The Research Council of Norway

Evaluation of Mathematics, ICT and Technology 2023-2024

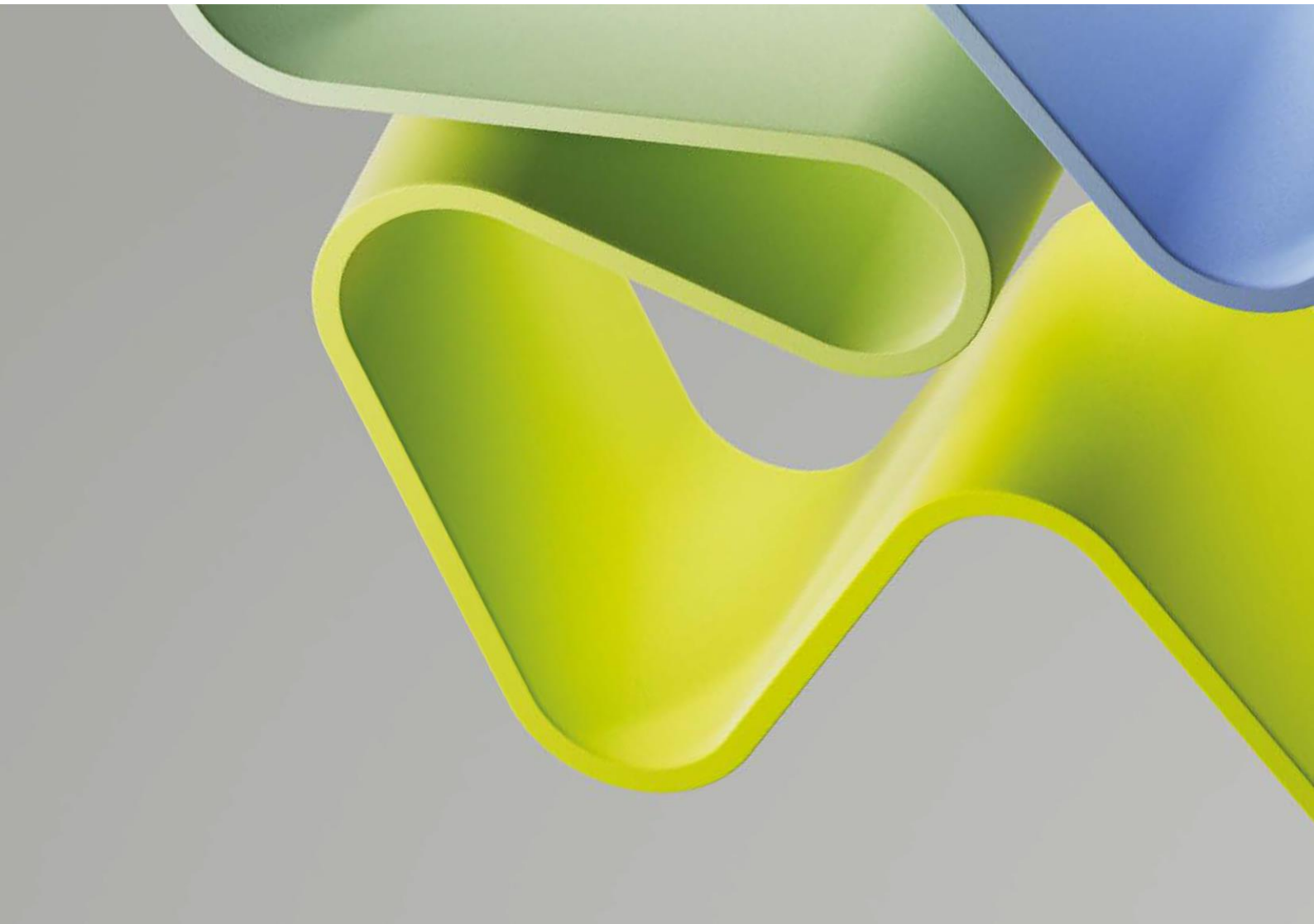
Evaluation Report for Administrative Unit

Administrative Unit: **Department of Mathematics**

Institution: **University of Bergen (UiB)**

Evaluation Committee Higher Education Institutions 1

December 2024



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Statement from Evaluation Committee Higher Education Institutions 1

