The Research Council of Norway

Evaluation of Mathematics, ICT and Technology 2023-2024

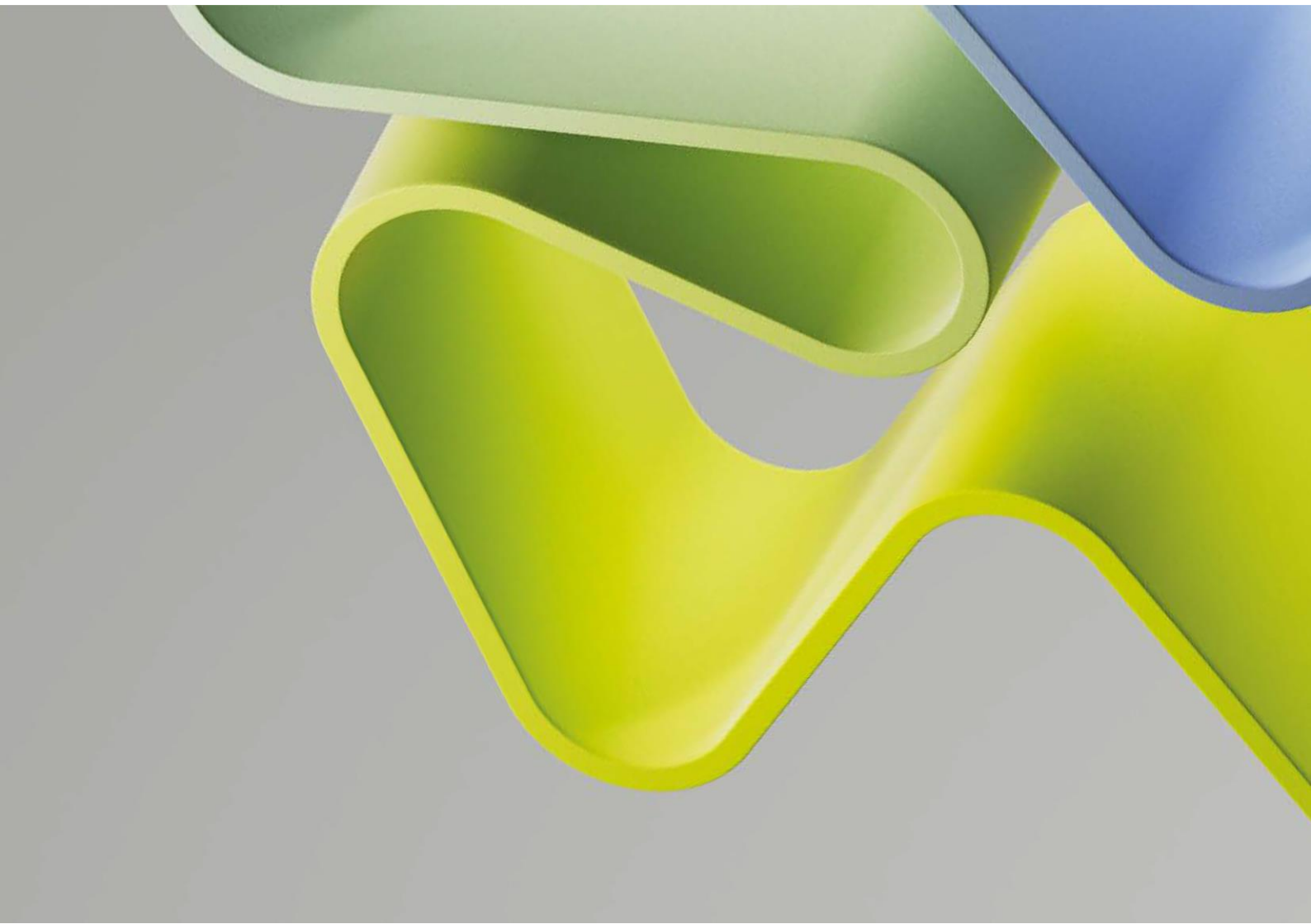
Evaluation Report for Administrative Unit

