Evaluation of Mathematics, ICT and Technology 2023-2024
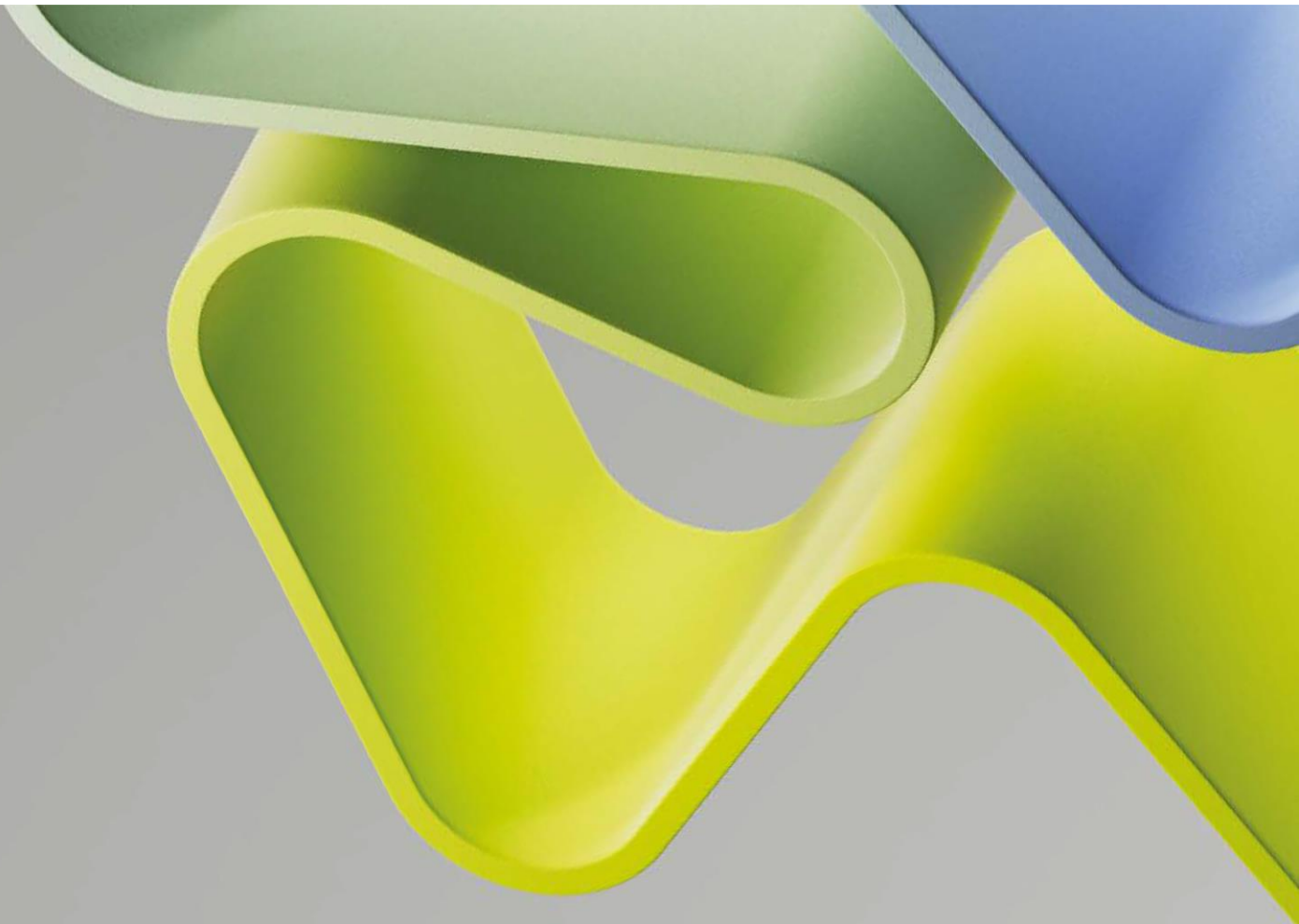
Evaluation Report for Administrative Unit

Administrative Unit: **Department of Science and Industry Systems (IRI)**

Institution: **University of South-Eastern Norway (USN)**

Evaluation Committee Higher Education Institutions 2

December 2024

Contents

Statement from Evaluation Committee Higher Education Institutions 2

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 has submitted a report for each administrative units:

