The Research Council of Norway

# Evaluation of Mathematics, ICT and Technology 2023-2024

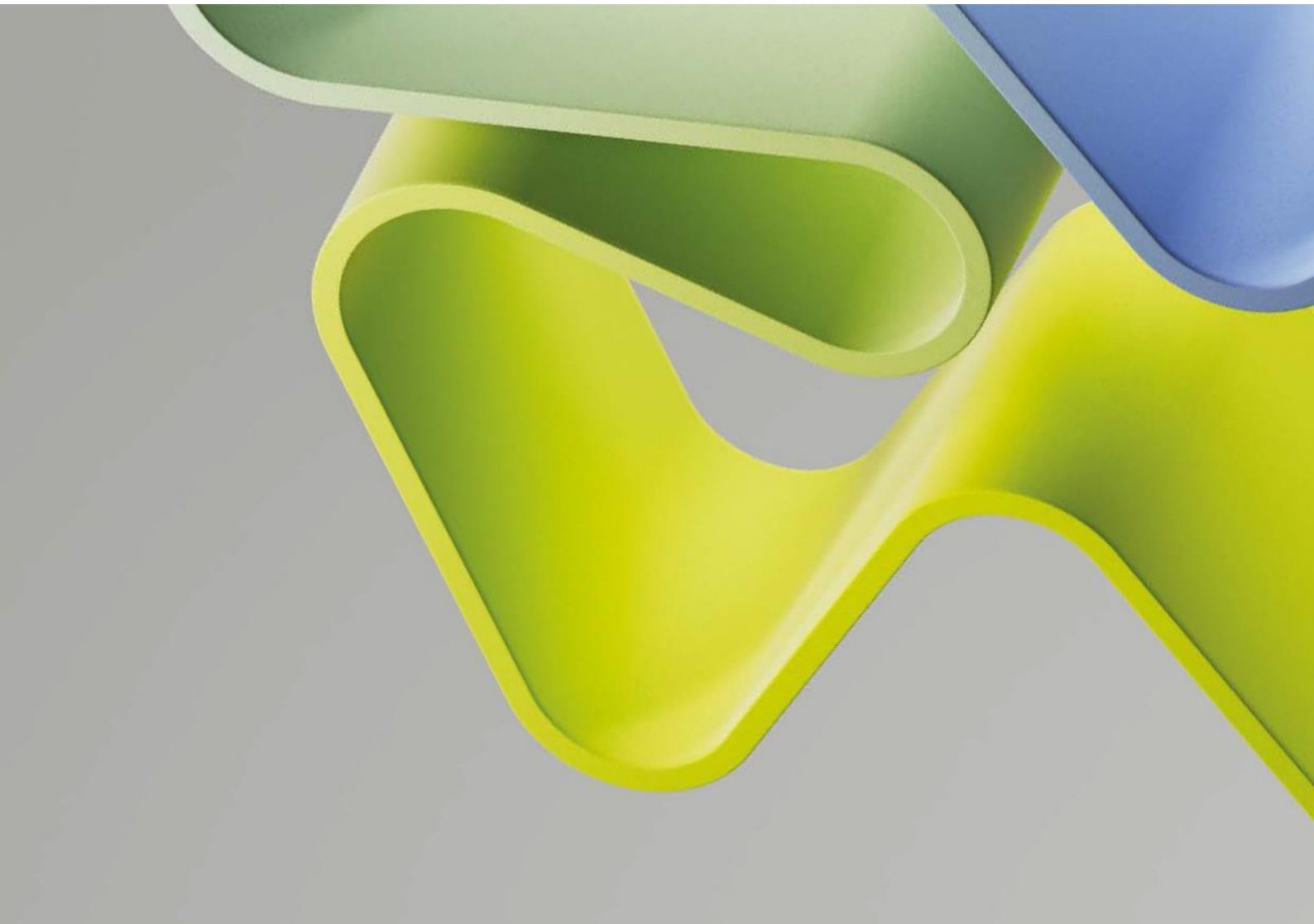
## Evaluation Report for Administrative Unit

Administrative Unit: **Department of Civil and Environmental Engineering (DCEE)**

Institution: **Norwegian University of Science and Technology (NTNU)**

Evaluation Committee Higher Education Institutions 4

December 2024



## Contents

## Statement from Evaluation Committee Higher Education Institutions 4

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

- Department of Building, Energy and Material Technology, UiT the Arctic University of Norway
- Department of Architecture and Technology (IAT), Norwegian University of Science and Technology (NTNU)
- Department of Civil and Environmental Engineering (DCEE), Norwegian University of Science and Technology (NTNU)
- Department of Geoscience (IGV), Norwegian University of Science and Technology (NTNU)
- Department of Structural Engineering (KT), Norwegian University of Science and Technology (NTNU)
- Department of Manufacturing and Civil Engineering (IVB), Norwegian University of Science and Technology (NTNU)
- Department of Energy and Process Engineering (EPT), Norwegian University of Science and Technology (NTNU)
- Department of Built Environment (BE), Oslo Metropolitan University (OsloMet)
- Department of Energy and Petroleum Engineering (IEP), University of Stavanger (UiS)
- Department of Mechanical and Structural Engineering and Material Science (IMBM), University of Stavanger (UiS)
- Department of Process, Energy and Environmental Technology (PEM), University of South-Eastern Norway (USN)

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 has consisted of the following members:

Professor Claudio Mazzotti, University of Bologna (Chair)

Professor David Baglee, University of Sunderland

Professor Elsa de Sá Caetano, University of Porto

Professor Sebastian Geiger, TU Delft

Professor Per Heiselberg, Aalborg Universitet

Professor Mohamed Pourkashanian, University of Sheffield

## Description of the Administrative Unit

The department's scientific staff includes 37 professors, 17 associate professors, 3.1 adjunct professors/associate professors, 64.4 PhD candidates, 6 research assistants, 15.2 postdocs, and 10.3 researchers. There has been a notable increase in female researchers. Although less than 20% of the professors are women, 35% of the associate professors are female.

The department is organised into eight research groups, along with technical and administrative staff groups. Each research group is led by a leader appointed by the head of the department and the dean. The deputy head of research coordinates common research activities and supports the head of the department in establishing and following up on the research strategy. This deputy also leads the research committee, supported by two permanent research advisors. Additionally, the department has an internal EU Forum, which includes the two research advisors and two senior professors with European Commission experience, providing hands-on support for finding relevant calls and advancing application processes.

From the unit's perspective, in recent years, the unit management group has evolved into a cohesive management team, with research group leaders contributing to the department's strategy rather than just representing their own group's interests. The department covers a wide range of research topics, with research largely driven and coordinated by the research groups, which decide on the fields and types of research their members undertake and contribute to.

The research is organised in the following research groups:

- Building Process (BP)
- Building Technology (BT)
- Geomatics (GM)
- Geotechnical Engineering (GT)
- Hydraulic Engineering Group (VT)
- Marine Civil Engineering (MB)
- Road, Railway and Transport Engineering (VJT)
- Water and Wastewater (VA)

The department's strategy plan for 2023-2026 aligns with the university and faculty strategies, emphasising sustainability and energy. The research strategy focuses on developing talents and outstanding research environments, enhancing research quality, and fostering interdisciplinary research. Key goals include increasing success in competitive arenas, strengthening research collaborations, improving publication quality, and promoting open access to research. These goals are supported by specific subgoals and tasks, such as enhancing positioning and networking. The department is also creating a strategic staffing plan to ensure a diverse mix of competencies, with a particular focus on attracting international and female researchers. This plan aims to meet the diversity and equality goals outlined in the NTNU and IV strategy plans.

