The Research Council of Norway

Evaluation of Mathematics, ICT and Technology 2023-2024

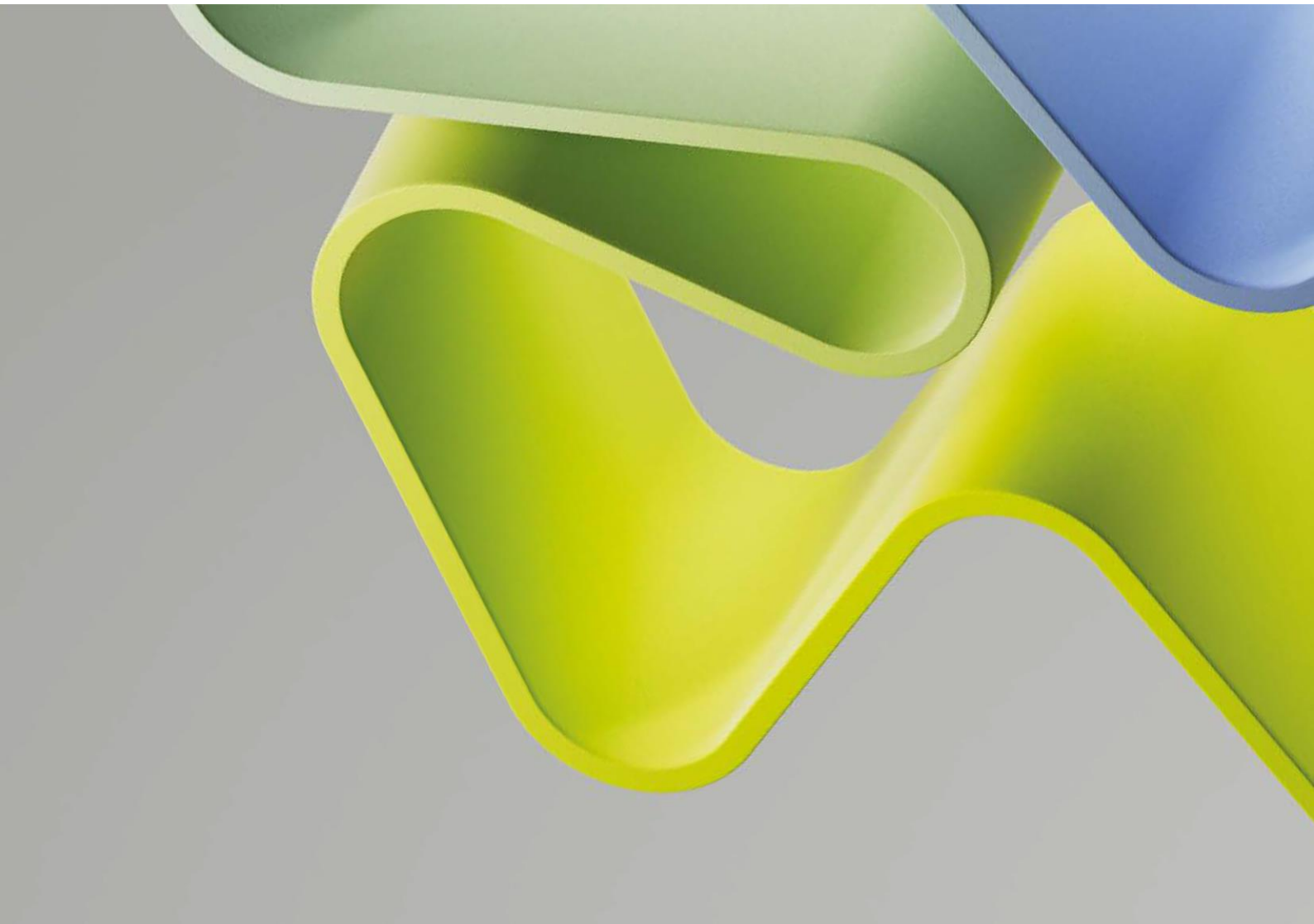
Evaluation Report for Administrative Unit

Administrative Unit: **Department of Electrical Engineering (IT) and Cybernetics**

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

Evaluation Committee Higher Educations 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/research institutes within Mathematics, ICT and Technology 2023-2024 and has submitted a report for each administrative units:

- 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 1.1.2026, 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 has 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

USN was created in 2016 by merging regionally-focused colleges across eight campuses in SE Norway and is still in the process of building and strengthening research capacity.

The unit has 4.2 FTE professors, and 0.8 FTE docent (0 women) – fewer than previously owing to retirements and departures. There are 7.6 FTE associate professors (3), one (male) researcher and 11 (2) research fellows[1] and the unit has several adjunct professors from regional industry. On the teaching side, there are 3.5 (0.5) FTE lecturers and 3 male assistant professors. There are also 4.2 (0.2) laboratory engineers and one female research assistant working 75%.

The research groups of the administrative unit

The unit has three research groups, of which the first two shown here have been submitted to EVALMIT

- Applied Modelling and Control
- Electric Power Systems
- Entrepreneurship and Student Enterprise

The unit's work and strategies

The research of the two research groups submitted to EVALMIT spans:

- Applied Modelling and Control (AMOC) – Instrumentation, Data Collection, Data Analysis, Machine Learning, Internet of Things, Industrial IT, Automation, Simulation, Prediction, Software Engineering and Programming, Autonomy, and Optimalisation.
- Electrical Power Systems (EPS) – System Optimisation, Digitalisation, and Integration (hydro, solar and wind, storage), Power Delivery and Apparatus, Multi-Energy market (flexible, ancillary services, and economics), Electrification (transport, process industry, offshore)

The self-assessment indicates that the unit did a self-evaluation of its research in 2014 and has since taken measures incrementally to increase its quantity and quality.