- Department of Computer Technology and Computational Engineering (IDBI), UiT The Arctic University of Norway
- Department of Automation and Process Engineering (IAP), UiT the Arctic University of Norway
- Department of Electronic Systems (IES), Norwegian University of Science and Technology (NTNU)
- Department of ICT and Natural Sciences, Norwegian University of Science and Technology (NTNU)
- Department of Information Security and Communication Technology (IIK), Norwegian University of Science and Technology (NTNU)
- Department of Engineering Cybernetics (DeptCybernetic), Norwegian University of Science and Technology (NTNU)
- Department of Information Systems (IIS), University of Agder (UiA)
- Department of Computer Science, Oslo Metropolitan University (OsloMet)
- Faculty of Science and Technology (REALTEK), Norwegian University of Life Sciences (NMBU)
- Department of Science and Industry Systems (IRI), University of South-Eastern Norway (USN)
- School of Economics, Innovation and Technology (SEIT), Kristiania University College

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:

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University of Hamburg

Description of the Administrative Unit

The Department of Science and Industry Systems (IRI) is an administrative unit of the University of South-Eastern Norway (USN). IRI was established in 2017 at the merger of the former University College Buskerud Vestfold and University College Telemark. The merged colleges were approved as a university in May 2018. The department is active in broad range of research areas which are linked through the common theme of "complexity"; in natural sciences; in man-made systems; in computation and in energy systems (though this theme has not yet been officially adopted). IRI hosts 14 professors (all of whom are women); 18 associate professors (33% women); 3 researchers, research assistants, and postdocs (none of whom are women); and 8 PhD students (13% women, and including students employed by a partner organisation). Apart from most positions at different professor levels, all personnel have temporary positions.

Research at IRI is organised according to four established research groups: i) Norwegian Industrial Systems Engineering (NISE), ii) Advanced Cognitive Systems and Data Science (ACSAD), iii) Quantum Technology (QT), and iv) Computers Science. *Note that three research groups have entered separate self-evaluations, two as part of EVALMIT (NISE and ACSAD) and the one as part of EVALNAT (QT)*. The research groups apply for external research funding and run the projects, though all applications must have a budget developed in close collaboration with the USN Financial Services. Research group leaders support group members to develop high-quality research, initiate new research projects, and support internationalisation and networking. Each group has their own obligation to follow up on the USN strategy to become a preferred research partner for regional, national, or international society and business.

IRI prioritises research that contributes to understanding and meeting the complex challenges of a sustainable future. The UN Sustainable Development Goals guide the department in its activities. IRI's research strategy is linked to USN's mission of "Knowledge now and in the future." IRI therefore aims to contribute to new knowledge for the future evolution of complex systems from the perspective of natural sciences as well as man-made systems. They aim to produce research at high international standards. The USN strategic objective in research is to prioritise "several outstanding and internationally competitive academic milieux and research at a high international level." Thus, the department aims to foster research groups that are recognised in their thematic areas, either through collaboration with national industry, or through strong Nordic or international networks. Lastly, in line with the USN vision of "regionally based and internationally recognised," the department has as its goal to host at least one internationally recognised research centre by 2026.

Interdisciplinary collaboration and applied knowledge of system development in engineered socio-technical systems enable the department to contribute to sustainable development in line with the UN SDGs. The results of IRI's research enable industrial green transitions, foster digitalisation, and provide fundamental scientific knowledge particularly in topical areas of quantum physics and mathematics.

Quality in research is seen through IRI's growing success in securing projects with EU and NFR funding over the past few years. These projects form a long-term foundation for research groups, allowing steady funding for researchers, postdocs, and PhD fellows. They have also increased the quality of research by growing the number of scientific publications both at level 1 and at level 2 journals. IRI's associate and full professors teach subjects at master and PhD level, and so the increased quality in research ensures updated teachers both at master and PhD level.

The department research topical areas are key to the development of the Norwegian high-tech industry. Both the master program in Computer Science as well as the master program in Systems Engineering are highly relevant to national industry. Strong collaborations with national industrial partners ensure that students work with relevant companies, engaging in the improvement of these companies, and many student projects directly influence internal value creation processes at the host company.

The department hosts the National Industrial Research School in Complex Systems (INRESCOS). The researcher school is in collaboration with NTNU Department of Mechanical and Industrial Engineering and University of Agder Faculty of Engineering and Science and industry research partners. The Industrial research school aims to increase the value creation and quality of the PhD- candidates towards world-class research and innovation of Complex Systems through cross-fertilisation between industry and academia.

Overall Assessment

The research strategy of the department of Science and Industry Systems (IRI) is well aligned with USN's vision "regionally based and internationally recognised". The department has very close collaboration with industrial partners (regional, national and international), especially within education. The evaluation committee also considers the goal to be internationally recognised to be well fulfilled. All research groups have successfully established international collaborations, both within Europe and outside Europe. The share of international co-publishing is 42,9 %.

External funding has increased in five years, with a growing share of RCN and EU-funding, which is good. A new EU grant with IRI as coordinator is a good achievement. Still, the level of external funding could be increased, and support activities to facilitate researchers funding applications need to increase. The distribution varies between individual groups, so certain groups may need more support. Given the high degree of industrial collaboration, the funding from industry is surprisingly low.