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 Informatics, University of Bergen (UiB)
- Department of Mathematics, University of Bergen (UiB)
- Department of Informatics, University of Oslo (UiO)
- Department of Mathematics, University of Oslo (UiO)
- Department of Computer Science (IFI), UiT The Arctic University of Norway
- Department for Mathematics and Statistics (IMS), UiT The Arctic University of Norway
- Department of Mathematical Sciences (IMF), Norwegian University of Science and Technology (NTNU)
- Department of Computer Science (IDI), Norwegian University of Science and Technology (NTNU)
- Department of Mathematics and Physics (IMF), University of Stavanger (UiS)
- Faculty of Engineering and Science (TekReal), University of Agder (UiA)
- Department of Electrical Engineering and Computer Science (IDE), University of Stavanger (UiS)

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

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

The Evaluation Committee consisted of the following members:

Professor Rebecka Jörnsten (Chair),

Univ. Gothenborg/Chalmers

Professor Matthias Schütt,
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Professor Mads Nielsen,
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Professor Tiziana Margaria,
University of Limerick

Dr. Joanna Staneva,
Helmholtz Zentrum Hereon

Professor Björn Engquist,
University of Texas at Austin

Professor Plamen Angelov,
Lancaster University

Description of the Administrative Unit

The Department of Mathematics is organized into four thematic sections: Pure Mathematics (REN), Applied and Computational Mathematics (ABM), Statistics and Data Science (STAT), and Mathematics Education (DID). Each thematic section has a research and educational leader, with the research leader part of the department's executive board, which includes the Head of Department (HoD), Head of Administration (HoA), and other key roles, meeting regularly to discuss strategy and priorities. The permanent staff is encouraged to develop their own research priorities and profiles, including intra-departmental and interdisciplinary research, yet while contributing to the strategic goals of the RG and of the department.

The department consists of 19.6 professors, 11.3 associate professors, 6 researchers, and 7 postdocs, with 31.8 PhD students. PhD students, postdocs, and staff work across sections based on project funding and research priorities. Since 2012, the number of women in research roles has steadily increased, with job postings using a gender bias text decoder since 2022. Research groups are included within sections, with diverse interests.

The research is organised in the following research groups:

- Analysis and PDE (AnPDE)
- Algebra, algebraic geometry and topology (AGATA)
- Porous Media Research Group (PMG)
- Fluid Mechanics (FM)
- Statistics and data science

Since 2022, the department has been developing a strategic plan for 2024-2030, building on its previous plan (2014-2022). The department focuses on advancing basic research, delivering high-quality education, and fostering societal value while addressing global challenges. Key future goals include strengthening its research in theoretical and applied mathematics, statistics, and data science, while promoting interdisciplinary collaboration. The department aims to enhance its international recognition by attracting permanent staff and PhD students, securing prestigious research funding, and expanding public engagement. These efforts align with the broader strategic initiatives of the University of Bergen and the Faculty of Science and Technology.

The department actively supports national and international collaboration and networking, encouraging scientific staff and research groups to pursue partnerships based on shared research and educational interests. Collaborations range from one-on-one projects to large consortia involving academic, industrial, and health institutions. Regionally, the department collaborates with units within the Faculty of Science and Technology (NT-Fak) and has established strong ties with NORCE (a major collaborator) and Haukeland University Hospital. Nationally, partnerships with institutions like NTNU, UiO, and SINTEF focus on energy, marine research, and health. Internationally, the unit maintains relationships with universities. Additionally, the department advises government agencies on mathematics education and research policy through participation in relevant associations and working groups.

Overall Assessment

The Department of Mathematics at University of Bergen – referred to as the administrative unit in what follows – is overall a high performing unit with strong to very strong research and research standing, an above average funding profile with 25% of the budget coming from external sources, a mature collaborative network, nationally and internationally, and a number of interesting and creating efforts towards societal engagement. This is achieved in an environment in which the administrative unit has a very large educational responsibility across the University.

In this report, a number of more detailed comments and suggestions are offered. However, the key observations, challenges and opportunities can be summarized as this

Strengths

- The reorganization of the administrative unit and the implementation of a cleared organizational structure must be considered a success.
- The research contributions of the administrative unit places it in the top three among Norwegian universities, albeit being substantially smaller.
- Without being outstanding, 25% of the total budget of an administrative unit in the mathematical sciences is very good.
- It has a strong and timely focus on important questions related to diversity, open science and societal impact.
- The impact cases illustrate well the importance of the administrative unit in both research, education and societal impact.