The unit's work in its sector

The unit has been developing educational and research capacity in line with the expectations of the responsible ministry, using a combination of internal and external resources. It has developed joint master courses with industry, while the quantity and quality of academic publication has been rising. It uses its regional presence to maintain contacts with regional industry, while USN as a whole has strengthened its commercialisation capabilities.

The future of the unit

During 2021 and 2022 USN carried out an extensive process to identify new strategic research areas (SRAs) to be the universities flagship initiatives for the next six years. The SRAs will be mission oriented with focus on interdisciplinary research. The unit's strategic objective is to offer future-oriented studies and research that contribute to a sustainable energy transformation and increased data security.

Overall Assessment

The Department of Electrical Engineering, Information Technology, and Cybernetics (EIK) at the University of South-Eastern Norway (USN) aligns closely with the university's vision of regional impact and international presence. EIK operates through three research groups: Applied Modelling and Control, Electric Power Systems, and Entrepreneurship and Student Enterprise that emphasise interdisciplinary and industry-focused work in sensor technology, system optimisation, and electrification, contributing to USN strategic themes of energy, climate, and sustainability. The department maintains industry partnerships and research collaborations, including projects with NTNU and international universities like MIT, enhancing its research reach and societal relevance.

Although EIK has a cohesive strategy for managing research activities, recruitment, and career development, there are opportunities for refining these strategies to more precisely align with institutional objectives and to increase productivity and innovation. Research funding predominantly comes from the Research Council of Norway, with significant projects like Semi-kidd, DigiWell, and SysOpt highlighting the department's expertise. While EIK is strategically aiming to secure EU funding, challenges remain, especially in engaging with large-scale, competitive grants and international research infrastructures like ESFRI.

EIK's research and education strategies underscore open science practices, promoting open access and responsible data management aligned with USN policies, yet progress remains varied across research groups. Diversity is also a key departmental value; EIK adheres to USN's Action Plan for Equality, Diversity, and Inclusion, focusing on gender balance and preventing workplace discrimination. However, recruitment and succession planning could be improved to support a balanced and dynamic research team and address a gender gap, particularly in senior academic roles.

In terms of infrastructure, EIK's participation is largely regional, with projects like the high-voltage laboratory at Campus Porsgrunn, but limited engagement in national and international infrastructures may hinder growth in research impact. Collaborations and partnerships, including with industry, remain central, though they would benefit from clearer alignment with long-term goals. Educationally, EIK industry master and the Y-route programme have broadened accessibility, providing practical pathways for students and aligning with USN's focus on sustainability and societal relevance. Overall, while EIK is well-positioned to enhance its research output and expand its impact, a more targeted approach to strategy execution, funding acquisition, and infrastructure engagement could amplify its effectiveness and international standing.

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

Recommendations

1. To enhance its research impact and alignment with broader institutional goals, the administrative unit should refine its research strategy with a clear focus on strategic alignment and measurable objectives.
2. The unit has to setup a mechanism for the regular reviews of their research strategy to allow the unit to respond dynamically to shifts in institutional priorities and emerging research trends. Robust evaluation metrics, including key performance indicators on research productivity, innovation, and collaboration, will help assess progress and maintain accountability for achieving strategic goals.
3. The unit should place greater emphasis on research training and mentorship to develop a strong pool of skilled researchers at various career stages, from master's

students to post-docs. Structured mentoring programs, interdisciplinary collaborations, and enhanced resource access for research training will support these researchers and ensure their work aligns closely with the unit's ongoing projects.

4. To support funding efforts, a dedicated grant support team could be established to guide researchers through the application process, offer proposal feedback, and provide insights into available funding opportunities.
5. A strategic approach to aligning research strengths with national and international funding sources can improve the unit's chances of securing relevant grants.
6. By fostering interdisciplinary projects, the unit can attract more diverse funding and bolster external partnerships.
7. Additionally, the unit should create a specific plan for increasing external funding, which may involve setting funding targets and establishing partnerships with other research institutions and industry.
8. Enhanced access to national and international research infrastructures will enable researchers to integrate cutting-edge tools into their projects. A dedicated support team can assist researchers in accessing and coordinating these infrastructures, which would also enhance the unit's capacity for hosting research facilities.
9. Adherence to the FAIR principles for data management is essential, as it will ensure research data remains accessible, reusable, and in line with global standards, thereby increasing the visibility of the unit's research outputs.
10. The unit should revisit its collaboration strategy, identifying strategic partners that align with its aspirations for advancing research quality. Facilitating cross-sectoral and interdisciplinary collaborations with industry, public entities, and non-academic partners can enrich research quality and foster a collaborative environment.
11. The unit should promote a diverse, balanced workforce and provide clear policies on research time allocation, sabbaticals, and recruitment will help create a sustainable and balanced work environment, benefitting both staff development and research output.
12. The administrative unit should offer mentorship, career resources, and opportunities for collaboration with experienced researchers to develop early-career researchers' profiles. Additionally, promoting open science through workshops and engagement in collaborative research networks will contribute to a culture of openness and reproducibility, aligning the unit with global scientific best practices and enhancing its overall research influence.

1. Strategy, Resources, and Organisation of Research

The Department of Electrical Engineering, Information Technology, and Cybernetics (EIK) at the University of South-Eastern Norway (USN) aligns its goals with the university's vision of being regionally based and internationally recognised. EIK's research and education reflect USN's values of being close to industry, sustainable, and innovative. The department hosts three research groups: Applied Modelling and Control, Electric Power Systems, and Entrepreneurship and Student Enterprise. These groups focus on areas such as sensor technology, system optimisation, and electrification, and actively contribute to the university's strategic research areas, particularly in energy, climate, and environment. EIK maintains strong regional industry ties and fosters interdisciplinary and international collaborations.