The unitary management model of USN, with no deputy heads for research, PhD-studies, or education and with no local research support is problematic. Since the research group leaders do not have allocated time for research leadership, and there are no deputy heads, there is a risk that management tends to be more focused on administrative management than research leadership. Further, the distribution of responsibility between USN, the faculty and the administrative unit becomes unclear (at least from the self-assessment).

Most problematic is the lack of local research support, as all administrative support for research is centralised to the multi-campus organisation for administrative support, headed by the director of administrative affairs. This central university administration consists of only four persons. There might be certain benefits of a centralised multi-campus research service, especially when it comes to specialised competence, but the central administration seems to have too little capacity. There is also a need for more locally based support, working closer to researchers. A strategy needs to be developed for how to develop local support, organising, and balancing the relation between central support and local support.

IRI follows the diversity and equality policy at USN. The gender balance among faculty members needs to be improved, especially at full professor's level.

The administrative unit has high relevance for the local society and regional development, as well as for institutional and sectorial purposes. The research areas are highly relevant and the close collaboration with industry both in research and education are important contributions.

The research department is quite focused on education, and the unique model for industrial Master students and the industry as laboratory approach is very interesting. The industrial master program, but also the close collaboration with industry in other projects is an important asset that has the potential to be further developed in relation to research in many ways. The relation between research, education and practice is very well described and reflected on in the self-assessment. Especially the education part is very strong and the practice orientation with close collaboration with industry is very strong. The research part could be further strengthened, but there is a great potential in doing that by leveraging the practice-oriented research, but also combining it with more fundamental long-term research.

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

Recommendations

1. **Strengthen the research strategy**
   - Continue the work with thematic strategic areas.
   - Further exploit and articulate the close industrial collaboration to strengthen research.
   - Balance the teaching orientation with more focus on research.
   - Balance the focus on short-term problem solving with more long-term fundamental research.
2. **Develop the industry as laboratory approach**
   - Develop opportunities to exploit industry-as-lab collaborations at all levels of academic seniority.
3. **Strengthen the organisation**
   - Implement more localised research support, together with processes for collaboration and distribution of work between the local support and the multi-campus centralised support.
   - Consider adding a deputy head of department for research.
   - Continue the work with principles on budget allocation to the groups, and to Incentivise the distribution of research time more effectively between individuals and levels of seniority. Continue to work on guidelines for research time and teaching allocation.
   - Clarify the relation between administrative management and research leadership.
   - Consider allocating some time for research leadership for research group leaders.
4. **Improve gender balance**
   - Start working on gender balance, especially for full professors through clear policy and activities.
5. **Develop a more ambitious publication strategy**
   - Develop a more ambitious publication strategy that is rooted in the differences in focus, capability and scale among groups and individual scholars and where the industrial focus is considered.
6. **Promote and support external funding applications**
   - Provide more support for funding application work.
   - Continue to promote EU applications and to develop a strategy to attract more EU funding.
   - Develop a strategy to attract more funding from industry, but also to engage industry in activities to attract other national and international funding.
7. **Expand the industrial PhD program**
   - Try to increase the number of Industrial PhD students in a structured way
8. **Work with research identity and research culture**
   - Engage in identity work beyond marketing.
   - Consider a department level research seminar (if it not already exists).

1. Strategy, Resources, and Organisation of Research

The department of Science and Industry Systems (IRI) is one out of six departments at the faculty of Technology, Natural Sciences and Maritime Sciences at the University of South-eastern Norway. It consists of four research groups: Norwegian Industrial Systems Engineering (NISA); Advanced Cognitive Systems (ACSAD); Quantum Technology (QTECH); and Computer Science. The first two groups were evaluated in EVALMIT, and QTECH in EVALNAT. Computer Science did not take part since they perceived the group as too immature. The department consists of 14 full professors (14 % women), 18 associate

professors (40 % women) and 6 assistant professors. Of these 7 are temporary positions. There are also 3 temporary research positions and 8 PhD-students (12 % women), of which 3 are industrial PhD-students. IRI research is founded on academic freedom and researchers are free to choose thematic areas, with no obligation for industrial collaboration, although there are strong industrial links. The administrative unit's research strategy is linked to USN's mission "Knowledge now and in the future" and USN's vision "regionally based and internationally recognised".

1.1 Research Strategy

The administrative unit's research strategy is aligned with USN's mission "Knowledge now and in the future". They also align with USN's vision "regionally based and internationally recognised". The regional part of the vision is strongly fulfilled through very close collaboration with industrial partners (both regional, national and international), especially within education. The evaluation committee also considers the goal to be internationally recognised to be well fulfilled. All research groups have well established international collaborations, both within Europe and outside Europe. The share of international co-publishing is 42,9 %.