Weaknesses

- There is a lack of strategic planning which is particularly problematic in a financially worsening situation with pending retirements and limited hiring ability.
- There is limited attention to mentoring of junior researchers – PhD students, postdoctoral researchers and permanent researchers – to prepare them for a career outside the university.
- There is a lack of collaboration within the administrative unit and across the University, inducing reduced visibility and difficulties in responding as part of larger multi-disciplinary research programs.
- Overall, the number of PhD students and postdoctoral researchers funded by the administrative unit is very low and limits the ability to pursue new and high-risk research directions.
- A stronger focus exchange with the local and regional industry, including monetizing such collaborations, should be expected

The Evaluation Committee considered the points raised by the unit in their Terms-of-Reference document and have commented on those throughout the report where applicable.

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

Recommendations

Following the detailed discussion points above, the main recommendations are

1. Given the challenging times ahead in which a controlled reduction of the administrative unit may be needed, a strategy for steering this to limit the impact on

the scientific quality of the administrative unit is necessary. This should include a willingness to shift resources between sections.
2. It should be considered whether shifting the resources from a few permanent positions to a few postdoctoral positions would be valuable – it could well be that the dynamics, talent development and ideas would overall be a benefit to the research groups.
3. Increase collaborations between research groups and sections. This should also help facilitatepositioning for larger scale project funding. The goal should be 1/3 of the budget is covered by external funding.
4. Establish a Science Advisory Board for the administrative unit to help drive the strategic development.
5. The central allocation of PhD fellowships – low for an administrative unit of this size - must emphasize quality of incoming students rather than attempt to equi-distribute resources between the sections and research groups.
6. Mentoring programs for both PhD students and postdoctoral researchers should be implemented and/or clarified, including activities to prepare these young researchers for non-academic careers.
7. Assess whether the administrative unit is the most natural home for the group in Didactics.
8. Diversity funding opportunities as much as possible, incl. industrial projects, international funding and support from foundations.
9. Explore new opportunities to monetize the more applied work in the administrative unit, e.g. in porous flows and media, through further collaborations with industry.
10. Maintain strong support to applicants for excellence grants
11. Develop a deep(er) collaborative effort with a small number of international partners to the benefit of both research and education.
12. Consider the introduction of a small number of full-time teachers to help address the substantial challenges with a high load for service teaching. A consequence should be that younger researchers should be offered a reduced teaching expectation for a period of time.
13. Mobility should be encouraged and incentivized, incl as a part of promotion assessments.
14. The career development and path for permanent research staff should be carefully monitored. It is essential that these individuals see a career – or be assisted to pursue alternatives. Involving them in teaching may help improve their opportunities.
15. Find a way to relaunch Mathematical Circles for talented youth – these are the future of Norwegian science and mathematics.

1. Strategy, Resources, and Organisation of Research

Since 2022 the administrative unit has been reorganized into four main sections with the goal to increase group sizes to a minimum of seven permanent members, increase visibility and improve alignment. The only exception is the small section on Didactics with only 3 members.

Each of these sections are then organized into smaller research groups, resulting in a total of six research groups of which five are part of the evaluation. The small section on Didactics is still in the formation stage and not part of this evaluation. Permanent members can be associated with more than one research group.

MSc and PhD students are anchored in the research groups as these are the main administrative units for research projects and funding.

The sections are overseen by the head of department with a supporting administrative support. PhD admission is centralized with admission through a committee comprising members of the four sections

Overall, this new organization appears to work well, and the administrative unit should be commended for undertaking such a substantial reorganization, despite the challenges.

1.1 Research Strategy

The research strategy is centred around the freedom to pursue curiosity-driven research. As a result, there is not a very specific strategy set by the administrative unit but rather a number of generic goals for the research, among them

- To contribute with curiosity-driven basic research and high-quality education to knowledge and value creation in society and sustainable development.
- To be competitive and regularly successful in prestigious research projects and national and international funding sources for research.

The research undertaken in the five evaluated research administrative units is well aligned with these goals and overall contributes to the standing and international visibility of the administrative unit. These generic goals are also well aligned with the strategic goals of the University of Bergen and the Faculty of Mathematics and Natural Sciences. However, there are few specific elements regarding the strategy of administrative unit of mathematics.

The strategies of the 5 research groups are likewise aligned with these overall goals where the research projects generally are driven by individuals and their sponsored projects.

The success of this approach is enabled by the strong and internationally visible permanent members of the research groups. This is also emphasized by the evaluations of the 5 research groups which all receive very good to excellent evaluations of the research quality and contributions.