1.1 Research Strategy

The research strategy of the department provides a moderate contribution to developing the research environment and enhancing research quality and productivity. It outlines some

initiatives aimed at fostering a supportive research culture and facilitating access to resources and funding. However, while these efforts are steps in the right direction, there is room for improvement in how these initiatives are executed and measured. The strategy could benefit from more concrete plans and targeted actions to better support researchers and drive higher productivity and innovation. A well-structured strategy fosters a culture of excellence by setting clear priorities, providing resources, and encouraging collaboration among researchers. This environment boosts innovation by promoting interdisciplinary research and facilitating access to cutting-edge technologies and infrastructure.

In terms of aligning with institutional strategies and scientific priorities, the research strategy generally meets the expected goals, but with varying degrees of success. It aligns with some of the institution's overarching objectives and national research priorities, yet there are instances where the connection is less clear. The department's focus on certain research areas is consistent with institutional priorities, but strategic goals could be better defined and more rigorously pursued to ensure comprehensive alignment. The strategy should aim to bridge any gaps and more explicitly connect departmental activities with broader institutional aims.

The implementation of the research strategy has achieved some progress but lacks a structured approach to tracking and enhancing its effectiveness. While the department's strategic goals are partially met, there is a need for more robust mechanisms to evaluate performance and impact. Introducing specific metrics and regular reviews could help in refining the strategy, ensuring that it not only supports the development of the research environment but also drives continuous improvement in research quality and innovation. Overall, while the strategy provides a foundation, further refinement and alignment are necessary to fully realise its potential. The strategy should also encourage partnerships with industry, government, and other stakeholders to facilitate the transfer of knowledge and technology.

Recommendations to the administrative unit.

- Enhance strategic focus and alignment. The administrative unit should refine the research strategy to ensure a clearer alignment with institutional priorities and scientific goals. This involves setting more specific, measurable objectives that directly support the overarching institutional strategy. Regularly reviewing and updating the strategy to reflect changes in institutional priorities and emerging research trends will help maintain relevance and drive progress.
- Implement robust evaluation metrics. Develop and integrate detailed metrics and key performance indicators to assess the effectiveness of the research strategy. These metrics should include measures of research productivity, quality, and impact, as well as indicators of innovation and collaboration.

1.2 Organisation of Research

The 2014 self-assessment of the EIK department marked a significant shift in how research was organised, moving from individual efforts by professors to structured research groups. This change led to an increase in research outputs, with the department achieving the highest publication score per researcher at USN in 2021 and 2022. The establishment of the Electrical Power Systems (EPS) research group and its integration into national initiatives like the Norwegian Hydro Power Center and FME HydroCen has been particularly successful. Additionally, EIK introduced new educational programmes, such as a Masters in Electrical Power Engineering, and combined research groups to strengthen interdisciplinary collaboration, particularly in areas like IT and Automation. EIK's research organisation is

supported by adjunct professors from industry, enhancing the relevance and application of research and education. The department has focused on strengthening industry collaboration, which has been crucial in maintaining high levels of scientific publications and securing external funding. The PhD programme in Process, Energy, and Automation Technology (PEA) is closely tied to these research groups, with increased supervision time and active involvement of industry professionals. This strategic approach has helped EIK foster a strong research environment, contributing to both academic excellence and practical industry partnerships.

The administrative unit has established a generally cohesive strategy for managing its research activities, recruitment, and career development. However, there are areas where the strategy could be more explicitly aligned with the unit's research goals and institutional objectives. While the current structure supports the core research activities, there is room for improvement in integrating recruitment practices with long-term research needs and ensuring that career opportunities are adequately tailored to attract and retain top talent. A well-structured administrative unit should be equipped with clear leadership, defined roles, and efficient processes that support research activities. When the administrative unit is appropriately organised, it can effectively manage resources, coordinate research projects, and ensure that researchers have the support they need to focus on high-quality research.

Regarding the unit's support for education and training, the administrative unit provides a solid framework for the education of master's students and the training of PhD candidates and post-docs. It offers essential mentoring and development opportunities, though the effectiveness of these programmes could be enhanced by incorporating more structured feedback mechanisms and expanding support services. Ensuring that these educational and training opportunities are closely linked with current research projects and emerging fields could further improve the quality and relevance of the training provided.

The current organisation of research contributes to the institutional strategies and objectives to a satisfactory degree. The alignment with institutional goals is evident in the integration of research activities with broader strategic initiatives. However, more explicit alignment with specific institutional priorities could be beneficial. Improving how the research organisation reflects and supports institutional objectives will enhance the overall impact and effectiveness of the unit's research contributions.

Recommendations to the administrative unit.

- Enhance alignment with strategic goals. The administrative unit should refine its strategy to more explicitly align with both its own research goals and broader institutional priorities. This can be achieved by developing a detailed strategic plan that clearly defines how research activities support institutional objectives and by setting measurable targets.
- Expand support for research training and mentoring. The unit should enhance its support for the education and professional development of master's students, PhD candidates, and post-docs. This could involve introducing more structured mentoring programmes via more interdisciplinary and cross-departmental collaboration, increasing access to resources for research training, and ensuring that these programmes are closely tied to ongoing research projects.

1.3 Research Funding

Most of the research funding for the department comes from the Research Council of Norway, with collaborations with other universities, particularly NTNU, where many of the research staff have established professional relationships. Successful projects like Semi-

kidd, DigiWell, and SysOpt, which align with the department's expertise in modelling, control, and electrical power systems, have been coordinated by its researchers. Despite being well-positioned for EU applications within the Green Deal programmes, success has yet to be achieved in this area. In 2022, the department's external research projects had a turnover of 7.8 MNOK, with the majority funded by the Research Council of Norway. The department is currently strategising to secure EU funding in the near future.

The evaluation of research funding reveals that while the administrative unit has demonstrated some capacity to secure and manage external funding, there is room for improvement in several areas. Funding levels generally reflect the quality of research being produced, indicating a strong alignment between research output and financial support. However, the unit could benefit from more strategic approaches to ensure that funding consistently matches the high quality and impact of its research activities.