Administrative Unit: **Department of Industrial Engineering**

Institution: **UiT The Artic University of Norway**

Evaluation Committee Higher Education Institutions 3

December 2024



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Statement from Evaluation Committee Higher Education Institutions 3

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

- Department of Industrial Technology, UiT The Arctic University of Norway
- Department of Electric Energy (IEL), Norwegian University of Science and Technology (NTNU)
- Department of Marine Technology (IMT), Norwegian University of Science and Technology (NTNU)
- Department of Mechanical and Industrial Engineering (MTP), Norwegian University of Science and Technology (NTNU)
- Faculty of Engineering and Natural Sciences (FIN) / Faculty of Technology, Environmental and Social Sciences (FTMS), from 1.1.2024, Western Norway University of Applied Sciences (HVL)
- Department of Mechanical, Electronic and Chemical Engineering, Oslo Metropolitan University (OsloMet)
- Faculty of Computer Science, Engineering and Economics (IIØ), Østfold University College (ØUC)
- Department of Electrical Engineering (IET), UiT The Arctic University of Norway
- Department of Technology and Safety (ITS), UiT The Arctic University of Norway
- Department of Electrical Engineering (IT) and Cybernetics (EIK), University of South-Eastern Norway (USN)
- USN School of Business, University of South-Eastern Norway (USN)
- Department of Microsystems (IMS), 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 consisted of the following members:

Professor Lina Sarro,
Delft University of Technology (Chair)

Professor Stefania Bruschi,
University of Padova

Professor Khaled Ahmed,
University of Strathclyde

Professor Andreas Müller,
Johannes Kepler University Linz

Professor Maria Teresa Correia de Barros,
University of Lisbon

Professor Kostas J. Spyrou,
National Technical University of Athens

Description of the Administrative Unit

The administrative unit

The Department of Industrial Engineering at UiT is one of five departments in the Faculty of Engineering and Technology. It is located in Narvik, building on an earlier college of technology established in the 1950s, which was absorbed into UiT in 2016. Narvik is about 230 km South of the main campus in Tromsø. UiT has other campuses at Alta and Harstad. The Department has three full professors (of whom, one woman) and a headcount of 42. Only about a third of the staff have PhDs, and the biggest staff category comprises university lecturers (18), reflecting the Department's history as a teaching institution. Eight of the eighteen lecturers are women. Only five of the 22 staff in higher positions are women.

The research groups of the administrative unit

The Department comprises two research groups – Intelligent Manufacturing and Logistics (IMaLog) and Arctic Technology and Icing (arcICE). Both are evaluated in EVALMIT.

The unit's work and strategies

UiT's strategic goal for 2030 is to be, or to have the potential to be, an internationally leading university by 2030, when UiT will:

- Be at the international forefront when it comes to knowledge and competence about and for the Artic and High North
- Contribute to developing innovative, democratic, and sustainable solutions for major societal challenges
- Be a centre for developing competence and talent of students and staff with diversity as a driving force and resource

Within this the Department focuses on the following, in addition to various SDG goals:

- Technological Innovation: Spearheading the development, adoption, and promotion of cutting-edge technologies to address evolving industrial paradigms
- Methodological Advancement: Enhancing methodologies to facilitate the transition towards Industry 5.0, emphasising efficiency, sustainability, and adaptability
- Regional Relevance: Tailoring solutions to the unique challenges posed by the region's geography and climate, fostering prosperity and societal welfare

The unit's work in its sector

The Department says that it aims to lead globally in advancing new technologies and methodologies in the transition from Industry 4.0 to 5.0. Given the region's vast distances and harsh climate, the department prioritises innovative, technology-driven solutions to address challenges and promote awareness. It aims to have high sector-specific impact through delivering: high-quality research and education; research and education for welfare, value-creation, and innovation; access to education; and efficiency, diversity, and solidity of the higher education actor. Teaching aims to be research-based, and correspondingly innovation is pursued in partnership with others. The Department's innovation activities are supported centrally by the UiT, and via project partnerships with industry and other academics notably those with interests in the High Arctic.