The department has a strong network of collaborations with stakeholders across public, private, and third sectors, as well as with research institutions and universities in Norway. These connections, particularly in civil and environmental engineering, involve public organisations like Statens Vegvesen (SVV), Miljødirektoratet, and Noregs vassdrags- og energidi-

rektorat (NVE), and are institutionalised through the Næringslivsringen (NLR) initiative. Currently, the department is focusing on expanding international collaborations, as shown by the increasing number of international co-authors. Researchers are building networks with European and international institutions, for securing EU-funded grants. These collaborations support joint projects, educational activities, and the personal and professional development of researchers and students through exchanges and shared knowledge. Strengthening these ties aims to enhancing the department's and university's roles globally, facilitating quicker adoption of research and implementation of solutions to pressing issues.

## Overall Assessment

The AU Department of Civil and Environmental Engineering (IBM) is a department with more than 50 professors, organised into 8 research units. Given the recent reorganisation of the Department, its staff is still hosted inside different buildings, with some of them outside the main location.

The strategy in terms of scientific goals seems to target actual challenges and topics and it is properly aligned with the strategies set by NTNU and the Faculty of Engineering; on the other side, the organisation to reach those goals seems not always effective. In fact, the layered and properly organised structure that should orient the research activities is, probably, sometimes bypassed by the single research group specific characteristics. The strategy of the Department could be defined as “mainly reactive” to the external inputs coming from administrative entities of higher level and from the scientific community, taking also into account the opportunities given from the market (ToR 1 and 5).

There is a structured organisation of the research; this has the potential drawback that a number of professors is strongly involved in administrative activities, thus limiting their capacity of attracting funds and of mentoring PhD students, due to time constrains.

In the last years the Department suffered some re-organisations of its RGs with separations and changes of buildings. The strategic plan seems to not address the possible issues related to the organisation of research activities carried out by members located in different places nor the necessity to follow closely the development of the new formed RGs. Some of the newly formed research groups are adapting to their new dimension and particular care should be used to allow them to properly align to the general departmental strategy (ToR 2 and 4).

The Department shows a yearly funding of approximately 105 MNOK, which is a relevant amount. Unfortunately, there is not a robust positive trend. The quality and the broadness of the research activity carried out at the department is not properly reflected by the attracted funding. There are some RGs which excel in this while others are less effective in translating their competence in funding.

The level of involvement in the national research infrastructures seems too low; in terms of international infrastructures, practically, IBM has no role, and this is quite relevant since this type of involvement can provide large visibility, respectability and authority.

IBM facilitate the collaboration with external partners trough the industrial link and the activity of Green2050. The intensity of national collaborations is also shown by the number of external co-authors included inside the publications from IBM. As for the international collaborations, IBM has a strong strategic focus on increasing and strengthening them. After the COVID event, a reduction of international co-authorship can be observed in the publications. The interdisciplinary research carried out at IBM seems strategic to tackle modern research issues and to gain that critical mass which can allow the AU to become a reference subject at the national and international level and to future proof its strategy (ToR 7).

Considering the research staff, there seems to be a non-optimal ratio among the different roles, with a too large number of professors, when compared to associate professors and a too small number of researchers-postdocs. The number of PhD students, the backbone of the research activity, per professor (1,4) is above the average of the AUs assessed in the present exercise but is rather low, to the committee knowledge, in international comparison and to meet the AUs expectation of research excellence.

Actually, the female's share globally (27%) is in line with the average of the administrative units (25%); nevertheless, the share for professors is small (14%) but the declared recruitment policy should increase this value. From the data collected, it is possible to observe that a great effort has been devoted to the increment of female professors while at other levels of the career, the trend is not positive. The career opportunity for female is structured and satisfying.

IBM publication strategy shows a stable trend towards the increment of Open Access publications, aligning properly with the international scientific trend.

Research activity developed at IBM led, along the years, to a growing number of publications. They are of high quality and mostly published in leading journals. The general number is comparable with that of others reputed European Department, but it is not evenly distributed across the different RGs. The hierarchical structure for controlling the research integrity is good and at the level of internationally reputed research structures.

The unit follows NTNUs practices and policies regarding the protection against any form of discrimination and to promote diversity. IBM takes actives measures in the recruiting process to make IBM more diverse and it starts to promote diversity already among the master and PhD students.

The Department provides a relevant impact to all three purposes of higher education institutions. It provides a clear contribution to innovation and commercialisation through its Innovation committee and its activities; this happens in coordination with IV activities on the matter.

The quality of Impact cases provided is apparent and of a high level. The Department is involved in many activities connected to important public authorities since a long period of time. The relevance to society of many described impact cases led to changes in terms of corresponding standards and guidelines' improvement or by changing administrative procedures.

The Department, through its articulation, has a strong potential to effectively provide a relevant impact to society. Its RGs developed innovation inside hot topics for societal development. These contributions have made a significant impact on the Norwegian Long-term plan for research and higher education. They address broader societal challenges and align with the United Nations Sustainable Development Goals, promoting a more sustainable and resilient future. Overall, the AU IBM is a well-organised system characterised by a good management structure, relevant KPIs and some excellence in different sectors. The RGs follow their activity according to approaches often quite different, probably reflecting their attitudes and characteristics. This is not a flaw in principle, but all the efforts should be made more coherent with the general strategy. The research quality is of a high level and many relevant topics are properly covered. Suggestions and recommendations given in the following should increase the probability of success of the AU, its visibility, impact and international recognition. By following them and making a further effort to improve the strategy towards a more active approach, will make it possible to obtain a major impact on the international arena and to future-proof the AU, mitigating the impact of the change in national policy.

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

## Recommendations

1. Given the dimension and the research and teaching capacities of the Department, it should try to shift from a reactive strategy to a pro-active one, where the AU can become an active subject in the definition of strategies of higher-level bodies. Such a

strategy development could start with a series of away days, horizon scanning activities, and/or workshops to identify new thematic and cross-cutting research opportunities for the department.