USNs strategic research objective is to prioritise "several outstanding and internationally competitive milieux and research at a high international level. In line with USN vision to be "regionally based and internationally recognised" IRI has a goal to host at least one internationally recognised research centre by 2026. The department develops in the right direction to be able to fulfil this goal, with a quite new EU-project and several other large projects with industrial partners. However, more strategic work needs to be done to achieve this. The groups are quite diversified in terms of maturity, and research directions.

The department has struggled to come up with a broader thematic area at department level, where complexity in natural science; man-made systems; computation and energy systems, are strong candidates. According to IRI, this work is not finished and continues to develop, which is good.

Furthermore, IRI aligns with two of USN's strategic areas "Energy, Climate and Environment" and "Regional Value Chain". Especially important here is the regional value creation group, for which the deputy research leader is located at IRI.

One issue raised in the department's SWOT-analysis and the interview is the external image of USN as a young university created from a merger of several university colleges. There is a high focus on teaching and external partners see the department as a provider of bachelor and master students, rather than as a research partner. Further, from the interview it is clear that the different parts in the merger, have different cultures, traditions, and matureness in research. Identity work beyond marketing is needed to strengthen IRIs image as a research partner, and to foster a common research culture.

The research strategy is quite focused on education. Here IRI has a unique model for industrial Master students in computer science which is interesting. The industrial master program offers a unique study model with a high degree of industrial collaboration, where the students work 50 % of the time with a partner company. The industrial master program is an important asset that has the potential to be further developed in relation to research in many ways. The action-oriented approach in "industry as laboratory" and close collaboration with practice could be one good candidate for further identity making (also in relation to related notions such design science and engaged scholarship).

Overall IRI's strategy is well described, but in some parts a bit vague. Key issues that are missing in the strategy are how to strengthen the academic profile and visibility of a young university; how to foster a research culture in a rather teaching heavy department; how to increase external funding; and how to exploit their excellent industrial collaboration in creative ways.

Recommendations to the administrative unit.

- The evaluation committee recommends IRI to continue the work with thematic strategic areas.
- The evaluation committee recommends IRI to develop a strategy to further exploit and articulate the close industrial collaboration to strengthen research.
- The evaluation committee recommends IRI to develop a strategy for balancing the teaching orientation with more focus on research.
- The evaluation committee recommends IRI to develop a strategy to balance the focus on problem solving with more long-term fundamental research.
- The evaluation committee recommends IRI to engage in identity work beyond marketing.

1.2 Organisation of Research

IRI consists of 14 full, 16 associate, and 6 assistant professors, 3 additional researchers and 8 PhD students of which 3 are industrial PhDs. The ratio of 40 senior researchers and 8 PhD-students seems unbalanced to the Evaluation Committee.

There are four research groups: Norwegian Industrial Systems Engineering; Advanced Cognitive Systems and Data Science; Quantum Technology; and Computer Science. NISE and ACSAD took part in EVALMIT, and QTECH in EVALNAT. The computer science group did not take part because they perceived themselves as too immature at the time of the evaluation. The department is working on principles for allocating budget to research groups, and guidelines for how to allocate research time for each employee based on merits. For a professor or associate professor research time would typically be between 25 and 35 %. A set of expectations is identified for researchers who have allocated research time: participation in a research group; external funding; publishing; international collaboration; dissemination; peer services. For expenses like travelling, senior researchers are expected to cover this with external funding, while post docs and PhD-students get a fixed amount, which the Evaluation Committee finds good.

The groups have different levels of maturity and size. They are responsible for applying for external funding, but it is unclear how internal budgeting as well as allocation of teaching works in relation to groups.

The department is engaged in several master programs and PhD-programs. Already mentioned is the industry master program in Systems Engineering with its unique study model of industrial collaboration, where the students spend 50 % of the study time with a partner company throughout their studies. There is also an Executive Master in Systems Engineering tailored for part time students with full job in industry. The department also offers a Systems Engineering major in the Master program of Innovation and Technology management, owned by the USN School of Business.

At PhD-education level PhD programs in Technology and Ecology are available at the department, as well as a portfolio of doctoral courses in computer science, quantum technology and systems engineering. Further, the department hosts the National Industrial Research School in Complex Systems (INRESCOS), a collaboration with NTNU Department

of Mechanical and Industrial Engineering and University of Agder Faculty of Engineering and Science and industry research partners.