While the research within the research groups is strong, there is less interaction between research groups and across sections, despite this being an explicit goal of the most recent strategy. This induces the risk of limiting impact. Furthermore, an increased collaboration may also increase opportunities to pursue larger scale project-focused research projects.

The future, however, looks to be challenging, due partly to limited funding and due, partly, to an increasing need for coordination and, possibly, resource reallocations between the sections. The challenge is reflected in a substantial growth from 2013 to 2021 from 55 to 70 permanent staff members and with a 30% growth of full professors. This may not be a problem if the financial resources are available for this, alas it appears they are not!

While an overall strategy appears to be in the works, it is not currently available – the most recent one from 2011-2012 points to reorganization as a major goal and this has been achieved. Other elements such as alignment with University of Bergen priorities and a focus on curiosity driven research remains unchanged. Apart from the reorganization, the 2011-2012 strategy mostly seeks to reinforce status quo, and the current assessment also reflects this.

However, as a result of over-hiring during the last decade, the administrative unit is now in a position where there are few expected retirements and very limited expected opportunities to re-hire. This situation imposes challenges in terms of maintaining critical mass in certain groups with a challenging age profile, yet an overall strategy is missing to drive hiring when possible or address this situation, e.g., it appears unclear how the research focus for new

hires is decided and whether hiring is a result of open calls or very specific calls. This could challenge the future quality of the administrative unit.

It is likewise a challenge that the administrative unit has no dedicated resources for postdoctoral researchers. In particular in the Mathematical Sciences, the value of postdoctoral researchers is very high and well acknowledged, for talent development as well as for enriching the administrative unit. The majority of leading Mathematical Departments worldwide have such positions.

To help drive forward the development of the administrative unit, in particular with a longer-term strategic vision during these challenging times, it may be worth establishing a Science Advisory Board.

A minor, but important, point for international visibility is the status quo of the webpages – this is below expectation, and it is recommended that these be updated and kept updated.

Recommendations to the administrative unit:

1. Given the challenging times ahead in which a controlled reduction of the administrative unit may be needed, a strategy for steering this to limit the impact on the scientific quality of the administrative unit is necessary. This should include a willingness to shift resources between sections.
2. It should be considered whether shifting the resources from a few permanent positions to a few postdoctoral positions would be valuable – it could well be that the dynamics, talent development and ideas would overall be a benefit to the research groups.
3. Increase collaborations between research groups and sections.
4. Establish a Science Advisory Board for the administrative unit to help drive the strategic development.
5. Revamp webpages for the administrative unit to help with visibility. There are lots of success stories to tell and the webpage is the place to do it.

1.2 Organisation of Research

The administrative unit is organized into four main sections which are then split into subgroups, resulting in a total of 6 such research groups. This is done, a least partly, to assure coherence and critical mass. Only five of these research groups are part of the evaluation as the small section on Didactics is still in the formation stage. The sections are overseen by the department head.

This is a relatively standard organization and appears to have been implemented well. Research and research initiatives are driven locally by the members of the research groups which are also responsible for attracting external funds.

The research activities are well aligned with the overall strategies of the Faculty as well as the University.

PhD students are admitted centrally through the administrative unit in a common committee where resources – there are 9 PhD fellowships in total available – are distributed between the sections and research groups. This means that typically less than 3 fellowships are assigned annually – which is a low number for a department of this size. This is complemented by externally funded PhD students. The central administrative unit is also responsible for follow-up after admission. However, the mentoring structure for all PhD students is unclear, e.g. does the PhD students have more than one mentor, with the second mentor being a non-academic mentor, as is becoming standard at many leading places?

Overall, the PhD students pursue different career paths with about 1/3 reported as going into each of academic/industry/research institutes, respectively. This emphasizes the importance of preparing doctoral students for a non-academic career during their studies.

The administrative unit hosts very few postdoctoral researchers and a structure for mentoring of these appears not to have been put in place. This is problematic as many postdoctoral researchers eventually leave the academic path and should be prepared for such a career.

A final question to consider is whether the Department of Mathematics is the most natural home for the group in Didactics. While such groups exist in some Institutions worldwide, there is a tendency to create more discipline agnostic groups which cover Didactics in science and engineering more generally. As this group is still in the formation stage, it seems a particularly timely question to consider.