The support provided by the administrative unit for researchers and research groups in applying for external funding is somewhat effective but could be enhanced. Current support mechanisms are in place, such as grant writing assistance and guidance on application processes. Nevertheless, there is potential for more proactive and tailored support to help researchers navigate complex funding landscapes, particularly for international grants and large-scale collaborative projects. Improved training and resources in grant writing and proposal development could further support researchers' success in obtaining funding.

Over the past five years, the administrative unit has secured external funding, but they are not very successful in attracting external large research funding according to their track record especially the number of full-time staff members is 22. It is also noted by the committee that the number of PhD students (14) is very low compared to the staff members. The ratio is 0.6, which is very low compared to the national or international levels. The administrative unit has not been involved in any EU project nor international research programmes, which had affected significantly the internationalisation. Therefore, their contributions to the wider research are limited in advancing the state of the art in such important field at international level. To improve, the unit could focus on fostering stronger partnerships with international research networks and providing additional support for researchers targeting high-competition funding opportunities. Enhanced strategic planning and better alignment of research proposals with funding agency priorities could also contribute to more successful grant applications in the future.

<u>Recommendations</u> to the administrative unit.

- Strengthen support for grant applications. The unit should develop a dedicated grant support team or office within the administrative unit to assist researchers with the grant application process. This team should provide tailored training on writing high-quality proposals, offer one-on-one consultations, grant application review, evaluate internally before submission and maintain up-to-date knowledge of funding opportunities.
- Enhance alignment between research quality and funding opportunities. The unit should conduct a thorough assessment of the unit's research strengths and align them with the most relevant national and international funding sources.
- Establish mechanisms for regularly reviewing and updating the research strategy to ensure it matches current funding priorities and trends.
- Encouraging researchers to collaborate on interdisciplinary projects could also attract more diverse funding opportunities.

- Develop a strategic plan to increase external funding. This plan should include setting clear funding targets, fostering partnerships with industry and other research institutions, and actively participating in national and international funding networks.

1.4 Research Infrastructures

The EIK department does not participate in any national nor international infrastructure. In addition, the department does not participate in any ESFRI infrastructure. However, the department has access to few national research infrastructures. USN and the EIK department participate in the Katapult (Node) project in Telemark, contributing expertise in electrification and digitalisation, with facilities like a high voltage laboratory at Campus Porsgrunn. The partnership in FME HydroCen, coordinated by NTNU, provides additional opportunities, though access to laboratories is limited and requires payment.

The research unit's participation in both national and international research infrastructures appears limited, which raises concerns about the unit's engagement with the broader scientific community. Despite having access to some infrastructure, such as the high voltage laboratory, the unit does not seem to take full advantage of available resources on the Norwegian roadmap for research infrastructures or international platforms like ESFRI. This limited participation could hinder the unit's ability to stay competitive and relevant in its research fields. Research infrastructures are foundational to the success and quality of research within any academic unit. When researchers have access to state-of-the-art facilities, databases, and tools, they can conduct cutting-edge research that meets high international standards. Participation in these infrastructures also fosters collaboration and knowledge exchange, which are critical for advancing research across disciplines. If the unit is effectively utilising these resources, it indicates a strong alignment between its research needs and the available infrastructure, which directly contributes to the unit’s ability to produce impactful research.

Furthermore, the unit's role in hosting or coordinating research infrastructures is minimal, which might indicate a lack of leadership or initiative in contributing to the development of significant research facilities. The reliance on external partnerships, such as the one with FME HydroCen, seems to be more about accessing resources rather than driving innovation or expanding capabilities within the unit itself. This passive approach may limit the impact and growth of the research activities in the unit. Hosting or coordinating research infrastructures further elevates the significance of the unit within the broader research community. By taking on these roles, the unit not only gains a leadership position but also influences the direction and focus of key research initiatives at both national and international levels.

Regarding the adherence to FAIR (Findable, Accessible, Interoperable, Reusable) principles, while there is some adherence to the FAIR principles in managing research data, the implementation seems inconsistent. The processes for ensuring that data is findable, accessible, interoperable, and reusable are in place but could benefit from greater rigor and oversight. The unit’s ability to fully meet the FAIR principles, especially in the context of larger, more collaborative projects, could be improved.

Overall, while the unit engages with research infrastructures and strives to align with FAIR principles, there is significant room for improvement in maximising the potential of these resources. Increased participation in and hosting of key infrastructures, along with a more robust implementation of the FAIR principles, would enhance the unit’s research impact and contribution to the broader scientific community.

Recommendations to administrative unit.

- Strengthen access and participation in national and international Infrastructures. The administrative unit should actively facilitate greater access to and participation in national (such as the Norwegian roadmap for research infrastructures) and international (such as ESFRI) research infrastructures. This can be achieved by establishing dedicated support teams that assist researchers in navigating access procedures, applying for usage time, and integrating these infrastructures into their research projects.
- Enhance capacity for hosting and coordinating research infrastructures. The unit should plan to host or coordinate major research infrastructures, which can be carried out by investing in building the necessary capacity and expertise to effectively manage these roles.
- Ensure adherence to FAIR principles in data management: The administrative unit should implement and regularly update policies and practices that ensure full adherence to the FAIR principles for all research data generated within the unit. This includes establishing partnerships with national and international data repositories and infrastructure providers to ensure that data is managed according to global standards, thereby enhancing the visibility and impact of the unit's research.

1.5 National and international collaboration

The EIK department follows USN's broader strategy for national and international collaboration, focusing on enhancing ties with academic, private, and public partners to secure funding and maintain societal relevance. Despite challenges in competing with larger institutions for national research funds, EIK is active in international projects to boost opportunities for EU funding and ensure high academic standards. Notable collaborations include leading the RCN competence project DigiWell, working with prominent industry partners and international institutions like MIT and Imperial College London, and engaging with regional industries and municipalities through initiatives such as monthly seminars at Herøya Industrial Park. These efforts reflect EIK's commitment to fostering meaningful research partnerships and addressing industry needs.