The future of the unit

The Department aims to increase its teaching and research excellence, aligning with the university's overall strategy (summarised above).

Overall Assessment

The overall strategy of the administrative unit aligns well with that of the Arctic University of Norway, with a shared focus on technological innovation, methodological advancement, and regional relevance for the Arctic and High North. The unit comprises two research groups, *Intelligent Manufacturing and Logistics (IMaLog)* and *Arctic Technology & Icing (aceICE)*, which conduct research consistent with the unit's mission, though they operate autonomously in day-to-day activities.

Each year, the research groups report their activities and plans to the Head of the Department, who is responsible for ensuring that the university's research objectives are met. While the organisational structure for research appears adequate, the number of professors and associate professors is limited.

A substantial portion of the teaching staff does not hold Ph.D. degrees; however, the unit actively encourages their engagement in Ph.D. programmes and offers financial support to facilitate this. The current number of Ph.D. fellows and post-doctoral researchers is satisfactory, but an increased focus on gender balance is needed, also among professors and associate professors. To address this, the unit is implementing corrective measures, which are anticipated to yield positive results over time.

The administrative unit has adequate physical resources for conducting research, though its participation in national and international research infrastructures remains limited. It has established numerous national and international collaborations with both academic and industry partners, which enhance its network, contractual opportunities, and reputation. A notable internal challenge remains the limited administrative support, which could hinder the development of additional research initiatives.

Research funding from national grants, particularly from the Research Council of Norway, is adequate relative to the number of professors and associate professors. However, funding could be increased in light of the overall number of permanent staff (including lecturers). National contract funding is almost negligible, with no contracts currently listed with industry—a surprising gap given the industrial orientation of at least one of the research groups. The unit's remote geographical location may contribute to this challenge. However, it is worth noting the substantial involvement in international grants, particularly from the European Union.

The scientific output of the unit varies significantly from year to year, with the highest publication volume recorded in 2022. Publications are primarily in proceedings and lecture notes, some of which are reputable venues. However, to increase the visibility of the administrative unit's research activities, it is essential to boost the number of publications in international peer-reviewed journals.Both research groups are highly active, striving to conduct cutting-edge research, secure EU funding, and achieve high-quality publications. Nevertheless, their impact is limited by the small number of professors and associate professors, which restricts their full potential.

The administrative unit places particular emphasis on collaborating with national, regional, and local business communities—a valuable asset. Its societal relevance is primarily reflected in its educational contributions, including the training of students and Ph.D. fellows. The research topics of both groups hold significant societal value, and their outcomes merit broader dissemination at both local and national levels, especially given the potential impact demonstrated in the reported impact case.

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

Recommendations

Based on the overall assessment of the Department of Industrial Engineering at the Arctic University of Norway, the Evaluation Committee recommends the following:

1. While aligned with the university's overall research strategy, the department's research strategy should be refined to emphasise its unique characteristics relevant to the High North. This includes outlining a clear plan to implement the strategy effectively, at the local level.
2. To organise seminars and workshops specifically for the unit's staff, as well as for the broader university research community. These events should also be open to local stakeholders to showcase research outcomes and explore potential collaborations. Graduate students could be invited to foster their engagement in research.
3. The department and university should consider specific measures to expand administrative support. For example, a dedicated team could assist research staff with grant and proposal writing, increasing their success in securing funding.
4. To pursue diverse funding sources, including national grants, industry partnerships, and international research grants, to enhance financial research support.
5. To develop targeted recruitment strategies for research staff (with special attention to gender balance), highlighting the benefits offered by the department, such as advanced research facilities, grant application support, and Ph.D. fellowship opportunities.
6. To invest in state-of-the-art research infrastructure and increase participation in both national and international research networks, ensuring equitable access for all researchers.
7. To encourage the development of scientific competencies and networking through sabbaticals and fellowships at leading research institutions. The department should work to reduce teaching obligations, enabling staff to take full advantage of these opportunities.
8. To support publication efforts in high-impact international journals by considering potential incentives for researchers.
9. To strengthen efforts to disseminate research findings to enhance the visibility of the administrative unit's research groups and their contributions.