Recommendations to the administrative unit:

1. The central allocation of PhD fellowships must emphasize quality of incoming students rather than attempt to equi-distribute resources between the sections and research groups.
2. The number of centrally allocated PhD fellowships is low for a administrative unit of this size. This adversely impacts the ability to pursue curiosity driven research as additional fellowships are tied to external funding. Efforts should be made to increase this, incl from administrative unit resources, and emphasis should be on supporting high-risk research that is otherwise hard to support financially by external funds.
3. Mentoring programs for both PhD students and postdoctoral researchers should be implemented and/or clarified, including activities to prepare these young researchers for non-academic careers.
4. Assess whether the administrative unit is the most natural home for the group in Didactics.

1.3 Research Funding

The budget of the administrative unit is covered 75% by the base funding with the additional 25% coming from external funding, primarily RCN. As this appears to become increasingly competitive, even with slowly increasing RCN total funding, this presents a long-term challenge for the administrative unit. However, the administrative unit has been successful in attracting other national and international highly competitive grants, like ERC and EU Horizon (as partner), TMS, Norad, VISTA. There has also been some success in attractive industrial funding although this appears to be an area with potential for growth.

For some of the research activities, eg porous media, it should be further explored how to monetize this expertise through additional and directed work with the local and national industry.

With an apparent shift in RCN funding towards project funding, it is essential that the administrative unit attempts to align with this by increasing collaboration between the research groups and within the university to reach critical size. This will also increase opportunities for EU funding.

The support to encourage the pursuit of highly competitive funding, e.g. ERC, is important and should be maintained. While the competition for such grants is intense, the opportunities and benefits associated with such grants – to the individual, the administrative unit and the university – are substantial.

Recommendations to the administrative unit:

1. Increase collaboration across administrative unit to improve positioning for larger scale project funding. The goal should be 1/3 of the budget is covered by external funding.
2. Diversity funding opportunities as much as possible, incl. industrial projects, international funding and support from foundations. While this is the situation in some of the evaluated research groups, it should be improved overall.
3. Explore new opportunities to monetize the more applied work in the administrative unit, e.g. in porous flows and media, through further collaborations with industry.
4. Maintain strong support to applicants for excellence grants

1.4 Research Infrastructures

The administrative unit does not participate in any national or international infrastructures as a host and has only a minor role as a user in national computing resources.

1.5 National and international collaboration

The administrative unit supports national and international collaboration and networking but does not have a specific policy. Research groups are encouraged to develop national and international collaborations and networking, motivated by common research and educational interests or competence.

As a result, the collaborations are diverse but nevertheless rich, both nationally and internationally as well as across different sectors, e.g. universities and national research institutes. There is a recently signed MoU with University of Stuttgart, Germany for a more extensive partnership but the goals and results of this remain unclear except through already existing collaborations in the research group on porous media.

The examples provided confirm that collaborations – national and international – are an important element in all research groups.

Recommendations to the administrative unit:

1. Develop a deep(er) collaborative effort with a small number of international partners similar to that with University of Stuttgart which appears focused on one research group. Such closer partnerships can benefit both research and education through collaborations, exchanges and common funding opportunities.

1.6 Research staff

The department consists of 19.6 professors, 11.3 associate professors, 6 researchers, and 7 postdocs, with 31.8 PhD students.

As discussed in detail in 1.1, the size of the permanent research staff is a challenge as it appears to be financially unsustainable. As a result, retirements rather than planning may decide the scienrtific strategy which is problematic. Furthermore this introduces the risk of limiting the intake of junior researchers and develop them, resulting in an unfavorable age distribution.

Overall, the available research time seems in line with international standards but the overall teaching contributions from the administrative unit to the entire university are very substantial and one may consider new models to help balance this, e.g., through the introduction of a small number of full-time teachers for the fundamental courses. This is a model that is gaining popularity elsewhere.

The gender balance in the administrative unit is improving but there remains room for further improvements. It is concerning that the number of women choosing to pursue a PhD appears to have been decreasing significantly during last years. Steps to understand and address this needs to be taken.

Additional initiatives to encourage mobility for the permanent staff may be beneficial and enhance the visibility and quality of the research and education of the administrative unit.

The status of permanent researchers, paid entirely on external funds, appears potentially problematic. Careful attention to career paths and opportunities within and outside the University must be part of this planning. As is, these positions may appear as dead-end job with limited if any opportunities for advancement and career development.

Recommendations to the administrative unit:

1. Careful attention is needed to avoid the development of an unfavourable age distribution due to retirements and no hiring of junior people.
2. Consider the introduction of a small number of full-time teachers to help address the substantial challenges with a high load for service teaching. A consequence should be that younger researchers should be offered a reduced teaching expectation for a period of time.
3. Mobility should be encouraged and incentivized, incl as a part of promotion assessments.
4. The career development and path for permanent research staff should be carefully monitored. It is essential that these individuals see a career – or be assisted to pursue alternatives. Involving them in teaching may help improve their opportunities.