USN has a unitary management model that is applicable to most departments. This means that there are no deputy heads for research, PhD-studies, or education at the administrative unit. Further there is no head of office, as all administrative support for research is centralised to the multi-campus organisation for administrative support, headed by the director of administrative affairs. This central university administration consists of only four persons. Issues around the research support have been raised both in the research group evaluations and in the SWOT-analysis. There might be certain benefits of a centralised multi-campus research service, especially when it comes to specialised competence. Currently, the central administration seems to have too little capacity. There is also a need for more locally based support, working closer to researchers. A strategy needs to be developed for how to develop local support, organising, and balancing the relation between central support and local support (the latter being an issue for the faculty).

The department is led by the head of department (HoD). The research groups are led by a professor, who does not have personnel responsibility as that lies with the HoD. They typically do not have allocated time for research leadership.

Also, "the department council" acts as an advisory board to the HoD. The members of the council are representatives from research groups, study program coordinators, and a representative for temporary research staff. Much responsibility lies on the HoD, e.g. responsibility for personnel and budget allocation to research groups.

The department has an applied focus with much collaboration with industry. Much of this collaboration is driven by education and practice, predominantly by the NISE group and the industry master students, as well as practitioners involved in the Executive master program. This close collaboration with regional actors is the main strength of the department. Also, in computer science and quantum technology there is a strong link between research and education.

The distribution of responsibility between USN, the faculty and the administrative unit is unclear. On the one hand it seems well structured and centralised, but on the other hand it is unclear how much autonomy the department has. There is a risk that management tends to be more focused on administrative management than research leadership. For example, there is no mention in the self-assessment of research seminars on group level or department level or other research-oriented activities at department level to foster common ground and share experiences. Further, according to the self-assessment, the research group leaders do not have allocated time for research leadership.

The relation between research, education and practice is very well-reflected in the self-assessment. Education is very strong especially and the practice orientation with close collaboration with industry is very strong. The research part could be further strengthened. The self-assessment report of the unit is somewhat unclear about publication strategy; a more ambitious strategy on productivity and quality in publications would be beneficial. However, it is important that such a strategy is rooted in the differences in focus, capability and scale among groups and individual scholars. The industrial focus needs to be considered.

- The evaluation committee recommends developing a strategy for more localised research support, together with processes for collaboration and distribution of work between the local support and the multi-campus centralised support.
- The evaluation committee recommends considering adding a deputy head-of department for research and education.
- The evaluation committee recommends continuing the work on guidelines for research time and teaching allocation.
- The evaluation committee recommends clarifying the balance between administrative management and research leadership.
- The evaluation committee recommends considering a department level research seminar (if it not already exists).
- The evaluation committee recommends developing a more ambitious publication strategy that is rooted in the differences in focus, capability and scale among groups and individual scholars and where the industrial focus is considered.

1.3 Research Funding

The department receives funding based on the budget allocation model at faculty level, which is 35 MNOK per year. This internal funding finances 31 % of research at the department. Typically, 35 % for professors and 25 % for other senior researchers. In the administrative unit's self-assessment, it is not mentioned if any portion of the basic funding is used for strategic initiatives. This allocation of research time is static and linked to position rather than other merits such as publications or attraction of external funding. This is mentioned as a potential weakness in the SWOT-analysis, and the Evaluation Committee agrees.

External funding has increased from 3,4 to 10,7 million Nok in five years. In 2018 the largest share came from regional research funding, but in 2022 the largest share came from RCN and EU. Five EU-projects are listed from 2018, the latest from 2023, where also IRI are the coordinator (ACSAD-group). Also commissioned research for industry supported by RCN and Innovation Norway has increased. The information about funding provided in the administrative unit's self-assessment is a bit hard to follow, since many projects are listed, but without any information about budget.

As discussed in previous sections the under-dimensioned centralised research support model makes it difficult for smaller research groups to be competitive in increasing the amount of external grants.

According to the research evaluation of the ACSAD-group they have struggled with limited funding for some years, however they were successful in getting a recent EU grant. The NISE-group has been very successful in attracting external funding, mainly from national grants, but also some international. However, funding from local industry and public sector is low. The evaluation committee agrees with the research group evaluation report on the NISE group, that this is surprising given the high degree of industrial collaboration.

The level of external funding could be increased, and support activities to facilitate researchers funding applications need to increase. The distribution varies between individual groups, so certain groups need more support.

- The evaluation committee recommends IRI to provide more support for funding application work.
- The evaluation committee encourages IRI to continue to promote EU applications and to develop a strategy to attract more EU funding.
- The evaluation committee recommends IRI to develop a strategy to attract more funding from industry, but also to engage industry in activities to attract other national and international funding.
- The evaluation committee encourages IRI to continue the work with principles on budget allocation to the groups, and to Incentivise the distribution of research time more effectively between individuals and levels of seniority

1.4 Research Infrastructures

IRI is not engaged in international infrastructures.