2. The weaknesses in terms of strategy reported for some research groups should be addresses properly, eventually also using possible incentives. E.g. possible limited incentives in terms of budget or staff, could be assigned to those groups coordinating European projects or remarkably improving their societal impact, etc…
3. Since in various RGs the administrative burden of the permanent staff is quite heavy (e.g. Geomatics, Building process), it should be reduced to allow the group to properly develop the required strategic actions.
4. Bring the attention of all the staff on the importance of multidisciplinary research, pushing them to work across the RGs, eventually by introducing some incentives or some type of recognitions inside the evaluation parameters of the Department. Actually, some RGs like Geotechnical Engineering, Geomatics, Road, Railway and Transport Engineering seem not properly aligned with this cross-disciplinary effort. At the same time, it could be part of the general strategy the definition of cross-departmental themes that multiple RGs contribute to, e.g. through internal/external workshops.
5. As a general suggestion, often inside these so large Units it is effective the introduction of a limited number of parameters able to describe the alignment of every single RG along the strategic directions stated by the Department. Their yearly evaluation can constitute an additional information, useful to the definition of the recruitment plan. Professors are sensitive to recruitment.
6. The research committee should increase the awareness of the different group leaders about the importance of differentiating and increasing the sources of funding. This renewed effort could try balancing (at least partially) the expected budget reduction from the central administration.
7. At least in some areas, may be the most active or of international perspective, IBM should try getting a role in the management, use/access of some international infrastructures on a permanent way, through some structured collaboration.
8. The AU should focus on the involvement of all the RGs in the hunt for collaborations, explaining them this is the path to funds, recognition, growth and to a modern and more internationally sound research oriented didactic.
9. The number of PhD students should be strongly increased. To this purpose, more resources are needed, which could be found from research projects with private companies and more European projects. Not all the RGs work in the same condition, so the improvement could be selective and not generalised, to save resources.
10. A possible measure to increase the number of sabbatical leaves could be to reduce their duration, for example six months or similar.
11. The framework set-up by IBM for managing the diversity concept seems more than appropriate. In addition to this, some mandatory courses about diversity and how to communicate it could be useful for the professors also.
12. There is a number of tools which could be used to enhance the impact and the societal relevance; i.e. some yearly events hosted directly inside the IBM labs to get in contact with stakeholders and engineers: i.e. Open days to present the IBM activity and understand the company’s expectations or Recruitment day to get in touch graduate students and public or private entities.

# 1. Strategy, Resources, and Organisation of Research

The AU IBM developed a strategic plan for the years 2023-26, where the quality of research is one of the four main pillars. The main addresses of the plan are coherent with the strategic plans produced by NTNU and the Faculty of Engineering (IV). In particular, two of the four strategic areas identified by NTNU are closely related to the activity of IBM: sustainability and energy. IBM also actively contribute to some of the strategic goals of IV: green shift in the built environment, sustainable and safer energy and leadership in Nordic region, involving a number of different research fields, e.g. multi-performances materials and components, smart roads, durability in harsh environment, etc.

The broad range of topics and competences, push IBM to establish multidisciplinary research across some different domains. One result of this approach is the centre "Green2050", working on the green shift in the built environment. Nevertheless, some RGs seem less involved in this multidisciplinary effort than they should be. The general strategy has been articulated in a number of key goals and sub-goals pointing at excellence in multi- and cross-disciplinary research, opening to external public and private research partners, facilitating knowledge trough open-access publications. Starting from these resources, the research activity is then to a large extent driven and coordinated by the research groups.

From the administrative point of view, the research strategies set by the Department are monitored and coordinated by a research committee, presided by the deputy department head, who is also supported by two permanent research advisors. There is also an EU forum to facilitate European calls' participation.

The strategy in terms of scientific goals seems adequate and targeting actual challenges and topics; on the other side, the strategy to reach those goals seems not always fully effective. In fact, the activity of the layered and properly organised structure that should orient the research activities is, probably, sometimes made more difficult by the single research group specific characteristics. This leaves random inhomogeneities among the research groups in terms of type of funds attracted, of projects, societal impact and relevance.

The described organisation to sustain the research activity is properly structured, with a research committee, two permanent advisors and an EU forum which can sustain all the research needs of the professors.

### 1.1 Research Strategy

The AU IBM developed a strategic plan for the years 2023-26, where the quality of research is one of the four main pillars. The main addresses of the plan are coherent with the strategic plans produced by NTNU and the Faculty of Engineering (IV). In particular, two of the four strategic areas identified by NTNU are closely related to the activity of IBM: sustainability and energy. IBM also actively contribute to some of the strategic goals of IV: green shift in the built environment, sustainable and safer energy and leadership in Nordic region, involving a number of different research fields.

The subjects considered represent real challenges of the modern society and at the edge of high-level research. Working in this framework will contribute to the development of the research environment, requiring the development of new technologies, materials, processes and management systems. After the general statements, there is also a list of more specific elements and aspects which cover a broad range of goals hidden behind the general concept of "enhancing the quality of research". They are further articulated in more specific strategic actions. This properly organised structure seems effective, at least at the general level.

From the assessment forms of each research group (RG) belonging to the department, it can be observed that not all the RGs follow the same general address. As an example, the Geotechnical group could improve the level of its strategic perspective, the road, railway and transport group could improve the interdisciplinary research activity, given the intersection with the digitalisation issue. The building process group could better align with European strategies, in order to excel at an international level. Different groups do not seem to follow the general strategy for the personnel, facing the gender issue, presenting a limited number of PhD students and with some problems due to the turnover of staff members.

In the last years the Department suffered some re-organisations of its RGs with separations and changes of buildings. The strategic plan seems to not address the possible issues related to the organisation of research activities carried out by members located in different places nor the necessity to follow closely the development of the new formed RGs.

No particular attention is devoted in the strategic plan about possible measures to better integrate the activity of two research groups which are not in the same space as others nor for members assigned to different groups in relation to research affinity. At the same time, new research groups have recently formed from the splitting of previous larger groups (tor 2-4).

Recommendations to the administrative unit.

- The proposed strategic plan is credible, but it must be followed by all the research groups. The adopted top-down approach should be better shared-with and accepted-by all the group leaders, which has the task to make it happen.
- The weaknesses in terms of strategy reported for some research groups in the previous section should be addresses properly. The layered organisation of the Department should find a way to control and sustain the application of the strategic policy, eventually also using possible incentives. E.g. possible limited incentives, in terms of budget or staff, could be assigned to those groups coordinating European projects or remarkably improving their societal impact, etc…
- Since in various RGs the administrative burden of the permanent staff is quite heavy (e.g. Geomatics, Building process), it should be reduced to allow the group to properly develop the required strategic actions.
- A specific focus should be placed in the level of engagement in the general departmental strategy by the staff members working in buildings separated by the headquarter. Close attention should be also placed in the way the new RGs are developing their research organisation and internal coordination.
- Inside the recently formed research groups, it could be analysed the level of effectiveness of the internal organisation they have defined.

### 1.2 Organisation of Research

IBM recently modified its articulation in Research Groups, by dividing some existing ones in a number of smaller ones, more homogeneous in terms of scientific interests (see the self-assessment form). If this is useful to improve the internal coherence, management and discussion, it could make more difficult the planning and development of interdisciplinary activity, which is of paramount importance in the actual framework of innovation and sustainability.

The described organisation to sustain the research activity is properly structured, with a research committee, two permanent advisors and an EU forum which can sustain all the research needs of the professors. The EU forum covers the European calls while the advisors provide insight for other types of research funds and opportunities. It is really positive that

the components of the management team have actually the only purpose to push the departmental strategy, leaving in the distance the local interests. Nevertheless, sometimes the specific characteristics of each research group seems to prevail on the general strategy. This leaves random inhomogeneities among the research groups in terms of type of funds attracted, of projects, societal impact and relevance.

The hierarchical organisation of the research actively contributes to the strategy of the Department and those of higher Institutions. At the same time, it offers support for the internationalisation and careers opportunity. The recruitment and the mobility opportunity, analysing the available data, could better supported. Of course, the available Department's budget is a rigid constrain which cannot be forgotten.