1.7 Open Science

The administrative unit follows the institutional policies for open access and open science which stipulates that research and research processes should be openly available unless prevented by legal considerations. In 2024, 94% of all publications were published OA – a very high number.

Data management follows the FAIR principles and comply with the data management plan, the latter implemented through demands from the funding agency and project ownership, i.e. it is the responsibility of the individual researchers to implement these policies. It is unclear if there is institutional support, e.g. through local archives, to support this.

Recommendations

1. Encourage the development of institutional archives for green open access – this will also help increase visibility and reduce the administrative responsibilities on researchers.

2. Research production, quality and integrity

The department consists of 19.6 professors, 11.3 associate professors, 6 researchers, and 7 postdocs, with 31.8 PhD students. PhD students, postdocs, and staff work across sections based on project funding and research priorities.

The research is organised in the following research groups:

- Analysis and PDE (AnPDE)
- Algebra, algebraic geometry and topology (AGATA)

- Porous Media Research Group (PMG)
- Fluid Mechanics (FM)
- Statistics and data science

Overall, the evaluations of the five research groups suggest that they perform from very good to excellent, with some variations due in part to sub-critical size.

2.1 Research quality and integrity

The research quality of the scientific staff of the administrative unit is strong to very strong overall, as also emphasised in the assessments of the individual research groups. Overall, this is a strong and well-performing administrative unit.

This situation is also clear from the bibliometric analysis, which shows that the administrative unit is securely positioned among the top three Norwegian institutions while substantially smaller than the University of Oslo and NTNU. When measured by the ability to attract excellence grants such as ERC, the administrative unit is a national leader.

The reorganisation and resulting research focus have resulted in larger research administrative units and a clear structure. However, it is unclear whether an increased collaboration level has resulted. This may limit long-term visibility and impact, and increased collaboration may also increase opportunities to pursue larger-scale project-focused research projects.

As discussed, the financial outlook is challenging, and this situation needs to be addressed urgently with the development of a long-term research and strategy plan to avoid a situation in which retirements dictate research foci, not deliberate choices and preferences. Such a plan must also include an open discussion of the balance between the five research groups.

Research group Analysis and PDE (AnPDE) overall assessment

Strengths: The Analysis and PDE group is highly active and influential in various aspects of mathematics. They engage in fundamental research, consistently publish in prestigious international journals, and maintain an above-average citation level. Additionally, they contribute significantly to academia by training doctoral students, postdoctoral fellows, and young researchers and organising conferences and workshops. Furthermore, the group is involved in editorial work for international journals and contributes to teaching at both undergraduate and postgraduate levels. They also handle administrative responsibilities within their department and participate in various committees related to hiring, evaluation, and promotion at universities and research councils globally. Despite their achievements, the group faces a gender imbalance, reflecting the broader challenge of female underrepresentation in mathematics. However, they maintain a well-balanced profile in terms of research interests, teaching commitments, administrative duties, mobility, and age diversity.

Weakness: Lack of financial funding from abroad, in particular European Research Council grants. However, it is tough to obtain such funds for groups that work mostly on theoretical research. The economic and societal impact could be improved. The group should focus more on dissemination exploiting the pedagogical courses attended by the group’s members. Overall, the group should continue this line of activities, strengthening the focus on applications and user-oriented publications. It should continue its efforts to attract new talented students, offering high-level courses and funds for positions. The level of research compared to other similar national and international research environments is excellent.

Research group Algebra, algebraic geometry and topology (AGATA) overall assessment

Strengths:

- Strong individual track record, high profile collaborators, big international visibility of group members
- Very high commitment to teaching (often involving classes on top of teaching load) and to community service (boards, panels)

Weaknesses:

- Very small group, highly unbalanced in terms of career stage, gender, diversity
- Huge teaching load imposed by institution despite decreasing capacity
- Few interactions (documented) within the group
- Little success in acquiring funding

With these credentials, most of the group's goals are realistic to achieve, but given the limited size of the group, it cannot be expected to initiate big grant applications or major contributions to the graduate programme.

Relative to the group's size, the overall performance is excellent. In detail, research quality and the group's contributions are not compromised by these limitations, as evidenced by the group members' individual track records. The societal impact, however, can hardly exceed average level in an absolute basis, and one could argue whether the organisations environment meets the standards to be called adequate. To this end, we decided to refrain from downgrading it, but only in acknowledgement of the group's great efforts while we cannot suppress the impression that the institutional support of the group is far too small.