IRI is using the Norwegian infrastructure for Micro- and Nano-fabrication (NORFAB). A set of infrastructures are available at campus: Composite laboratory with fibre materials; Mechanical properties test lab; SR/VR lab; Indoor drone lab; and a Physics quantum optomechanical lab. The department has access to the infrastructure needed for its research, both in terms of above-mentioned infrastructure and infrastructure used in partner collaboration in industry-as -laboratory.

FAIR-principles are upheld by adhering to USN-standards and with the help of USN data stewards, who work closely with researchers and research groups. The close industrial collaboration may complicate this, but the department have good experience of balancing non-disclosure and confidentiality agreements with claims for openness and academic freedom.

Recommendations to administrative unit.

- The Evaluation Committee feels that the unit has sufficient access to research infrastructures

1.5 National and international collaboration

Collaboration is strong, especially with industry but also with academia in Norway and internationally. Many collaborative projects are listed in the self-assessment. Researchers from the department are engaged in international communities and community services to an extent that can be expected from any academic institution. The level of international co-publishing is rather high, 42,9 % according to the NIFU report, while the level of national collaboration in terms of co-publishing is lower, 10,2 %.

The vision of "regional importance and international recognition" is well grounded in the department's collaboration portfolio. The department has an impressive portfolio of collaborations, especially with regional and national industry, but also with global industry. Much of this collaboration is grounded in master programs and to some extent industrial PhD-students. Industrial PhD-students are a very strong source of knowledge transfer. The Evaluation Committee believes this could be exploited further.

The industrial collaborations provide a lot of added value to research quality. However, there is a great opportunity to develop this further. The close collaboration with industry in an industry-as-laboratory fashion is a great opportunity that could be further exploited at all

levels: master students, industrial PhD-students, and researchers. It could also be linked to similar approaches such as engaged scholarship and design science.

Recommendations to administrative unit.

- The evaluation committee encourages that IRI look into ways of exploiting Industrial PhD students as a source of knowledge transfer to and from industry.
- The evaluation committee recommends that IRI develop opportunities to exploit industry-as-lab collaborations at all levels of academic seniority.
- The evaluation committee encourages IRI to further exploit the close collaboration with industry and practice-based research to strengthen research quality and identity.

1.6 Research staff

According to the self-assessment there is no policy for sabbaticals, but there are programs for promotion to associate professor and professor. Likewise, staff and early-career researcher mobility are encouraged, both internationally and nationally. Different activities for career development and planning are in place for PhD-students. IRI follows USNs templates for career planning in order to increase career awareness at an early stage, and pinpoint both academic and industrial career paths.

After the merger, USN was reaccredited with the HR Excellence in Research award in 2020.

Overall personnel issues, such as recruitment, promotion and career planning seem to be in good order.

IRI is working on guidelines to allocate research time based on merits such as participation in a research group, external funding, publications, collaboration and public dissemination of research results. Concerning other costs, experienced researchers are expected to cover travel expenses and the like through external project funding, while PhD-students and post docs get a fixed amount of allocated funding for this (120k Nok).

IRI has a diverse staff profile and adhere to USN's action plan for Equality, Diversity, and Inclusion. Somewhat symptomatic here (common to many institutions), is that many policy documents and action plans are listed in the self-assessment, but no actions. The Evaluation Committee therefore cannot discern what is actually done beyond policy documents to work with diversity and equality.

Recommendations to the administrative unit

- The Evaluation Committee recommends that the unit start working on its gender balance, especially for full professors through clear policy and activities, though the Evaluation Committee acknowledges that current levels are typical or even good for the discipline.
- The evaluation committee encourages IRI to continue the work with principles for allocation of research time.

1.7 Open Science

The department is aligned to national and university policies on open science: Research data should be as open as possible and as closed as necessary and must be handled in a way that complies with the FAIR-principles. Given the high level of industrial collaboration, confidentiality and IPR issues also need to be taken into account. USN has its own classification guide for confidentiality in data management, with four classes: Open for all access, internal, confidential, and strict confidential.

The use of data management plans is implemented in the department. The university always owns research data produced by its employees unless stated otherwise. Projects with external partners regulate ownership of data in the cooperation agreement.

For open access, USN policy is that a full copy of all academic articles should be made available from USN's institutional repository. USN also takes part in national agreements with larger publishers. USN library arranges courses on open access and open science for researchers and research groups. However, according to NIFU 65 % of publications from the department in 2022 are not open access, 8 % are gold OA and 26 % archived OA.

Overall, IRI comply with national and USN policies for open science. However, the share open access publications could be increased.

Recommendations on how to promote open science

- The evaluation committee recommends IRI to monitor and encourage open access publishing.