Adoption of a structured organisation has the drawback that a number of professors is strongly involved in administrative activities; this burden can limit their capacity of attracting funds and of mentoring PhD students, due to time constrains.

Recommendations to the administrative unit.

- Bring the attention of all the staff on the importance of multidisciplinary research, pushing them to work across the RGs, eventually by introducing some incentives or some type of recognitions inside the evaluation parameters of the Department. Actually, some RGs like Geotechnical Engineering, Geomatics, Road, Railway and Transport Engineering seem not properly aligned with this cross-disciplinary effort. At the same time, it could be part of the general strategy the definition of cross-departmental themes that multiple RGs contribute to.
- The Department should organise some mentoring and coaching of staff focusing the attention and the energy of the colleagues in strengthening those activities that are weaker (and specific) inside their RG (e.g. societal impact, European funding, private funding, etc…).
- As a general suggestion, often inside these so large Units is really effective the introduction of a limited number of parameters able to describe the alignment of every single RG along the strategic directions stated by the Department. Their yearly evaluation can constitute an additional information useful to the definition of the recruitment plan. Professors are really sensitive to recruitment.
- It is suggested to improve the conditions under which a larger number of professors could consider the possibility of taking a sabbatical leave. This could strengthen the international collaboration, the reputation of the department, its recognition at least at a European level and the possibility to attract the best young researchers/PhD students from abroad. Eventually shorter periods of leave could be suggested, if better accepted or feasible. In this framework, the Department could work on the administrative and didactic burden of the professors.
- Please, consider the possibility of using resources coming from activity for private companies to cover the salary for the best master students, before becoming PhD students, or to finance PhD scholarships.

### 1.3 Research Funding

According to the self-assessment form, the Department shows a yearly funding of approximately 105 MNOK. Even if it is claimed that in the last years there was a reduction, if the 20 MNOK per year (given for a specific project) are removed from the budget of 2018 and 2019, the annual income seems not too variable. Unfortunately, there is a stagnant number, which is not optimal in perspective considering inflation and higher overheads.

The quality and the broadness of the research activity carried out at the department is not properly reflected by the attracted funding. There are some RG which excel in this while others are less effective in translating their competence in funding.

The AU organisation supports the application for external funding through the research committee, the permanent advisors and the EU forum. Nevertheless, the amount of funding attracted for private projects is not completely satisfying, according to the Committee's view, and below the potential of the RGs of the Department.

The rate of success in applying for national grants is satisfying while that for international ones could be more and better distributed among the different RGs. After an initial stage where the European funds were targeted as partners, the strategy is shifting towards coordinating this type of initiatives.

Recommendations to the administrative unit.

- The research committee should stress more the commitment of the different RGs to the differentiation of funding' sources. As an example, the groups of Geomatics, Geotechnics, Road, railways and transport, Building technology and to a less extent Water and waste water could focus more on attracting more research funding from the industry. This could give them the opportunity to have resources for more PhD students, to put fundamental research into applications and to create partnerships needed for future large-scale consortia. Building technology, Geotechnics and Road, railways and transport should pay attention also to European calls, thus increasing their visibility and impact.
- Although the number of applications for European funds, according to the Committee view, is quite satisfactory, it is recommended to continue maintaining the focus on this issue, to improve it (at least in some RGs) and to oversee the coordination aspect of European initiatives, in order to become an internationally recognised partner.
- In general, the didactic and administrative organisation of the Department should try leaving more time to professors for funds application and, at the same time, to introduce some evaluation parameter connected to fund attraction.

### 1.4 Research Infrastructures

The AU researchers have access and are using 4 national infrastructures, mainly in the area of "environmentally friendly energy". They are: Sigma2, NorFab, NSST and SIOS. Actually, the Department is trying to join the new initiative SOLARLAB. These infrastructures are not used by all the RGs but mainly by Building tech and Marine Civil Eng. Sigma2 is used by several RGs. None of these infrastructures is led/coordinated or hosted by IBM. Other RGs has access and use to other local infrastructures and labs (i.e. Hydraulics, Geotechnics, Road, railway and transport, Water wastewater).

IBM has been and is actually involved in other projects involving some infrastructures listed in the Norwegian roadmap for research infrastructures. They mostly belong to the areas of Geotechnics, Hydraulics and Building technology.

IBM is not participating in any international infrastructure, but it is collaborating with two of them: ESA (Geomatics) and SIOS (Marine Civil Eng). At the same time, IBM is not participating in any ESFRI infrastructures.

Considered that IBM aspires at becoming leader within its areas of expertise at national level and among the best in the international arena, the level of involvement in the national infrastructures seems too low; in terms of international infrastructures, practically, it has no role,

and this is quite relevant since these types of involvement can provide large visibility, respectability and authority.

In general terms IBM follow the FAIR principle, even if no specific details are provided other than the general rules adopted by NTNU.

Recommendations to administrative unit.

- At least in some areas, the most active or of international perspective, IBM should try getting a role in the management, use/access of some national infrastructures on a permanent way, through some structured collaboration. This will increase visibility, attraction of resources and possibility of hiring more researchers. To make this possible, a potential reorganisation of the time allocated for the different activities could be necessary for some professor or researcher.
- Even if it is not an easy task, the same should be done at an international scale. To achieve this goal, the RGs should reach a remarkable level of international recognition and capacity of innovation.

### 1.5 National and international collaboration

The AU has a large number of National collaborations both with private and public entities. Unfortunately, they seem not to be uniformly spread across the wide spectrum of competencies of the Department but mainly concentrated with few RGs: Hydraulics, Road, railway and transport and to a lesser extent Water wastewater and geomatics. Collaborations are mostly with relevant public stakeholders and a team of private companies, which is a good mix for relevance and importance. The link with the private sector is also strengthened by the introduction of the “industry ring” (NLR), organised within NTNU.

The AU facilitate the collaboration with external partners trough the industrial link and the activity of Green2050, whose office at NTNU is located inside the Department, boost the inter- and trans-disciplinary research.

The intensity of national collaboration is also shown by the number of external co-authors included inside the publications from IBM. Again, the number is good but not uniformly distributed across the RGs.

As for the international collaborations, IBM has a strong strategic focus on increasing and strengthening them. Actually, there are already consolidated collaborations with important European Universities and lot of activity is carried out within the Built4people European initiative, where IBM is represented.

The international co-authorship has been growing in the last decade, but an inverse trend can be observed starting from 2020. This element should be carefully analysed, and some actions should be taken.

Nothing is said about international collaborations outside Europe, if any. These types of relationships, when developed towards highly developed countries, can boost the relevance and recognition of the Department; when they are developed with developing countries, they can allow exporting modern and sustainable models towards a large share of population and can attract relevant funds and strongly motivated students.

This collaboration profile is not fully satisfying and only partially meets the vision of the Department, which aspire to a role of leadership and to excel at a national level and to be easily recognised at an international level. In any case, the present collaborations are important,

and they represent an added value to the research quality and impact of the research carried out at IBM.

Recommendations to administrative unit.

- The AU should put a lot of energies towards the involvement of all the RGs in the hunt for collaborations. The expected outcomes in terms of funds, recognition and more internationally sound research oriented didactic outweigh the effort required.
- The Department could push activities like sabbatical leave and mobility to make international collaborations easier.
- Internal workshops and meetings could be organised to target strategic collaboration at the department level, thus coordinating the efforts of the whole staff towards along shared directions.