Research group Porous Media Research Group (PMG) overall assessment

The PMG group defines itself as "a leading international research group in applied and computational mathematics of porous media". It includes nine permanent members, among which four full professors, one associate professor, one senior researcher and three researchers. It also has three adjunct professors from Stuttgart, Munich and Simula Research laboratory. PMG has been a partner in several national research centers. Since 2021, the group has hosted and led the research Center for Modelling of Coupled Subsurface Dynamics (2021- 2026), one of the two VISTA research centers with EQUINOR. All permanent PMG staff members are involved, of which seven as principal investigators.

The PMG research group at the University of Bergen has demonstrated consistent productivity and growth, maintaining its high-level status since 2012 through diversified research portfolios and successful attraction of national and international funding. Efforts to enhance societal impact have also been notable. The group's strategic focus on securing funding, excellence in research and publication, active societal contributions, and user involvement have earned high scores across various dimensions, reflecting their strong organizational structure and research quality.

In terms of organizational strategy, the PMG showcases robust internal collaboration, with all permanent members engaging in collaborative projects and contributing to the training of PhD students. The group's rotational leadership system ensures effective planning and coordination, supported by regular international collaborations and research visits.

Regarding resources, the PMG has navigated fluctuations in funding, with an increasing trend in securing external funding and diversifying funding sources. The group's success in

attracting external research funding is highlighted by participation in numerous research projects, notable grants like the ERC Consolidator grant, and collaborative ventures contributing to societal challenges.

PMG is a highly productive group delivering internationally leading research output. It managed to maintain its high level performance from 2012, and even increased it by diversifying its research portfolio and attracting first rate national and international funding.The group also made efforts to improve its societal impact. During the evaluation period, members of the research group have engaged actively in the public arena and the societal impact of the group is significant.

Research group Fluid Mechanics (FM) overall assessment

The Fluid Mechanics Group at the UiB demonstrates a robust organisational structure, cohesive strategy, and exceptional scientific quality, positioning it as a leader in its field both nationally and internationally. The group's composition reflects strategic recruitment efforts, fostering inclusivity and diversity. Their well-defined strategy encompasses research activities, recruitment, and internationalisation, effectively addressing fundamental scientific questions and practical challenges.Despite a recent decrease in resources, the group has remained active in securing funding from various sources, reflecting its resilience and adaptability.

Moving forward, diversifying funding sources and strengthening collaborations will be crucial to ensure sustainability and innovation. The group's scientific quality is good, evident in its wide-ranging contributions and participation in cutting-edge projects. Collaborations with leading institutions globally enhance its international profile, underscoring its influence and impact on a global scale.

In terms of societal contribution, while the group demonstrates adequate level strides in translating research outcomes into tangible solutions, there is room for improvement in user involvement and societal impact. Strengthening knowledge transfer initiatives and enhancing engagement with non-academic partners will be essential to bridge the gap between academia and industry, addressing real-world challenges more effectively.

Demonstrating a high level of research excellence, the group maintains a commendable level of research and publication quality. Their robust publication record and successful grant acquisitions reflect their dedication to producing high-quality research outputs. Additionally, the group makes significant contributions to the research landscape, with a strategic focus on addressing pressing global challenges. Collaborations with some leading institutions worldwide further enhance their research group's standing and influence. Actively engaging in addressing societal challenges through its research, with notable contributions to areas such as marine environment, pollution, and mathematical education, the group's commitment to societal impact enhances the relevance and importance of their work. However, opportunities exist for enhancing direct user involvement and strengthening networking within Norway to increase the practical implications of their research and enhance their influence and collaborative potential within the country.

Research group Statistics and data science overall assessment

The research group is one of the four subgroups within the Mathematics Institute at the University of Bergen. The group develops and applies statistical methods. The research encompasses medical-/biostatistics, computational statistics, statistical learning and data science, probability theory, and statistical analysis of financial/insurance markets.

The group achieves the benchmark, namely, to be a highly recognised competence centre for developing and utilising statistical methods and to deploy these methods through excellent education on all levels.

The level of research compared to other national and international groups is excellent. They are at the forefront of statistics and publish in high methodological and applied journals. The group has obtained prestigious fellowships.