The EIK department's collaboration profile shows some alignment with its strategic aspirations, but it falls short in fully realising its vision. While the department engages in national and international partnerships, there is a lack of clarity and focus on how these collaborations directly support and advance the unit's long-term goals. The efforts to form partnerships, although present, do not always seem to be strategically integrated into the department's broader research objectives, potentially limiting their impact and alignment with the unit's vision.

The value added by these collaborations to the research quality within the unit is somewhat limited. Although the department participates in notable projects like DigiWell and has connections with key industry and academic partners, the overall impact on research quality and output has been inconsistent. The benefits derived from these collaborations are not always apparent in terms of significant advancements or enhancements in research outcomes. There seems to be room for improvement in leveraging these partnerships more effectively to boost research productivity and quality. Engaging with external partners, especially those who are leaders in their respective fields, brings new perspectives, methodologies, and resources that can elevate the unit's research output. International collaborations often open doors to cutting-edge technologies and facilities that may not be available locally, thereby enhancing the scope and impact of the research conducted. Furthermore, collaborations that result in co-authored publications in high-impact journals or

joint research projects funded by prestigious grants are clear indicators of the added value these partnerships bring to the unit's research quality.

The administrative unit's facilitation of cross-sectoral and interdisciplinary collaboration, as well as partnerships with non-academic and public entities, is present but not particularly robust. While there are some initiatives and agreements, such as with local industry and public sector partners, these efforts often lack cohesion and strategic direction. The department could benefit from a more organised and proactive approach to fostering and managing these collaborations, ensuring they are effectively integrated into research activities and contribute meaningfully to interdisciplinary and cross-sectoral advancements. By actively promoting and supporting these types of collaborations, the unit can ensure that its research is not only academically rigorous but also relevant to societal needs. Such collaborations can lead to the development of innovative solutions that address real-world problems, thereby increasing the societal impact of the unit's research. Moreover, cross-sectoral partnerships can provide additional funding opportunities and pathways for research translation and commercialisation, further contributing to the unit's strategic objectives. The effectiveness of the administrative unit in fostering these collaborations is thus a key factor in the overall success and relevance of the unit's research activities.

Recommendations to administrative unit.

- Align collaboration strategy with unit aspirations. The administrative unit should conduct a thorough review of its current collaboration profile to ensure it aligns with the unit's long-term aspirations and visions. This might involve identifying strategic partners both nationally and internationally that complement the unit's research strengths and goals.
- Maximise the research quality through collaborative efforts. To ensure that collaborations add significant value to the unit's research quality, the administrative unit should facilitate joint research initiatives, co-authorship opportunities, and shared access to cutting-edge research infrastructures.
- Promote cross-sectoral and interdisciplinary collaborations. The administrative unit should actively foster cross-sectoral and interdisciplinary collaborations, including partnerships with non-academic, public, and industry partners.

1.6 Research staff

The EIK department has historically struggled with gender imbalance, particularly in electrical engineering and cybernetics, where female representation remains low. By 2022, improvements were noted with the hiring of three female associate professors and better gender balance among PhD candidates, though challenges persist at the bachelor and master levels. The department has seen a reduction in full professors due to retirements and has fewer assistant professors, though the number of associate professors has increased. The presence of four professor emeriti in 2022 highlights their continued contribution despite these shifts in staff demographics. The department's strategy for new hires emphasises elevating vacant positions and encourages all professors to actively participate in research groups, which are well-funded to support various activities like seminars and project collaboration. The department supports early-career researchers through various initiatives, including career development programmes, research leadership training, and specific career planning tools provided by USN. Recent developments include the establishment of career planning resources, a dedicated early-stage researcher organisation, and involvement in the European Digital University initiative to further enhance career development and research skills.

The unit's current recruitment policy and succession plan fall short in addressing future research needs effectively. Although there is a clear intent to upgrade vacant positions to at least associate professor level, the implementation has been inconsistent, resulting in an imbalance in gender representation and age distribution. The department has made some progress in employing female associate professors, yet broader gender balance remains problematic, especially in higher academic ranks and research staff. Additionally, the succession planning does not seem to adequately prepare for an aging faculty or ensure a balanced influx of junior researchers and new talent, which is critical for maintaining long-term research vitality.

Regarding the distribution of research time, the current practices reveal some gaps in fulfilling the unit's goals. While research time allocation is tailored to individual performance and preferences, the lack of a formal policy for sabbaticals and research leave creates uncertainty and may hinder research productivity and staff development. The absence of structured criteria for sabbaticals limits opportunities for staff mobility and professional growth, which could otherwise enhance research output and innovation. This inconsistency undermines the unit’s ability to effectively manage research workloads and maintain a dynamic research environment.

Overall, the unit’s approach to managing research staff needs improvement. The existing recruitment and succession strategies do not fully address the need for a diverse and balanced research team, nor do they adequately support career progression or succession planning. Similarly, the lack of a formalised and transparent system for research time distribution and leave further impairs the unit’s capacity to achieve its research goals. Addressing these issues is crucial for enhancing both the quality and sustainability of the department's research activities.