### 1.6 Research staff

The number of researchers decreased after 2013, with a proper redistribution between associate professors and post-doc. Recently (2021), the number of professors strongly increased while the numbers of PhDs is quite stable. In the last years, there seems to be a reduction of permanent staff due to economic contingencies, reducing the public funds.

Actually, among the various levels of the academic career, there seems to be a not optimal ratio, with a too large number of professors, when compared to associate professors and a too small number of researchers-postdocs. This is really expensive and not so effective for the development of the research activity. The average ratio between the number of PhD students (the backbone of the research activity) and that of professors is 1,4 in average. Although slightly above the national average, this parameter, in the Committee view, is not too satisfying at an international level and by considering the ambition of the Department to excel in the research.

In terms of age distribution, each group of professors has a satisfying age range and in the close future no particular concerns can be observed. This distribution will also allow a smooth succession plan. The AU is expecting a relevant reduction of FTE in the coming years and, consequently, it has introduced a two ways recruitment policy: 1) to tackle the issue of turn-over, 2) to introduce some strategic initiatives to open new opportunities.

Actually, the female's share globally (27%) is in line with the average of the administrative units (25%); nevertheless, the share for professors is small (14%) but the declared recruitment policy should increase this value and we have to also consider that the number of female candidates embracing the civil engineering academic career is only recently increasing. From the data collected, it is possible to observe that a great effort has been devoted to the increment of female professors while at other levels of the career the trend is not positive. This is an element of great attention. The career opportunity for female is structured and satisfying.

In order to boost the international networking activity, a number of foreign professors have been recruited. This is the right direction to rapidly pursue the internationalisation of the Department.

The theoretical time devoted to research (40%) for professors seems adequate; nevertheless, this parameter is strongly inhomogeneous throughout the different RGs, since some of them are really active, others less. It should be better controlled through the RG leader.

The sabbatical leave option is considered only by a very limited number of professors due to family constrains and budget and teaching issues. Mobility opportunities are structured inside a framework of possible funding and are often project-based. NTNU doesn't encourage travels mainly for a sustainability reason. Please consider that travelling if of essence for a researcher aiming at building a solid national/international network. Online meeting can help but are not sufficient.

Recommendations to the administrative unit

- The number of PhD students should be strongly increased. To this purpose, more resources are needed, which could be found from research projects with private companies and more European projects. Not all the RGs work in the same conditions, so the improvement could be selective and not generalised, to save resources.
- Pursuing the recruitment strategy will not be easy in a situation of reduced budget from central administration. For this reason, the (few) new strategic initiatives could usefully be flanked by a robust increase in PhD students and post-docs; the necessary funds can be found by embracing a thematic approach, since big funding opportunities are across disciplines. Accordingly, the Department needs good collaboration among the groups (and horizon scanning to create themes); this activity, given the large dimensions of the AU, needs to devote time to build international collaborations to be a trusted partner and leader in EU projects.
- The Department should keep monitoring the application of modern policies increasing the number of female researchers, especially among the professors. This can be done also by starting from the PhD level.
- The tenure-track for early researchers could be improved by addressing them along topics fundamental for the strategic Department plan and by developing dedicated mentoring and coaching activities.
- A possible measure to increase the number of sabbatical leaves could be to reduce their duration, for example six months or similar.

### 1.7 Open Science

IBM follows the NTNU open science Policy, active since 2020. It applies to research outcomes, teaching and dissemination activities. The key principle is "data and results should be accessible *as open as possible but as closed as necessary*".

Analysing bibliometric data, it can be observed that in the last decades IBM has moved from a share of about 70% of not OA publication to an actual share of about 45%. This value is close to that of most of others AUs but could be improved, given the expectation of IBM to push the quality of research. The trend of the last 5 years is affected by the embargo period of 2 years. It is not so clear the role of the embargo and its impact on the concept of open science.

Researchers also follow the policy introduced by NFR and the EU Commission when dealing with projects funded by those entities.

In terms of IPR policy, IBM follows that introduced by the University centre. There is a structured organisation to promote and to uniformly apply the concept of Intellectual Property.

University library provides services on data research management and open science

Recommendations on how to promote open science

- It could be useful to introduce mandatory courses for PhD students on Open Science and its rules and opportunities.
- To boost OA publications, it is useful the availability of a department fund to sustain, at least partially, the expenses to be covered by researchers for publication. These resources can complement the funds from the University and provide a clear statemen of the department in this respect.

## 2. Research production, quality and integrity

Research at IBM covers a broad range of research topics belonging to Civil and Environmental Engineering. They span from water to soil, buildings, energy, positioning, monitoring and transportation. They are all connected by two general key concepts of sustainability and clean energy production, while focusing on materials, technologies and processes. At the same time, all the research fields present the common need of the digitalisation.

Most publications fall within the “construction engineering” area but, since all the cited components heavily interact among them, the research at IBM can easily be multi-disciplinary and can produce publications falling inside other areas like “energy” and “material science”. The constant and increasing attention to the environmental issues, makes the share of publication belonging to the area of “geosciences” continuously growing. The introduction of digitalisation has recently led to an increasing number of publications inside the “informatics” area.

Publications covering some specific topics (i.e. coming from water and wastewater, marine sectors) are hidden inside the general area of “construction engineering” or that of “energy” (hydropower and geothermal energy).

There are publications falling inside some areas of strong national focus like mobility conditions in the north, polar regions, effect of ice in rivers and on solar panels for the energy production, digitalisation of building technology and process. Other publications focus on international topics like solar- and hydropower or water and wastewater management or satellite survey.

Research activity developed at IBM led, along the years, to a growing number of publications. Actually, the general figure is at the level of many international recognised Departments, but it is not evenly distributed across the different RGs. The research can be considered state-of-the-art and mainstream, within a broad range of strategically relevant topics. The quality of the research is very good with most of the papers published in reputed journals.

IBM follows the university general policy for research integrity and guidelines for the treatment of possible scientific dishonesty. Every employee has an independent responsibility that research takes place in accordance with good research practice, recognised scientific and ethical principles.

The PhD students have to follow a mandatory course where a part is devoted to research ethics, publications, co-authorship and Vancouver recommendations.

NTNU has proper guidelines on how to report suspicion of, and how to act upon such notification of the suspicion of breach of research integrity rules as in falsification, fabrication and plagiarism. They are judged as robust.

The layered structure for controlling the research integrity is good and at the level of internationally reputed research structures.

### 2.1 Research quality and integrity

**Research group Building process overall assessment**

The group's research contribution to the field of project management and construction engineering is convincing through its legacy initiatives and research projects (strength). However, the impact of this seems to be hampered by the wide spectrum of research applications covered by the group, ranging from sustainability in built environments to productivity management (weakness).

The group seems to be operating at capacity with a high workload and research management commitments that are somehow impacting on the research outputs, including scientific publications of the group, as several of these are led (first author) by researchers outside the group or PhD students (weakness). The number of publications in leading journals should be increased, to reflect its impressive portfolio of funded research and the number academics.

A great deal of the funding is dedicated to coordination and strategic actions. The group should endeavour to attract more mainstream research funding with a focus on European funding, such as Horizon Europe (challenge) so to diversify its grant capture by focussing more on research initiatives.