1. Strategy, Resources, and Organisation of Research

The research strategy of the administrative unit is aligned with the Arctic University of Norway's objectives: leading Arctic research, fostering innovative and sustainable solutions, and preparing talented, diverse students and staff. With a strategic focus on advancing from Industry 4.0 to Industry 5.0, the unit prioritises technological innovation, sustainability, and regional relevance in the High North. It collaborates with local and European industries through its two research groups, *IMaLog* (Logistics and Agile Manufacturing) and *aceICE* (Arctic Technology). Both groups focus on sustainability and regional challenges, supporting local solutions for Arctic conditions.

Despite adequate physical resources and strong national and international collaborations, limited administrative support restricts further growth. Research funding largely comes from national grants, with some EU involvement, though geographic remoteness may limit industry partnerships. The unit's research staff includes PhD-holding professors and

associate professors, who split time between research and teaching, alongside lecturers without PhDs, whom the unit actively supports in obtaining degrees.

While the research unit maintains gender balance among lecturers, the percentage of female PhD students is low, posing a future recruitment challenge. To address this, the unit offers mentorship programs and tenure-track opportunities to support career development and gender diversity. Staff can also take research leave every four years, enabling them to build international collaborations and increase research impact.

1.1 Research Strategy

The research strategy of the administrative unit is aligned with that of the Arctic University of Norway, which is identified through three major objectives: (i) to be at the international forefront in terms of knowledge and competence for the Arctic and High North; (ii) to develop innovative, democratic and sustainable solutions for major societal challenges; (iii) to be a centre for preparing highly talented students and staff with diversity.

In such a context, the administrative unit aims to be strategic when transitioning from Industry 4.0 to Industry 5.0, prioritising technological innovation, methodological advancement, sustainability, and regional relevance. The latter is particularly significant, given the administrative unit's geographical position in Norway and Europe, characterised by vast regions and harsh climates.

The administrative unit collaborates with local, national, and European industries in the framework of funded projects through its two research groups: the Intelligent Manufacturing and Logistic (IMaLog) and the Arctic Technology & Icing (aceICE) research groups. IMaLog is particularly active in the field of logistics and supply chain management connected to European Small and Medium-sized enterprises (SMEs). The same research group has interests in agile manufacturing and reverse logistics, which are linked to sustainability between manufacturing and end-product performance. Both the IMaLog and aceICE research groups are well aligned with the sustainability goals interpreted as climate actions. The topics addressed by the research units are of high regional relevance and can contribute to providing tailored solutions to the unique challenges posed by the region's geography and climate.

The administrative unit has comprehensive international collaborations leading to long-term partnerships.

<u>Recommendations:</u>

- The administrative unit should better address its research strategy in comparison to that of the university it belongs to, providing a convincing path line and focussing on specific objectives within the overall research strategy of the Arctic University of Norway.
- The research strategy at the local level must be enforced, taking advantage of the administrative unit's peculiar geographical position.

1.2 Organisation of Research

The administrative unit is led by the Department Head, who is responsible for meeting the strategic objectives at the department and university levels. The administrative unit comprises two research groups that function autonomously in their daily activities but have to report annually to the Department Head, submitting a report and development plan every December. This strong interaction between the Head of the administrative unit and research groups helps monitor the research activities and possibly apply contingency plans. In

addition, this strong interaction proves that there is a cohesive and adequate strategy at the administrative unit level to reach the foreseen research objectives.