Recommendations to the administrative unit

- Revise recruitment and succession planning. Develop a comprehensive recruitment and succession plan that addresses current gaps in gender balance and age distribution among research staff. This plan should include specific strategies for attracting and retaining diverse talent, promoting gender balance, and ensuring a balanced mix of permanent and temporary positions.
- Formalise research time allocation and sabbaticals. Establish a structured policy for allocating research time and sabbaticals to ensure that all staff have equitable opportunities for research and professional development.
- Implement transparent criteria for research leave and sabbaticals. Allowing staff to plan and prepare for these periods effectively. This policy should include provisions for mobility options and encourage participation in national and international research projects, which can enhance the unit's research quality and staff development.
- Enhance support for early-career researchers. Introduce targeted programmes and resources to support the career development of early-career researchers, including new associate professors and postdocs such as access to mentorship, career planning resources, and opportunities for collaboration with senior researchers.
- Leverage partnerships with external organisations and research schools. This will offer specialised training and development programmes. This support will help early-career researchers in building their research profiles and contribute more effectively to the unit's goals.

1.7 Open Science

The EIK department adheres to the university's open science policies, which include guidelines for research data management and open access publication. These guidelines ensure that research data is managed according to FAIR principles, and that full-text copies of academic articles are available in USN's institutional repository. The university also participates in national agreements with major publishers, offering researchers access to high-quality journals with open access options. Additionally, USN has a publishing fund to cover article processing charges for journals not included in these agreements.

The department actively promotes open science through various initiatives, including courses and resources provided by the USN University Library. These are designed to educate researchers and PhD fellows on data sharing and open science practices. The department has seen a significant increase in open access publication, with a substantial portion of its articles being published openly in recent years. Additionally, the department collaborates with societal actors to ensure research relevance and public engagement, while maintaining strict guidelines for data management and confidentiality, especially in projects involving external partners.

The administrative unit has demonstrated a strong commitment to Open Science through its university well-developed policies, proactive approaches, and diverse activities aimed at promoting transparency, accessibility, and collaboration in research. The USN has established comprehensive guidelines that encourage researchers to publish in open access journals, share data openly, and participate in collaborative research networks. These policies are clearly communicated and supported by the administration, ensuring that all members of the unit are aware of and engaged in Open Science practices. This commitment to openness not only enhances the visibility of the unit's research but also fosters a culture of sharing and collaboration within and beyond the institution.

The administrative unit has also established robust policies regarding the ownership of research data, data management, and confidentiality, which are critical to the success of Open Science. These policies ensure that research data is managed responsibly, with clear guidelines on data ownership, storage, and sharing. The unit places a strong emphasis on maintaining the confidentiality of sensitive information while promoting the open sharing of non-confidential data, striking a balance between openness and ethical responsibility. By providing researchers with the tools and support needed to manage their data effectively, the unit ensures that its contributions to Open Science are both impactful and ethically sound, further enhancing its reputation as a leader in this area.

In terms of contributions to different areas of Open Science, the unit has made some progress, though the impact appears to be moderate. There are instances where the unit has participated in open access publishing and contributed to open data repositories, but these activities are not consistently prioritised across all research groups. While some projects have embraced Open Science principles, others have been slower to adopt these practices, leading to uneven contributions across the unit. As a result, the overall impact of the unit's Open Science efforts is present but not particularly strong or distinctive.

The unit's policies on ownership of research data, data management, and confidentiality are adequate but could benefit from further refinement. There are guidelines in place that address these issues, ensuring that data is managed and shared in a responsible manner. However, the policies might lack the detail and clarity needed to fully support researchers in navigating complex issues related to data ownership and confidentiality. While the unit has laid the groundwork for effective data management, a more robust framework and greater

emphasis on training could help to better align these practices with the goals of Open Science.

Recommendations on how to promote open science

- Enhance training and support for open science practices. Providing training and resources to researchers on open science principles and practices is crucial for fostering a culture of openness. The administrative unit should offer workshops, seminars, and online resources regularly on topics such as data management, open access publishing, and reproducibility of research.
- Promote collaboration and engage with open science initiatives. To advance open science, the administrative unit should actively participate in and support collaborative research networks and open science initiatives. This includes engaging with national and international open science platforms, contributing to open data repositories, and participating in collaborative research projects that embrace open science principles.

2. Research production, quality and integrity

The Department of Electrical Engineering (IT) and Cybernetics has three research groups: Applied Modelling and Control; Electrical Power Systems, and Entrepreneurship and Student Enterprise (which has not been submitted to EVALMIT). The work of the two research groups submitted spans:

- Applied Modelling and Control (AMOC) – Instrumentation, Data Collection, Data Analysis, Machine Learning, Internet of Things, Industrial IT, Automation, Simulation, Prediction, Software Engineering and Programming, Autonomy, and Optimalisation.
- Electrical Power Systems (EPS) – System Optimisation, Digitalisation, and Integration (hydro, solar and wind, storage), Power Delivery and Apparatus, Multi-Energy market (flexible, ancillary services, and economics), Electrification (transport, process industry, offshore)

Research from the Department tends to be published in conference proceedings rather than traditional journals, which is a common practice in many of the fields researched. However, papers are cited much less than the average in these fields and rarely appear in the top-10% most cited publications. In 2017-2019, almost three-quarters of papers were in open-source venues, while in the other years in the 2013-2022 period only a small minority was published open source. However, open-source publication appears to have had no effect on the number of citations. The comparatively low ratio of PhD students to faculty members may tend to limit both the quantity and the quality of research.

2.1 Research quality and integrity

Research group Applied Modelling and Control (AMOC research group) overall assessment

The AMOC research group at USN demonstrates both strengths and areas for improvement. Its strong connections to Norwegian industry provide a solid foundation for expanding its research portfolio, and the group has produced some high-impact publications, showcasing its scientific capabilities. However, the management structure is somewhat weak, with unclear links between line management and research management. The voluntary nature of activities led by the research group leader may limit strategic coordination.

Strategically, the group has a clear focus on specific scientific capabilities but lacks detailed plans for achieving its broader goals, such as becoming the preferred partner for industry in

Norway. Challenges include limited experience in writing research applications, significant workloads, modest funding, and a small number of PhD students relative to the group's size.