2. Research production, quality and integrity

IRIs research is focused on complex systems from a natural science perspective. Much of the research is applied and there is a high degree of industrial collaboration. There are four research groups, of which two were evaluated within EVALMIT and one within EVALNAT. The Quantum Technology group (EVALNAT) performs rather theoretical research in the general area of quantum technologies, optomechanics and electromechanics.
The Norwegian Industrial Systems Engineering group do research that is strongly linked to the industrial master program, and accordingly the group is much involved in master level teaching. The research is practice oriented and typically focuses on problem solving, engineering and system architectures.

The Advanced Cognitive Systems and Data Science group do research within AI and data processing, currently with much focus on Unmanned Aerial Vehicles (UAVs). They recently gained an EU grant as coordinators. This group also has many teaching responsibilities, The Computer Science group is focused on research linked to industrial applications such as autonomous systems, health applications and traffic control.

The research groups show variance in output and quality. Generally, the research production could be improved (research quality measures from the group evaluations are 2, 2, 3). For some groups the publications reflect their industrial focus, which is fine.

The NIFU report shows rather low relative citation indicators, with average mean normalised citation score of 58 for the period 2019-2021. Here 100 is the world average. For 2022 international co-publishing was 42, which is a bit under average, but still indicates good international collaboration. National co-publications are lower, only 10 %.

The self-assessment report of the unit is somewhat unclear about publication strategy; a more ambitious strategy on productivity and quality in publications would be beneficial. However, it is important that such a strategy is rooted in the differences in focus, capability and scale among groups and individual scholars. The industrial focus needs to be considered.

Policies for research integrity in the administrative unit are handled on the university level, according to USN guidelines for research ethics standards and processes.

2.1 Research quality and integrity

Research group Norwegian Industrial Systems Engineering (NISE) overall assessment

The group is of a sub-critical size to meet their research goals. The gender balance is fine considering the area but might be improved in future with the role model of one full professor being a female. They have a clearly rising activity in research publication. The impact of 2 publications from 2019 has obtained 10-42 citations, which is good in an applied area like systems engineering where only few industrialists have a research background and fewer allocate time and effort to publish. Research publication activity and funding are picking up but has not yet reached a level where a clear impact will be possible. Full-time faculty are enthusiastic, dedicated and putting in recognisable effort to enhance the level of activity, but with only 25-35% of time allocated to research, they are fighting uphill to reach a critical mass in research. The group has a rising activity in creating national and international research funding and is increasingly obtaining projects where they have the lead. The group is participating in national and international research projects and has close interaction with more than 80 local industries. The group are increasingly seeking to obtain projects where they have the lead. However, direct support from local industry is very low compared to what might be expected, considering the number of collaborative projects. USN support of research in the group is rather small (as presented in the self-assessment report), and time is not being allocated for research leadership. The University ought to provide more wholehearted support. The gender balance is fine considering the area and might be improving with the role model from one full professor being a female.

Research group Advanced Cognitive systems and Data Science (ACSAD) overall assessment

The group has a good potential mainly to contribute to the field of UAVs and in more applied research directions, since the majority of the group's projects are towards this direction. However, the very small size of the group and the non-existing support from the Department and the University, make very difficult, if not impossible, for the group members to increase the amount of successful grant applications and the overall research impact, since most of their time is going on management and educational purposes. As such it is rather questionable that the group will be able to achieve the overall goals and visions if the group remains without any extra support from the University or without managing to succeed in large grant applications. The overall research contribution of the group is also limited, mainly due to the issues mentioned before, however the group is providing very good educational contributions that can be considered excellent contributions as well in case that the University values more education from research. The group is not strong in an international context; however, it has the potential and very good contacts to strengthen more its international position.

Research group Quantum Technology (QTECH) overall assessment

The group is well-organised and successfully supports a large number of early career researchers. Despite the stated strategy to transition from petroleum with some early signs of success, their vision for the future seems vague and greater support is required from the department and faculty to enable them to make an effective transition. The group produces internationally recognised research, but does not provide the intellectual leadership needed to be classed as excellent or outstanding. A stronger articulation of their societal and economic impact could help the group attract both students and external funding.

3. Diversity and equality

The administrative unit has a diverse staff profile, though it is male dominated. Staff come from Norway, Scandinavia, Europe, Asia, Middle East and USA. PhD students also have a diverse range of backgrounds. IRI's goal is to promote diversity and protect its staff and students from discrimination. They align to the university action plan for equality, diversity, and inclusion, which describes the policy and practices to protect against any form of discrimination in the workplace.

USN has equality as a fundamental goal and measure gender balance in senior scientific posts. IRI has no plan of its own, nor were any activities described, but it has a goal to develop their own plan, based on USNs action plan, to promote diversity and protect against discrimination. This work had not yet started at the time of the self-assessment.