The administrative unit aims to maximise its overall engagement in research, didactical, and outreach activities through the alignment of research and education objectives, periodic evaluation of the educational programs by academic and industrial stakeholders, the establishment of a Competence Centre for Arctic Logistic Operations to give answers to industrial challenges specific to the Arctic Region, the organisation of public events, and the use of labs as learning spaces for students that are then exposed to cutting-edge researches.

There is a shortage of administrative resources, which may negatively affect the present and future performance of the research staff.

The administrative unit counts 3 postdocs and 8 PhD research fellows. The PhD student fellows undergo mandatory research training activities. In addition, young researchers are encouraged to apply for short-term research visits, given that they meet educational requirements, and to participate in research projects initiated by senior researchers. Engaging students in research projects is a core policy of the administrative unit and represents a very good asset for their mentoring.

Recommendations:

- To strengthen the link between the administrative unit and the research groups by organising regular in-person meetings during which the research groups show and discuss their most recent research achievements.
- To provide different, effective means for training and mentoring PhD candidates and postdocs.

1.3 Research Funding

Most of the research funding is from institutional funds for the research staff provided by the Ministry of Education and Research. In addition, the administrative unit receives funds from national grants, national research contracts, and international grants.

The percentage of funding from national research contracts is very limited, mainly from the public sector, which can be partly ascribed to the geographical location of the administrative unit that limits extensive collaboration with industry. Collaborations with companies giving economic support appear indeed to be very limited.

Income from national grants has been more than twice that from international ones in the period 2018-2022 period. This shows quite good capacity of the research staff to attract national funds, especially from the Research Council of Norway and the public sector.

At the same time, the administrative unit demonstrates acceptable involvement in internationally funded projects, especially from the European Union, which is significant giving the limited number of research personnel employed in the administrative unit.

The approval rate of external funding was 39.9% in 2021 and 28.7% in 2022, which is quite good, again given the reduced number of research personnel.

On average, it can be stated that the funding reflects the level of the quality of research being produced by the administrative unit.

Recommendations:

- To increase the number of national research contracts, especially those from industry, trying to establish effective collaborations with local companies, which can benefit from the closeness with an academic institution.
- To assist researchers, particularly at the administrative level, in applying for international grants, with a focus on EU-level funding.
- To discuss a possible strategy at the national level to reduce the educational duties of those professors and associate professors who are more engaged in funded research.

1.4 Research Infrastructures

Since 2021, the administrative unit has used the SIGM-2 Norwegian high-performance computing infrastructure to carry out numerical simulations. The administrative unit's CFD programs are installed on this infrastructure.

The administrative unit is not involved in the access/use of international and European infrastructures.

The administrative unit complies with the FAIR principles as given by the Arctic University of Norway.

Recommendations**:**

- To evaluate the access/use to other national infrastructures, especially the physical ones, to strengthen specific research themes that can benefit from experimental activities.
- To evaluate the access/use to international infrastructures, also to develop further international collaborations.

1.5 National and international collaboration

The administrative unit demonstrates a strong commitment to engaging in national and international collaborations with both research institutions and companies in the research fields in which it is active. The department head may organise meetings with different groups, including groups external to the department, to favour the establishment of effective collaborations, with the first step being the signature of a Memorandum of Understanding

At a national level, collaborations with companies can boost research activities that are industrially driven. At the same time, collaborations with national research institutes can contribute to creating a common national research environment.

The vast majority of the international collaborations are with research institutes, some of them in projects funded by the European Union. There are significant collaborations with institutes in Northern Europe on research themes that are relevant to cold climates. These collaborations represent an added value for the administrative unit, as a common vision on very specific research themes can be developed.

Thanks to a continuous awareness of the ongoing collaborations through meetings with the Department Head, the possibility of pursuing cross-section and interdisciplinary collaborations within the administrative unit is effective. The expertise of the administrative unit in industrial engineering is pretty well suited to establish even more collaborations, especially with local companies.