The group's research output is of high quality but modest in volume, with contributions from only a few key researchers. While it has notable industry connections, its international impact and collaborations are limited. However, the group's research topics align well with international agendas, suggesting potential for greater global engagement.

Overall, the AMOC research group has a solid foundation and significant potential. Addressing management weaknesses, securing more funding, increasing research output, and enhancing international collaborations will be crucial for achieving its strategic goals and improving its international standing. Leveraging its strong industry ties more strategically can also drive growth and success in the coming years.

Research group Electrical Power Systems (EPS RG) overall assessment

The research group has as a suitable structure and composition to conduct its research activities but not excellent. There is a group leader and deputy group leader for the research group, who manages financial affairs in the group and at the departmental level. The group does not have a clear focused detailed strategy for its research activities, recruitment, and internationalisation. The number of PhD students is very low compared to the staff members. The ratio is 1.16, which is very low compared to the national or international levels. The research group has an adequate, reasonable and achievable benchmarks aligned well with the institutional strategies and objectives, but it is not clear how the group will achieve it. The research group has no clear mobility opportunities to educate master students, training and mentoring of PhD candidates and post-docs. The group organisational environment is adequate for supporting the production of excellent research. The host organisation is not supporting the research group with basic funding. Although the research group has secured external funding in the last 5 years, but they are not very successful in attracting external large research funding according to their track record especially the number of full-time staff members is 6. The research group is not involved in any EU project nor international research programmes, which had affected significantly the internationalisation. The group is carrying out research activities under an important research area, however their contributions to the wider research are limited in advancing the state of the art in such important field at international level. The group is involved only in some national projects, and their role is not clear, and it seems that they are not leading some projects although the group comprises 6 full-time staff members. The research of some outputs not all is sufficient to achieve international recognition but not excellent. Their work would be perceived nationally as strong and an internationally recognised level in terms of originality, significance and rigour. The research group had a modest contribution to economic, societal and cultural development in Norway and internationally. In addition, there is little engagement of societal partners' participation in their research activities from problem formulation to the publication level to create new product, software, ideas, knowledge patents, and innovation.

3. Diversity and equality

The department values a diverse staff profile, recognising that a range of opinions and experiences enhances scientific creativity, international relevance, and global networking. Although the department lacks its own diversity or equality policies, it adheres to USN's Action Plan for Equality, Diversity, and Inclusion (2022-2025), which outlines practices to prevent discrimination and promote equality. This plan aligns with Norwegian statutory

protections against workplace discrimination and supports the sector objectives set by the Ministry of Education and Research, aiming for gender balance in senior scientific roles and fostering an inclusive work environment.

The administrative unit demonstrates a strong commitment to diversity and equality, actively working to create an inclusive and supportive environment for all employees. The USN policy (implemented by the unit) has comprehensive measures to prevent discrimination and promoting equal treatment, which are well-communicated and consistently enforced. This proactive approach to diversity ensures that all employees, regardless of background, have access to the same opportunities and are treated with respect and fairness. By fostering a culture of inclusion, the unit not only enhances the well-being of its staff but also encourages a more dynamic and innovative research environment.

The unit’s commitment via the USN Action Plan to diversity and equality is also reflected in its transparent and accountable practices. Regular assessments and reviews are conducted to monitor progress and identify areas for improvement, ensuring that the unit remains responsive to the needs of its employees. This continuous evaluation process helps to maintain high standards of equality and inclusion and demonstrates the unit’s dedication to creating a workplace where everyone feels valued and supported. By making diversity and equality a core part of its mission, the unit not only protects against discrimination but also strengthens its overall effectiveness and impact.

4. Relevance to institutional and sectoral purposes

The department has enhanced its education and research quality through increased external funding for major projects like HydroCen and SysOpt, and international collaborations with leading institutions such as NTNU and MIT. This funding has improved the department's visibility and attractiveness, resulting in more high-quality publications and providing opportunities for multiple PhD candidates to engage in cutting-edge research. By integrating new knowledge into educational programmes and maintaining close collaborations with industry, the department ensures that its research is relevant and impactful. Additionally, programmes like the industry master’s and the Y-route for vocational certificate holders have broadened educational access and attractiveness, aligning with USN’s strategy to address societal challenges and foster sustainable innovation.

The administrative unit shows some alignment with sector-specific objectives, though its contributions to innovation and commercialisation activities are modest. While there are efforts to engage with industry and promote innovation, these activities appear to be somewhat limited in scope and impact. The unit is involved in some projects that have potential for commercialisation, but this is not a central focus of its activities. As a result, the unit’s overall contribution to sector-specific innovation is present but not particularly strong, suggesting that there is room for more strategic efforts to enhance its impact in this area.

Regarding the training and mentoring of young researchers, the administrative unit provides opportunities, but these initiatives may not be as fully developed or impactful as they could be. There are programmes in place to support early-career researchers, including mentoring and career development opportunities, but these efforts might benefit from further expansion and stronger integration into the unit's overall strategy. The unit's commitment to fostering the next generation of researchers is evident, but enhancing these programmes could improve their effectiveness and better prepare young researchers for future careers in both academia and industry.

5. Relevance to society

The department’s research aligns with Norway’s Long-term Plan for Research and Higher Education 2023–2032, focusing on climate, environment, and energy, which ensures a stable funding outlook and societal relevance. In 2022, the department helped develop five Strategic Research Areas (SRAs), notably in energy, climate, and regional value creation, aimed at addressing key global and regional challenges through collaboration with various stakeholders. The department’s work contributes to several UN Sustainable Development Goals, such as affordable clean energy and sustainable industry, and supports the EU's Green Deal by enhancing regional industry’s green transition efforts. This alignment with strategic goals highlights the department's commitment to addressing pressing societal and environmental issues while fostering regional and global research collaborations.