The group's workload, and legacy research projects, may be a potential blocker for further grant capture. This should be overcome by either increasing the size of the group or reducing its teaching and admin workload. The research strategy of the group should be aligned with the European Commission Green Deal or ECTP strategic actions to ensure successful participation to ongoing EC programmes.

**Research group Building technology overall assessment**

The group is making clear contributions in the field of zero emissions neighbourhoods and buildings, energy saving and innovative materials in buildings, fire research and innovation in buildings. The projects have a very good scientific quality and demonstrate various collaborations with research and industry partners at national and international level (strength).

The group has clearly demonstrated its very good capacity to produce research outputs in international scientific peer-reviewed journals (strength). There is a good international cooperation in the publications, even if it could be improved. The number of books and conference papers is a little bit too high and should be reduced in favour of journal papers (challenge).

Research topics are original and innovative, in line with European and international trends. The group also seems to have a good ability to attract national funds, but not as good concerning European and industrial funds. International cooperation seems limited and not structured (weakness). In fact, most of the projects seem to be coordinated by the national research infrastructure SINTEF.

**Research group Geotechnical engineering overall assessment**

The research profile of the research group provides a holistic approach to geotechnical engineering, incorporating field and laboratory testing as well as numerical and analytical methods in the field of soil mechanics. The group is involved in the development and establishment of a national research test site facility for geotechnical research (strength).

The research projects and publications are on high level with a high relevance for successfully mastering the energy transition. Research topics are innovative and on a high level for emerging topics such as climate and digitalisation. The research infrastructure is excellent.

Actually, the funds attracted by the industry and the number of PhD students working inside the group are too limited (weakness). It is recommended that the activities remain in the current scope under continuous assessment and adaptation to future requirements. Furthermore, it is recommended that the existing excellent research infrastructure is further evolved strategically to attract more commissioned research and research with industry. It is recommended to expand international research- oriented relations and cooperation. With new available funds, the number of PhD students could be more easily self-financed (challenge).

**Research group Geomatics overall assessment**

The research profile of the Geomatics groups covers three core elements of geomatics, i.e., (1) geographical information science and cartography, (2) geodesy and global navigation satellite systems (GNSS), and (3) photogrammetry and 3D modelling. For each of them there is a professor covering the topics: this is a strength. The group has competences that contribute already to a strong profile, which however could be further elaborated to exploit possible synergies (challenge).

One of the professors is involved in the scientific consortium of a European Space Agency satellite mission, which is an example of the international recognition the group receives. Several group members are in key positions, e.g., on editorial boards of relevant scientific journals. Having reached the final stage in the competition for a European Research Council grant can also be considered as a success, although the grant so far has not been awarded.

It is suggested to keep the focus on high-quality research and apply to large interdisciplinary projects, where their transversal competences are often requested (challenge). At the same time, the research activity with private companies and partners could receive more attention, so that new resources could be attracted and used to support more PhD students.

The selected publications show a very high quality of research developed by the group.

**Research group Marine civil engineering overall assessment**

The group’s activity covers numerical modelling of waves and hydrodynamics, offshore wind and cold climate and arctic technology. The research group has made significant national and international contributions in the above-mentioned research fields (strength).

All publications are of high international scientific quality and provide a significant scientific contribution to the research perspective of development in the respective fields (strength).

The sources of funding are well balanced and include RCN and other national organisations, Norwegian industry and the EU framework programmes. The amount of funding received is relatively high (strength). The research group has sufficient facilities and infrastructure resources at its disposal. Nevertheless, it is not involved in research projects that require other Norwegian and/or European research infrastructures for their implementation (weakness).

To increase the interdisciplinary research within the research group could have a significant impact on increasing the quality of research (challenge).

Further effort is needed to increase the number of PhD students and more mentoring and other support is essential to retain them for the duration of their studies (challenge).

Strengthening the wind energy team, by hiring additional highly qualified scientists, will help advance the global effort to support the production of sustainable energy.

**Research group Water and wastewater systems engineering overall assessment**

The group's focus is rather broad, covering water and wastewater treatment, sustainable stormwater management, urban water systems, asset management and nature-based solutions. Its members have complementary skills and competences that are actively used to create a unique profile for the group.

The research group is well organised with a clear strategy and modus operandi and is well embedded in the Norwegian and European research landscape. The current level of research funding includes a range of Norwegian (decreasing trend) and notably prestigious EU grants (increasing trend).

The staff burden is quite high, and time availability can become a limitation for initiating new initiatives (weakness). The group has the potential to become internationally leading, if it can develop significant research based on own ideas and new theory with potential for achieving research excellence (challenge).

The group's publication strategy emphasises (i) publishing in high quality journals and (ii) actively seeking with high-quality research groups for the group's PhD students (who visit other research groups on secondments). As a fundamental tool for improving the quality and the impact of the research, the number of PhD students should be increased.

**Research group Hydraulic engineering overall assessment**

The research group at NTNU has an international reputation in the field within their 4 main areas of investigations: (a) Hydraulic/Hydropower Structures: this research is supported by both laboratory experiments and numerical modelling; (b) Cold Climate Processes: the group conducts both basic and applied research; (c) Environmental Impact of Hydropower: with over 30 years of experience; this work has led to the development of guidelines, design manuals, knowledge summaries for industry, and publications at national and international levels; (d) 3D CFD Modelling: the group is a pioneer in 3D Computational Fluid Dynamics (CFD) modelling of water and sediment flow. The group carries out research activities with very good quality according to international standards in these four fields.

They lead several projects at NTNU by collaborating with other groups within the university and also within international collaborations framework. The listed publications and their research outputs are clearly major and leading contributions. However, the scientific originality of the findings in the listed publications is limited (weakness) and gives space to further expansion of their domain of investigations with novel approaches (challenge).

In parallel of their applied research within industrial collaborations it is suggested to also strive to improve the research quality and impact with innovative methodological frameworks. Resources coming from industrial collaborations could be also used to increase the number of PhD students (challenge), actually too low (weakness) with respect to the number of Professors belonging to the group.

**Research group Road-, rail- and transport engineering overall assessment**

The research group covers the disciplines of railway engineering, road engineering and transportation engineering in its publications. This is a wide range (strength) and it provides interdisciplinary opportunities (challenge), due to the nature of these fields of research, intersecting with each other and a variety of other disciplines. At the same time, the research group consists of a comparably large number of professors, even though the number of PhD students are rather low (weakness).

The research group is well- equipped with a pavement material laboratory, snow laboratory and traffic engineering laboratory and is in charge of two research centres. Research is mainly financed by nationally funded projects, since the group has a clear focus on maintaining its role as the preferred partner of the Norwegian transport infrastructure owners. EU funding is existing, however on a comparably low level (weakness).

Research co-operation with other researchers within NTNU, and within both the Norwegian and the international research community has contributed to the group's impact. Their research activity helped translate international practise into Norwegian practise.

The group publish their results regularly in the leading field journals and it is well respected nationally and internationally. Nevertheless, the group might want to consider increasing the number of PhD students to grow their network of contacts nationally and internationally (challenge). A stronger emphasis on journal publication and quality would also help the group's international visibility. The broadness of the research profile is regarded as a strength; however, a stronger focus on the development of a research strategy on research group level is recommended.