Recommendations**:**

- To increase industrial collaborations, for instance through the organisation of dedicated workshops where the research activities of the administrative unit are shown together with its major industrial achievements.
- To increase international collaborations outside Europe.

1.6 Research staff

The faculty members of the administrative unit holding a PhD degree include three professors, four associate professors, and two researchers. The professors and associate professors with a PhD degree are allotted 50% of their time for research and 50% for educational duties, whereas researchers are exempt from educational responsibilities. To increase the research impact of the administrative unit, it would be beneficial to decrease the time allotted for the educational duties of those faculty staff members who are more engaged in research activities. Nevertheless, during the interview, the committee was informed that the time allotted to research and educational duties is decided at the national level.

In addition, there is a substantial number of employees without a PhD degree (among which 2 seniors), who serve as lecturers. They are asked to integrate the latest research into their teaching, but not to perform research activities on their own, for which a maximum of 30% of their time is allocated. As the number of employees who do not hold a PhD degree is quite high, it will in practice be difficult to do research. Nevertheless, the administrative unit has a policy of helping its employees engage in PhD studies, providing financial support and necessary time, and, upon completion, assisting in securing postdoc positions.

The administrative unit also counts 3 postdocs and 8 PhD research fellows.

Given the field of industrial engineering, the administrative unit is addressing the issue of gender balance within its research staff quite well, especially as regards the share of women in the category of lecturers (44.4%). On the other hand, the share of women as PhD research fellows is low (12.5%), which may represent a burden for future recruitments as postdocs and researchers. The administrative unit applies proactive measures such as specific mentorship programs for women and recruitment strategies to try to address the gender disparity.

The administrative unit provides substantial career opportunities to the most talented researchers, in the form of a six-year tenure-track program thanks to which the candidates serve first as associate professors towards a full professorship.

To encourage closer collaborations with well-recognised international institutions, staff members are eligible for research leave every four years for up to one year. Approval of sabbatical leave depends on publication and project management track records.

Recommendations:

- To increase the number of researchers with a PhD degree promoting effective means of recruitment.
- To encourage lecturers to take up PhD studies.
- To increase the number of administrative staff.

1.7 Open Science

The administrative unit complies with the Arctic University of Norway’s policy on open science, ensuring that all academic publications are accessible through open-access

journals or repositories. The administrative unit's publication profile from 2013 to 2022 shows a trend to reduce non-open-access or non-archived publications in favour of gold open-access approaches. The publications that still do not comply with open science policies are those that are subject to industrial disclosure obligations, which is very reasonable and understandable.

The data generated in the research activities are owned by the university and stored at facilities or repositories that must be approved by the university.

Recommendations:

- To increase the share of gold open-access publications.
- To establish agreements with companies in advance to have the right to publish the research results in a way they do not lead to confidentiality issues.

2. Research production, quality and integrity

The administrative unit has two research key areas, namely Intelligent Manufacturing and Logistics, and Arctic Technology & Icing. The latter has research topics aligned with the specific climate of the region where it is located, such as atmospheric icing on structures, and renewable energy in the Arctic.

The number of yearly publications from 2013 to 2022 is very variable, with minimum values in 2015, 2019, and 2021. The value of 2021 can be ascribed to the pandemic, which may have limited scientific production to a significant extent. Nevertheless, the highest number of publications was reached in 2022, sensibly higher than in the previous year.

As regards the publishing venues, the highest share is in IEEE conference proceedings, IEEE International Symposium on System Integration, and Lecture Notes in Electrical Engineering. The share of publications in high-ranked journals is much less.

The citation indicators show that there were publications belonging to the 10% most cited ones only in 2016 and 2020, while in the other years in the period between 2013 and 2021 the mean normalised citation scores were quite low.

Nevertheless, given the small number of research personnel with a PhD degree as well as the number of PhD research fellows and postdocs, the outcomes in terms of publications and citations can be considered acceptable.

The administrative unit organises and hosts international symposia and conferences, which can increase its recognition and reputation at the international level.