The administrative unit has made some contributions to societal relevance, though these efforts appear to be somewhat limited in scope and impact. There are indications that the unit is aware of the Norwegian Long-term Plan for Research and Higher Education, and some of its research activities do align with national priorities. However, these contributions are not particularly strong or consistent, suggesting that while the unit is making some efforts to support national goals, there is room for improvement in fully integrating these priorities into its overall research agenda.

In terms of addressing broader societal challenges, the unit has touched on some relevant issues, but these efforts lack depth and focus. There are a few projects that have the potential to impact societal challenges such as environmental sustainability, but they do not seem to be a central or coordinated part of the unit’s strategy. While there is some recognition of the importance of societal impact, the unit could enhance its relevance by developing a more strategic approach to selecting and prioritising research topics that directly address pressing societal needs.

Regarding the UN Sustainable Development Goals (SDGs), the unit has made some initial strides, though its engagement with these global objectives remains modest. There is some overlap between the unit’s research and the SDGs, but it does not appear that the SDGs are a driving force behind the unit’s research direction. While there are isolated examples of contributions towards these goals, the unit could strengthen its societal relevance by more actively and intentionally aligning its research efforts with the SDGs, thereby contributing more meaningfully to global sustainability and development efforts.

5.1 Impact cases

Comments on impact case 1: Semikidd (Sensors and models for improved kick/loss detection in drilling)

According to the EIK impact case document, the impact case is based on providing industry with models and algorithms for flow of fluids in open channels via a research project. This project involved collaboration between academia and industry, with four PhD candidates and over 90 MSc and BSc students participating. The research focused on improving models and algorithms for fluid flow in open channels, which has applications in oil and gas production, hydropower, and other industries. The work also emphasised the use of machine learning to enhance measurement accuracy and develop smart sensors. The insights gained from this project have positioned the USN to better address industrial challenges, leading to the continuation of this research through the DigiWell project. The project's impact extends beyond the immediate research outcomes. It has contributed to the academic development of numerous students and led to the publication of 20 papers in international journals (2 Q1

journals according to the record), as well as presentations at conferences. The knowledge generated from this project has been integrated into MSc and PhD courses at USN, further enhancing the university's educational offerings and research capabilities. This project has not only advanced scientific understanding in the field but also strengthened ties between academia and industry, setting the stage for future collaborations. The impact case demonstrates contributions to both academic research and industrial practice, particularly in the fields of fluid dynamics and drilling operations. Through the development of advanced models, algorithms, and smart sensors, the project has enhanced the understanding and practical capabilities related to fluid flow measurement and control. The involvement of numerous students and successful collaborations with industry partners like Equinor underline the project's broader impact on education and its potential to influence future technological advancements in the industry. However, the impact case, while showing academic and industrial collaboration, lacks clear evidence of substantial breakthroughs or widespread practical applications. It is unclear how much of the work will have a lasting influence on the industry. The project's impact on education is very positive, but overall, the case does not strongly demonstrate a significant or transformative impact beyond its immediate academic context.

Comments on impact case 2: Enhanced utilisation of the Norwegian power system

According to the EIK impact case document, the impact case is based on the development of a new methodology and technical solution for a system optimisation between Norwegian hydropower plants and the electric grid side. The aim to strengthen the national power system operational security of supply and power transfer capability, while reducing investment costs and transmission losses. This advancement enhances the operational security of the national power system, reduces investment costs, and minimises transmission losses. The project, titled "System optimisation between power producer and grid owners for more efficient system services (SysOpt)," emerged from extensive collaboration between USN, regional companies, national industry partners, and policymakers. Funded by the Research Council of Norway in 2020, SysOpt focuses on developing advanced models and algorithms to optimise hydropower utilisation within the Nordic Grid. These efforts aim to improve the efficiency of the power system, reduce transmission losses, and lower grid tariffs for consumers. The research also addresses challenges related to voltage control and reactive power exchange, essential for maintaining grid stability as electrification increases. The project has academic and societal impacts, including the publication of open-access results that shape future education and inform policy and regulatory changes. With strong collaborations across private, public, and international sectors, the research has played a crucial role in enhancing national competence in hydropower management. Ongoing and spin-off projects, such as those with Kathmandu University and the National Renewable Energy Laboratory (NREL) in the USA, continue to explore new technologies and market mechanisms to further optimise the power system, ensuring its resilience and sustainability in the face of future challenges. The total research activities at USN within the thematic area of the FME centre have included 4 PhD thesis with an additional 6 PhDs from spin-off projects in the RG Electrical Power Systems. The research outcomes have been published in international journals (2 Q1 IEEE transactions according to the record), as well as presentations at conferences. The impact case presents a solid effort in advancing hydropower optimisation and enhancing the interaction between power producers and the grid. While it showcases meaningful collaborations and development of new methodologies, the impact appears to be primarily within the academic and theoretical domains. The work has potential for broader application, but the case could benefit from clearer evidence of how these advancements are being

implemented in practice and influencing industry standards or policies. Overall, it represents a commendable step forward, though its full impact remains to be seen.

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 substantive 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
University of South-Eastern Norway (USN)	Department of Electrical Engineering (IT) and Cybernetics	Applied Modelling and Control (AMOC RG)
		Electrical Power Systems (EPS RG)

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 Electrical Engineering, IT and Cybernetics 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 Electrical Engineering, IT and Cybernetics 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 Electrical Engineering, IT and Cybernetics 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 Electrical Engineering, IT and Cybernetics 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 Electrical Engineering, IT and Cybernetics 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 Electrical Engineering, IT and Cybernetics. The Department of Electrical Engineering, IT and Cybernetics 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 Electrical Engineering, IT and Cybernetics.

Appendices

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

The Research Council of Norway

Norges forskningsråd
Besøksadresse: Drammensveien 288
Postboks 564
1327 Lysaker

Telefon: 22 03 70 00

post@forskningsradet.no
www.forskningsradet.no

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