## 3. Diversity and equality

The unit follows NTNUs practices and policies regarding the protection against any form of discrimination and to promote diversity at IBM. It promotes the use of the HMS portal (Health, Safety and Risk assessment) to report anonymously: damages, rule violations, violation of ethical norms or others serious matters.

IBM takes actives measures in the recruiting process to make IBM more diverse and it starts to promote diversity already among the master and PhD students. The communication advisor supports, from his point of view, the process of making diversity visible.

Overall, the framework set-up by NTNU for managing the diversity concept seems appropriate. However, IBM is encouraged to set its own policy and commit itself to DEI e.g. supporting students and staff with special needs. The department should also foster social and psychological safety in its work environment. In addition to this, some mandatory courses about diversity and how to communicate it could be useful for the professors also, since the PhD are professors of the future but now, they have other people organising and directing the Department and RGs.

Some RGs struggle to reach gender balance; the AU should try to understand the reasons behind and to introduce specific measures to reverse the trend, making some positions more attractive for women.

For safety, there is an HSE structure to inform and follow safety regulations. The ARK survey is an effective tool to develop a positive working environment.

In terms of safety in the working environment, it is not clear how it is taught and controlled. Are there safety courses? Are they mandatory and for whom? Since the professors are responsible for the PhD activity, it is useful and necessary that they are skilled in these matters.

## 4. Relevance to institutional and sectorial purposes

The Department provides a relevant impact to all three purposes of higher education institutions. In particular, provides education at a high international level by offering solid and high-

class fundamental knowledge, followed by integrating research, research methods and outcomes closely into the education of the students; it develops a large amount of research output both in projects as well as in publications, while maintaining a broad range of excellent cooperation partnerships. The dissemination is developed via different channels, communication channels but also via project results and integration of stakeholders directly into projects and research. A number of RGs could do more in this framework by increasing their social impact, through a more effective dissemination and engagement, beyond training students to a high standard or making publications.

IBM provides a clear contribution to innovation and commercialisation through its innovation committee and its activities; this happens in coordination with IV activities on the matter. At the same time, the podcast “lets talk innovation” helped rising the innovate climate among the staff members. As a proof, the number of Disclosures of invention (DOFI) steadily growth in the last few years. IBM willingness to open to market concretised in supporting and hosting to SFI initiatives like Samcot or Green2050, enabling an ecosystem of innovation.

Overall, the activities of IBM in this domain can be considered as good and articulated. Nevertheless, there is a number of tools which could be used to enhance the impact and the relevance, i.e. some yearly events hosted directly inside the IBM labs to get in contact with stakeholders and engineers: i.e. Open Days to present the IBM activity and understand the company’s expectations or Recruitment Day to get in touch graduate students and public or private entities. Even if NTNU already organises similar activities, the sector of constructions is really specific and requires a specific approach and organisation. Spin-off and patents are other tools that should be better exploited; particularly in a more homogeneous way inside the Department.

Results from the various research projects are implemented in teaching at master level and PhD-level courses. Research based teaching is focused on master level, where students are involved in on-going research projects through their thesis during the 10$^{th}$ semester. Some students are involved in research activities through research assistant positions announced by the department. This is a position where a student, typically in 3rd of 4th year, is hired to work on an ongoing research project. IBM seems to exploit properly the opportunities of an early introduction of research topics and challenges inside the teaching path, so to attract more students to the innovation arena and build for them a stronger career opportunity. The Undergraduate Research Opportunity Program (UROP) project, where students are paid to do limited research activity, could be better funded, possibly making use also of funds coming from on-going projects.

Overall, IBM demonstrates very good performance in research, education, and innovation, making significant contributions to both the academic and commercial sectors.

## 5. Relevance to society

The Department, through its articulation, has a strong potential to effectively provide a relevant impact to society. Its RGs developed innovation inside hot topics for the societal development like energy saving, mobility, climate adaptation, development of Nordic regions and building technology.

The quality of impact cases provided is apparent and of a high level. The Department is involved in many activities connected to important public authorities since a long period of time. The long-term collaboration with these bodies is an additional indicator of the quality of the results.

The relevance to society of many of the described impact cases is evident, since they provided a contribution in terms of corresponding standards and guidelines' improvement or by changing some administrative procedures.

What is not so evident from the self-assessment is the effort dedicated to the public dissemination of the results to society at large.

Another aspect to be considered is that not all the RUs are equally involved in this process of public engagement. A Department strategy in this respect could be useful to increase the visibility and the perception of the AU.

It is recommended to keep developing cases with an impact similar to that of those attached also in the future, since the latter mainly refer to a time period not always too close to the present; on the other side, the AU has the dimension, the potential and the relevance to have some of them continuously active.

Overall, these contributions have made a significant impact on the Norwegian Long-term plan for research and higher education. They address broader societal challenges and align with the United Nations Sustainable Development Goals, promoting a more sustainable and resilient future.

### 5.1 Impact cases

#### Comments to impact case 1: Concept Research Programme

The Concept Research Programme develops ways of improving the efficiency and effectiveness of major public investment projects, with particular focus on the front-end phase. This was an answer to projects experiencing major cost and schedule overruns and benefit shortfalls. The current version of the scheme includes external quality assurance (QA) of the decision documents at two points in the project's planning process: before the government's choice of concept (QA1) and before the parliament's final approval (QA2). The key activities are: 1) to collect data from the projects; 2) to conduct thematic studies on various topics, such as cost, financing, benefits, environmental impacts…; 3) a systematic ex-post evaluation of projects that are completed; 4) extensive dissemination activities towards the Norwegian target group; 5) collaboration with international researchers and dissemination of results in peer-reviewed journals and conferences.

Impact case 1 is of great relevance since it focuses mainly on the design and management of construction processes, which is one of the core areas of IBM; at the same time, Concept operates at the highest level of the national stakeholders (the Ministry of finance) and in the framework of very large projects. The importance and relevance can be also measured by data, which confirm an evident improvement of the cost and time controls of these large projects. A further proof is the actual application of this control program to other ministries and public bodies where it was not originally applied. In terms of strength, Concept has stood already the test of time, being applied since early 2000 and it is continuously improved and adapted to new innovation and challenges.

#### Comments to impact case 2: The Centre for Research-based Innovation SFI Klima 2050

Klima2050 is a research centre developing research and innovation inside a broad set of topics relevant for risk reduction of building and infrastructure in respect of climate change. The final goal being finding suitable adaptation measures. A number of studies have already been carried out at the level of building and of sustainable infrastructures. A building climate

adaptation framework for Norway has been developed and the award “Statens pris for byggkvalitet” (The National Award for Building Quality) was given the Centre pilot project building ZEB laboratory. Klima2050 pursue the increase of knowledge necessary for the responsible stakeholders to enable them to take the right decisions, in both public and private organisations. Finally, an important contribution has been initiated in making a climate adaptation monitoring framework for municipalities in Norway

The relevance and importance of the Centre are related to its specific research activity, concerning the reduction of societal risk and adapting buildings and infrastructure to the threats posed by climate change; these aspects have a tremendous impact of economic and social level. Pilot projects and research carried out allowed the definition of guidelines and building certification systems which are broadly used in Norway. The strength of this initiative can be found considering that the research and the innovative techniques have been regularly tested on real pilot cases facing all the criticality of the “real” world.