The administrative unit complies with the regulations of the Arctic University of Norway in terms of research integrity and ethics.

2.1 Research quality and integrity

Research group Intelligent Manufacturing and Logistics (IMaLog) overall assessment

The group comprises 2 professors, 1 associate professor, 1 researcher, and up to 9 temporary employees engaged in research tasks, implying a good capability to recruit in temporary positions. Its strategy mainly focuses on establishing effective collaborations with local companies, especially SMEs, in manufacturing and logistics. This is reasonable given its location, but means it lacks a unique profile, which would make it stand out in these fields.

Most of the research group's projects are EU-funded, scientifically relevant international collaborations, illustrating the group's commitment to high-quality projects. However, there are few industrial projects, and there should be more of them given the group's research interests, should be much higher. While some of the group's publications are in highly ranked journals and have significant numbers of citations, most are in conference proceedings. The group's commitment to societal challenges is evident, but in practice it makes few effective contributions to addressing them.

The IMaLog research group needs to sharpen, improve and better specify its vision, objectives and related benchmarks. The group lacks a unique profile, i.e. methodological/technological competences and lighthouse projects, to be distinguished in the domain of manufacturing and logistics. Remedying this requires effort from senior staff, in particular the professors, to shape and rethink the goals not only at the regional and university level but also thinking beyond these to identify new opportunities, e.g. within the context of European Digital Innovation Hub and other European funding schemes. The group lacks strong and strategic networks with other European partners. IMaLog is not as strong or as highly rated as other national and international groups in its field, but has the potential to improve, based on the resources at the group's disposal and its ability to publish research results. However, sustaining and expanding this research and education portfolio require major, goal-oriented efforts.

Research group Artic Technology & Icing (arcICE) overall assessment

The research group was formally established in 2018 with a focus on atmospheric icing on structures, artic/cold climate technology, renewable energy in the Arctic, and computational fluid mechanics. This focus is of high relevance for Norway and might have a potential for future growth and development. Currently, it comprises only 1 professor but with a research team of 5 people (2 postdocs and 3 PhD students). The challenge is to recruit additional permanent staff members to stabilise the team.

The group has been able to attract considerable funding since its establishment in 2018, mainly from the Research Council of Norway and the CBC Kolartic, even if other national and EU funding sources have been secured. It publishes well in high-ranked journals showing the high quality of its research. However, collaborations with local companies and stakeholders have not been established so far, but are needed to transfer academic knowledge into practice in Northern Norway.

The group has the potential for further growth and to develop a more prominent profile, if it is institutionally supported. With only one professor, it is hard to forecast the future of the group, though, given the current trajectory, one can be optimistic that the goals will be reached in so far as they depend on the group itself. It is therefore important to develop more sustainable funding and support structures. Desirable investments in better and more laboratory facilities depend on the university`s strategy as well as the group's performance. Strategic infrastructural partnerships could be a way to establish the needed infrastructure.

3. Diversity and equality

The administrative unit complies with the regulations of the Arctic University of Norway in terms of scientific equality, diversity, and inclusion, taking care of any needed measures to implement them. In addition, if needed, the department head engages in individual dialogues with employees to address these issues and follow up on any violations that may arise.

4. Relevance to institutional and sectoral purposes

The administrative unit has several sector-specific objectives. The main ones are:

- In high-quality research and education: to produce industry-ready, highly qualified industrial engineers, who can be excellent candidates not only for companies but also for doctoral research fellowships at other academic institutions.
- In research and education for welfare, value creation, and innovation: to maintain close collaboration with national, regional, and local business communities, integrating them into the administrative unit's initiatives.
- In access to education: to pursue a multidisciplinary environment, particularly in the health sector.
- In efficiency, diversity, and solidity of the higher education sector and research: to demonstrate high performance in various metrics, even if the administrative unit has limited resources compared to many other peers in the sector.

The activities of the administrative unit contribute to reaching the above-mentioned objectives to a significant extent.