The Evaluation Committee would like to emphasise that it is very important that this work is started, and not only leads to a plan and policy documents, but to some concrete activities and actions. This is especially important concerning full professors.

4. Relevance to institutional and sectorial purposes

IRI conducts research and education of high relevance. Master programs are linked to research and associate- and full professors are responsible for master and PhD-courses.

The industry master program in systems engineering is perhaps the best example, as it fulfils the goal of research-based and work-integrated education. The industry master model requires students to work at an industrial partner for 50 % of their course. This program contributes to innovation and competence development in industry, but also to training and career opportunities for students. This program is presented as IRIs first impact case.

The Evaluation Committee sees an opportunity to scale up the program with a more structured program for industrial PhD-students. Currently there are only a handful of industrial PhD-students.

This also goes well with the focus of reginal value creation.

Access to education is enabled by a remote lab, using video nuggets. This material is used both in master programs, lifelong learning programs and in-company courses.

Another example is research in quantum technology, with strong Nordic and European collaboration. Generally, IRIs research topics as well as the master programs in computer science and systems engineering links well to needs in Norwegian high-tech industry.

Impact case two, below, describes research that focuses on innovation, and how a new company was developed.

5. Relevance to society

IRI contributes to the Norwegian long-term plan for research and higher education primarily by their applied research and education in close collaboration with industry.

The department aligns with USN's goal to build competence and knowledge for green transition. Of USNs five strategic areas, two are especially relevant for IRI: "energy, climate and the environment", and "regional value creation".

According to their self-assessment, the UN SDGs guide many activities at the department, especially with regard to:

- SDG 4 – quality education
- SDG 5 – gender equality
- SDG 7 – affordable and green energy
- SDG 9 – industry innovation and infrastructure
- SDG 11 – sustainable cities and communities
- SDG 13 – climate action
- SDG 17 – partnership for the goals

The two impact cases document well impact through industrial collaborations where researchers, master students, PhD-students and practitioners are engaged in problem solving and adding to the knowledge base of systems engineering. The action-oriented approach "industry-as-laboratory" is a method that has been used and further developed in many projects and provides a sound basis for this collaboration.

5.1 Impact cases

Comments to impact case 1: The education program of industry master's in systems engineering

The awarded education program of industry master's in systems engineering is likely to have had a substantial impact on regional and national tech-industry, both in terms of competence development and a more general rise of knowledge in systems engineering.
In this program students are working 50 % in a company as engineer for three years and studying 50 %. In the last semester the students do research according to the industry-as-laboratory concept. The approach is a version of action research and may also be linked to notions as engaged scholarship and design science. Master students approach real world problems in an industrial setting and help companies at the same time as they develop knowledge and learn. The program has addressed over 200 challenges. Many of the alumni have today important positions in public and industrial sectors.

The evaluation committee finds that this is a relevant and important impact case, and that it is well documented.

Comments to impact case 2: The Human Systems Engineering Innovation Framework (H-SEIF)

H-SEIF is a series of industry research projects to enhance and realise innovations driven by the NISE group together with industrial partners in the Kongsberg region, many of them large global corporations. Researchers, industrial master students, industrial PhD students and practitioners participate in the projects. Over time the H-SEIF framework or toolbox was developed, that has been focused on human-oriented technical solutions. It has been used for communicating between development stages in the innovation process and early validation of systems. Another focus area is creating value from big data and digitalisation, aiming for more data-driven decision-making processes.

Companies involved are Semcon, Kongsberg Defense and Aerospace, Kongsberg Maritime, TechnipFMC, and Oslo Metro. Substantial impact has been documented for several of these partners, such as huge savings in maintenance for Oslo Metro.

The evaluation committee finds that this is a relevant and important impact case, that is well documented.

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 HEIs)

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

List of administrative unit's research groups

Institution	Administrative Unit	Research Groups
The University of South-Eastern Norway	The Department of Science and Industry Systems	Norwegian Industrial Systems Engineering (NISE)
		Advanced Cognitive systems and Data Science (ACSAD)
		Quantum Technology (QTECH) (**EVALNAT**)

Terms of Reference (ToR) for the administrative unit

The board of Faculty of Technology, Natural Sciences and Maritime Sciences mandates the evaluation committee appointed by the Research Council of Norway (RCN) to assess the Department of Science and Industry Systems 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 Science and Industry Systems 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.

In addition, we would like your report to provide a qualitative assessment the Department of Science and Industry Systems 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 the Department of Science and Industry Systems 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 the Department of Science and Industry Systems 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 Science and Industry Systems. The Department of Science and Industry Systems 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 Faculty of Technology, Natural Sciences and Maritime Sciences and the RCN no later than two weeks after all feedback on inaccuracies has been received from the Department of Science and Industry Systems.

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)