**Comments to impact case 3: SAMCoT**

The SAMCoT initiative is a joint research between NTNU and TU-Delft, aimed at developing fundamental and applied research on ice actions on fixed and floating structures and on the design of coastal infrastructures on permafrost. Researchers developed advanced software for the simulation of ice motion and its interaction with floating system; this tool has been validated against real full-scale trials. SAMCoT produced another software predicting the vibrations of structures induced by the presence of ice, together with a complex constitutive model of the ice.

The case study seems well aligned with the department's strategic intent to become an international reference for Arctic constructions. The activity carried out has an important impact and relevance because it not only develops research on the artic environment but it mainly provides operative tools (software) to predict and design the behaviour of structures in that environment; the strength of the initiative is mainly based on the possibility of combining numerical tools with validations on full-scale real cases, drawing on IBM's specific experience and opportunities in this field. The continued use of the developed software is further proof of the impact of the case study on the society at large and on the construction industry, specifically.

**Comments to impact case 4: Norwegian Winter Maintenance Research Centre**

*Norwegian winter maintenance research center* is an initiative which developed a number of studies concerning the analysis of salt effect on ice, how to optimise its impact and the best practices for maintenance procedure of runways, roads and bike lanes during winter conditions.

This initiative is also well aligned with the department's desire to become a reference for construction in the Arctic environment. The relevance of the case is apparent, since it was translated in a number of operative procedures or standards. In particular, studies carried out at the center contributed to the introduction of a national guideline for salt usage, of a new training program for winter maintenance personnel and of new standard for winter maintenance of bicycle lanes. At the same time, other studies contributed also to the development of a decision support system for the assessment of runways contaminated by ice; this system has been also certified by ICAO. The strength of the initiative is the possibility to apply locally the studies developed and to collect and use real-world data (locally available) to validate the tools developed. The impact is relevant in general, but it is even more important since it improves the living conditions of the Norwegian territory.

## 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 three 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 assessment, and the interview. The Administrative Unit had the opportunity to fact-check this summary. The Administrative Unit approved the summary with minimal adjustments.

### Limitations

The Committee judged the information received through documentary inputs and the interview with the Administrative Unit sufficient to complete the evaluation.

## List of administrative unit's research groups

| Institution | Administrative Unit | Research Groups |
|---|---|---|
| Norwegian University of Science and Technology (NTNU) | Department of Civil and Environmental Engineering (DCEE) | Building Process (BP) |
| | | Building Technology (BT) |
| | | Geomatics (GM) |
| | | Geotechnical Engineering (GT) |
| | | Hydraulic Engineering Group (VT) |
| | | Marine Civil Engineering (MB) |
| | | Road, Railway and Transport Engineering (VJT) |
| | | Water and Wastewater (VA) |

## Terms of Reference (ToR) for the administrative unit

The board of the Faculty of Engineering, Norwegian University of Science and Technology (NTNU) mandates the evaluation committee appointed by the Research Council of Norway (RCN) to assess the Department of Civil and Environmental Engineering (IBM) based on the following Terms of Reference.

**Assessment**

You are asked to assess the organisation, quality and diversity of research conducted by the Department of Civil and Environmental Engineering 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 [7] aspects in your assessment:

1. As a department under NTNU's Faculty of Engineering, Department of Civil and Environmental Engineering follows common strategic goals and research areas of priorities from both a faculty level and centrally at NTNU, as well as on a departmental level. Relevant strategic documentation from NTNU has been listed under "Documentation". Note that the Faculty of Engineering's Research Strategy for 2018-2022 is still valid.
2. IBM is a relatively new administrative unit, and was established in 2016, after the merger of two former departments at NTNU (formerly known as the Dept. of Building, Construction and Transport Engineering and the Dept. of Water and Environmental Engineering) together with parts of Dept. Of Civil and Environmental Engineering at the former University College of Sør-Trøndelag. Physical co- localization of the department was implemented in 2019 and finalized in 2020, though two research groups are still situated outside the main location of the department. IBM has undergone substantial upgrades in research infrastructure post-merger.
3. Employees from the former University college of Sør-Trøndelag are placed in different research groups, based on their teaching and research interests.
4. The latest years, some research groups at the department have undergone a reorganization. The former research group Building and Construction Engineering is divided into two groups, the groups Building Technology and Building Process. The former research group Road, Transport and Geomatics is divided into the two groups Road, Railway and Transport Engineering and Geomatics.
5. IBM has established a new department strategy, targeted towards the main strategies of NTNU and the faculty of engineering (IBM Periodeplan 2023-2026) which has defined "research quality" as one of its main strategic areas. It was finalised in March 2023 and as per today we are working on the implementation.

6. The current structure and composition of the expert panels does not reflect the research topics and interest of most of the research groups at IBM well. As an example, the topics of urban hydrology, cleaning processes, drinking water, waste water, resource recover, and water quality, which are the core research topics of one of IBMs research groups, are not covered in the panel composition from May 2023. The same applies to several core topics / research groups.
7. IBM hosts and serves as partner for several interdisciplinary research initiatives that encompass parts or the entirety of NTNU, as well as the private and public sectors, such as i.a.:
    - Green2050 – Centre for Green Shift in the Built Environment
    - Concept Research Programme
    - Prosjekt Norge – Project Norway
    - Center for Sports Facilities and Technology (SIAT)
    - Næringslivsringen

As a result, many of the researchers work inter-disciplinary, more process oriented and case oriented with qualitative research methods, which does not directly contribute to the research output of this administrative unit, but more as a share of several units.

In addition, we would like your report to provide a qualitative assessment of the Department of Civil and Environmental Engineering 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
- strategic plans of relevance from NTNU and its Faculty of Engineering, (hyperlinks to NTNU-sites included):
    - NTNUs main strategy 2018-2025 (e)
    - NTNUs development agreement with the ministry 2023-2025 (n)
    - NTNUs wider contribution to innovation, (n)
    - NTNUs international development plan 2023-2025 (e)
    - NTNUs development plan for open science 2023-2025 (e)
    - NTNUs development plan for gender equality and diversity 2023-2025 (e)
    - Faculty of engineering main strategy 2018-2025 (n)
    - Faculty of engineering research strategy 2018-2022 (e)
    - IBM Periodeplan (attached, the English version will follow)

**Interviews with representatives from the evaluated units**

Interviews with the Department of Civil and Environmental Engineering 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 Department of Civil and Environmental Engineering 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 Department of Civil and Environmental Engineering and the RCN. The Department of Civil and Environmental Engineering should be allowed to check the report for factual inaccuracies; if such inaccuracies are found, they should be reported to the mathematics, ICT 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 Faculty of Engineering, NTNU and the RCN no later than two weeks after all feedback on inaccuracies has been received from Department of Civil and Environmental Engineering.

## 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)

The Research Council of Norway

**Norges forskningsråd**
Besøksadresse: Drammensveien 288
Postboks 564
1327 Lysaker

Telefon: 22 03 70 00

post@forskningsradet.no
www.forskningsradet.no

Publikasjonen kan lastes ned fra
www.forskningsradet.no/publikasjoner

Design: [design]
Foto/ill. omslagsside: [fotokreditt]

ISBN 978-82-12-04150-9 (pdf)