("Sea map to Green Shipping") describing a four-step approach towards zero emission maritime transport.

The impact case relates to early stage assessment of ship designs in relation to use of alternative fuels. Underpinning research papers are listed, and reports produced. It is not clear how the new methods and recommendations are being used in industry and impact upon the sector.

Comments to impact case 2: Offshore Wind

SINTEF Ocean has developed competence, tools and laboratories which are applied in development and testing of new concepts for floating offshore wind. The research community at SINTEF Ocean has been involved in the majority of the floating wind concepts presently installed or which are under commissioning. Knowledge, software, laboratories and methods from SINTEF Ocean have been instrumental for realisation of floating offshore wind and is therefore strongly contributing to the green transition with more renewable energy production and green jobs.

The software produced, SIMA, is distributed world-wide by DNV Digital Solutions, as part of Sesam – a software suite for hydrodynamic and structural analysis of renewable, offshore and maritime structures. SIMA is intellectual property of SINTEF Ocean. It is underpinned by research published in conference papers, but journal papers are not listed. The methodology been used for design and assessment of multiple floating offshore wind developers, and SIMA is very widely used in industry. Strong impact demonstrated.

Methods and limitations

Methods

The evaluation is based on documentary evidence and online interviews with the representatives of Administrative Unit.

The documentary inputs to the evaluation were:

- Evaluation Protocol that guided the process
- Terms of Reference
- Administrative Unit's self-assessment report
- Administrative Unit's impact cases
- Administrative Unit's research groups evaluation reports
- Bibliometric data
- Personnel and funding data
- Data from Norwegian student and teacher surveys (only for HEI's)

After the documentary review, the Committee held a meeting and discussed an initial assessment against the assessment criteria and defined questions for the interview with the Administrative Unit. The Committee shared the interview questions with the Administrative Unit at least two weeks before the interview.

Following the documentary review, the Committee interviewed the Administrative Unit in an hour-long virtual meeting to fact-check the Committee's understanding and refine perceptions. The Administrative Unit presented answers to the Committee's questions and addressed other follow-up questions.

After the online interview, the Committee attended the final meeting to review the initial assessment in light of the interview and make any final adjustments.

A one-page summary of the Administrative Unit was developed based on the information from the self-assessment, the research group's evaluation reports, and the interview. The Administrative Unit had the opportunity to fact-check this summary. The Administrative Unit approved the summary with minor adjustments.

Limitations

The Committee judged that the Administrative Unit self-assessment report was insufficient to assess all evaluation criteria fully. However, the interview with the Administrative Unit filled gaps in the Committee's understanding, and the information was sufficient to complete the evaluation.

List of administrative unit's research groups

Institution	Administrative Unit	Research Groups
SINTEF	SINTEF Ocean	Maritime ICT and Cybernetics Structural Mechanics (KT) Experimental Hydrodynamics Marine Structures (MS) Ship Hydrodynamics Aquaculture Robotics and Automation Maritime Energy Systems Marine Operations Marine CFD

Terms of Reference (ToR) for the administrative unit

The board of SINTEF Ocean AS mandates the evaluation committee appointed by the Research Council of Norway (RCN) to assess SINTEF Ocean based on the following Terms of Reference.

Assessment

You are asked to assess the organisation, quality and diversity of research conducted by SINTEF Ocean as well as its relevance to institutional and sectoral purposes, and to society at large. You should do so by judging the unit's performance based on the following five assessment criteria (a. to e.). Be sure to take current international trends and developments in science and society into account in your analysis.

a) Strategy, resources and organisation

b) Research production, quality and integrity

c) Diversity and equality

d) Relevance to institutional and sectoral purposes

e) Relevance to society

For a description of these criteria, see Chapter 2 of the mathematics, ICT and technology evaluation protocol. Please provide a written assessment for each of the five criteria. Please also provide recommendations for improvement. We ask you to pay special attention to the following 5 aspects in your assessment:

1. Relevance of research for ocean industries (maritime, aquaculture, offshore wind, oil & gas) (applicable to all research groups)
2. Contribution and relevance of our research towards reduction of GHG emission from maritime transport (applicable to research group Maritime Energy systems, Ship Hydrodynamics and Marine CFD)
3. Contribution and relevance of our research to enable offshore floating wind (applicable to research group Marine Structures, Structural engineering, Experimental Hydrodynamics, Marine Operations, Ship Hydrodynamics and Marine CFD)
4. Contribution and relevance of our research for more precision and control in fish farming (applicable to research group on Aquaculture Robotics and Automation)
5. International excellence in marine hydrodynamics and marine structures (applicable to research group Marine Structures, Structural engineering, Experimental Hydrodynamics, Ship Hydrodynamics, Marine Operations and Marine CFD)

In addition, we would like your report to provide a qualitative assessment of SINTEF Ocean as a whole in relation to its strategic targets. The committee assesses the strategy that the administrative unit intends to pursue in the years ahead and the extent to which it will be capable of meeting its targets for research and society during this period based on available resources and competence. The committee is also invited to make recommendations concerning these two subjects.

Documentation

The necessary documentation will be made available by the mathematics, ICT and technology secretariat at Technopolis Group.

The documents will include the following:

- a report on research personnel and publications within mathematics, ICT and technology commissioned by RCN
- a self-assessment based on a template provided by the mathematics, ICT and technology secretariat
- Annual and Sustainability Report 2022 for the SINTEF Group
- Annual report (director's report) 2022 for SINTEF Ocean AS
- Presentation of the Norwegian Ocean Technology Centre
- Final report of SFI Smart Maritime - the Norwegian Centre for improved energy efficiency and reduced harmful emissions
- Final report of SFI Exposed - Centre for Research-Based Innovation on exposed aquaculture operations
- Annual report 2022 for SFI Blues – Centre for Research-Based Innovation for Floating Structures for the Next Generation of Ocean Industries
- Annual report 2022 for FME NorthWind - Norwegian Research Centre on Wind Energy

Interviews with representatives from the evaluated units

Interviews with the SINTEF Ocean will be organised by the evaluation secretariat. Such interviews can be organised as a site visit, in another specified location in Norway or as a video conference.

Statement on impartiality and confidence

The assessment should be carried out in accordance with the *Regulations on Impartiality and Confidence in the Research Council of Norway*. A statement on the impartiality of the committee members has been recorded by the RCN as a part of the appointment process. The impartiality and confidence of committee and panel members should be confirmed when evaluation data from SINTEF Ocean are made available to the committee and the panels, and before any assessments are made based on these data. The RCN should be notified if questions concerning impartiality and confidence are raised by committee members during the evaluation process.

Assessment report We ask you to report your findings in an assessment report drawn up in accordance with a format specified by the mathematics, ICT and technology secretariat. The committee may suggest adjustments to this format at its first meeting. A draft report should be sent to SINTEF Ocean and [RCT]. The SINTEF Ocean should be allowed to check the report for factual inaccuracies; if such inaccuracies are found, they should be reported to the mathematics, ICT 3 and technology secretariat within the deadline given by the secretariat. After the committee has made the amendments judged necessary, a corrected version of the assessment report should be sent to the board of SINTEF Ocean AS and the RCN no later than two weeks after all feedback on inaccuracies has been received from SINTEF Ocean.

Appendices

1. Description of the evaluation of EVALMIT
2. Invitation letter to the administrative unit including address list
3. Evaluation protocol
4. Template of self-assessment for administrative unit (short-version)

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