In compliance with the university guidelines, the administrative unit has developed good practices for innovation and commercialisation: regular evaluations; assessment of the impact of the administrative unit's initiatives; seeking feedback from the stakeholders; and providing access to lab facilities, mentorship programs, and networking events. Particularly relevant is the administrative unit's support in making available its facilities for pioneering approaches in innovation, allocating time and physical space in the labs.

The administrative unit favours the students' involvement, inviting master's and PhD students to participate in research projects. It takes the initiative to enhance the lab infrastructure and thus the educational and research activities. It actively participates in internal and external reviews of its educational programs to enhance the curricula it provides, with particular attention to customising knowledge and skills for Industry 5.0. It provides internationalisation support to master's and PhD students for exchange programs. It encourages and supports student-led innovation activities, to increase entrepreneurship within the academic community.

Master students actively participate in ongoing research projects as part of the master theses, working in close collaboration with professors. They can also publish the results of their work in peer-reviewed journals and present them at international conferences. They have access to international mobility programs and professional networks. They can attend workshops and research seminars held at the administrative unit. Finally, they are encouraged to engage in science activities, such as the yearly Norwegian Research Day, to communicate the results of their research.

5. Relevance to society

The educational programs of the administrative unit are closely interconnected with its research activities, representing an unquestionable strength. Each researcher is committed to both education and research, which contributes to having relevant master's and PhD programs. The strategic partnership with industries also adds value to educational and research activities.

The two research groups IMaLog and arcICE specialise in topics relevant from a societal point of view, namely the former in digitalisation, robotics, and logistics, while the latter in

cold climate engineering. The research groups also comply with some of the UN Sustainable Development Goals, such as n. 9 (Industry, Innovation, and Infrastructure), n. 12 (Responsible Consumption and Production), n. 13 (Climate Action), and n. 17 (Partnership for the Goals).

Given the impact case and its relevance particularly to SMEs, the societal contribution of the administrative unit to enhance the competitiveness of local industries is acknowledged.

5.1 Impact case

Comments on impact case 1: Intelligent Manufacturing and Manufacturing System Management (IMMSM)

IMMSM focuses on developing systematic technological solutions for regional industries to ensure their competitiveness and sustainability in global markets. In particular, it aims to provide companies with technological advancements, tailored solutions to address industrial challenges, collaborative platforms for facilitating business alliances and industrial-oriented research, and customised solutions to support technological transformation.

The impact case is highly relevant to the region where the administrative unit is based, and the developed strategy can be applied to sectors beyond manufacturing. It offers a promising approach to strengthening collaborations with local companies, potentially leading to more research contracts and increasing opportunities for industrially orientated research. PhD research fellows are actively participating, which represents a major strength also from the educational point of view. Some publications are already available on this topic published by the research team in journals and conference proceedings.

Methods and limitations

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 without 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 research groups at the Administrative Unit

Institution	Administrative Unit	Research Groups
UiT The Arctic University of Norway	Department of Industrial Engineering	Intelligent Manufacturing and Logistics (IMaLog)
		Arctic Technology & Icing (arcICE)

Terms of Reference (ToR) for the administrative unit

The board of Faculty of Engineering Science and Technology mandates the evaluation committee appointed by the Research Council of Norway (RCN) to assess Department of Industrial Engineering based on the following Terms of Reference.

Assessment

You are asked to assess the organisation, quality and diversity of research conducted by Department of Industrial 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 aspects in your assessment:

1. Industry relevance

In addition, we would like your report to provide a qualitative assessment of Department of Industrial 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

Interviews with representatives from the evaluated units

Interviews with the Department of Industrial 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 Industrial 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 the Department of Industrial Engineering and RCT. The Department of Industrial Engineering and RCT 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 board of the Faculty of Engineering, Science and Technology and the RCN no later than two weeks after all feedback on inaccuracies has been received from the Department of Industrial Engineering and RCT.

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

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