The group has been successful in broadening its expertise via new recruitments. While the group has an international profile, a plan for the international mobility of group members is lacking. The panel finds the number of PhD and MSc degrees low. The group contributes to teaching in BSc and MSc, both in statistics and for other programmes. The group invests in excellence in teaching. The group has several outstanding publications and successfully obtained grants, particularly prestigious fellowships. The group has developed many software packages and tools, but their impact is unclear. The group is also visible via articles in newspapers.

3. Diversity and equality

It is stated as a core value to encourage a diverse and inclusive community where all are treated equitably and with respect. This is entirely in line with the policies of the Faculty and the university, and the administrative unit is actively engaged in promoting these values.

The administrative unit is an active partner in the GenderAct project with the main goal to achieve long-term, sustainable gender balance at the faculty through cultural and structural change. To implement these initiatives, the administrative unit has developed an action plan, to be evaluated and revised every second year.

Nevertheless, the gender balance is acceptable, albeit still with room for improvement, in particular due to a substantial inhomogeneity across sections. 17% of full professors are female, 27% of associate professors. These are encouraging trends. On the other side, there are no women among Adjunct professors or postdoctoral researchers.

It is also concerning that the fraction female PhD students appear to be declining.

4. Relevance to institutional and sectorial purposes

The administrative unit pursues mathematical research at a high international level, driven by academic freedom and curiosity-driven inquiry. The goal is to strike a balance between theoretical mathematics, applied mathematics, and statistics – to develop mathematical theories and abstract concepts to understand the fundamental nature of mathematical objects and relationships; to develop mathematical models, analyze data, and make predictions or decisions based on mathematical insights; and to make predictions or generalizations based on sample data and quantify uncertainty and variability in observations. As such it has the characteristics of a traditional, strong and broadly founded department of mathematics. The overall goals are universal and the main research activities in the administrative unit support these goals.

The administrative unit furthermore has a strong commitment to education - to discipline-specific programs and to research-driven mathematical education to the three faculties at the University.

MSc and PhD candidates are advised on projects and topics that fall within the area of expertise or scientific interest of the individual researchers and students are included to the relevant research group both socially and scientifically.

PhD students are employed on a 3y-contract, with the possibility of a 4th year through duty work for the administrative unit.

Overall, the contributions of the administrative unit to research-based education across the entire university is very substantial and this must be recognized.

Both MSc and PhD programs attract national and international candidates who enriche the overall research and educational experience. It is estimates that about 60% of the PhD students are international and that about 50% of these stay in Norway after completion. This is clearly a benefit to Norway.

5. Relevance to society

The Norwegian Long-Term Plan (LTP) for research outlines three main goals - competitiveness and innovation, economic-social-environmental sustainability and high quality and accessibility of research and higher education. The impact outlined in several subtopics and the administrative unit contributes significantly to several of these as highlighted in the three impact cases.

Overall, the administrative unit has several projects and activities that attempt to connect directly or indirectly with the general public while generating impact through its research in areas of national interest. A added substantial impact is of course the substantial numbers of MSc and PhD students being educated in the research groups.

It is unfortunate that activities which directly involve the general public, e.g., involvement in museum exhibitions or the creation of activities for talented young people, appear to have been terminated. Efforts should be made to relaunch these, in particular the Mathematical Circles for talented youth.

5.1 Impact cases

Comments to impact case 1: Knowledge for offshore CO2 storage

The Norwegian Government has decided to explore the possibility for a large-scale commercial Carbon Capture and Storage (CCS) value chain, with the goal of subsea CO2 storage off the Western Norwegian coast.

Members of the research groups for porous media and fluid dynamics have been extensively involved in the knowledge development to allow this project to mature from the conceptual stage to become a viable commercial by providing one of the first quantitative assessments of the Johansen formation as a storage site and by contributing to the development and validation of the computational tools that have been used for site assessment. The work has also led to an improved understanding of the environmental risk.

This impact case comprises a number of subprojects conducted over a long period of time and involving both national and international partners.

The project is highly visible and ongoing although the direct involvement is limited to the period of 2002-2022.

Several students and researchers who were involved in the above-mentioned projects have subsequently worked for companies in the CCS value chain and various government owned research institutes, providing another important vector for knowledge transfer.

Throughout the performance period the administrative unit has been active in dissemination of the research in a variety of ways, e.g. meetings on monitoring and risks. In February 2020 the administrative unit organized the STEMM-CCS open science meeting. The University Museum of Bergen selected porous media as the topic of a one-year special exhibit. Here, CO2 storage was the key example of the exhibit, and particular emphasis was placed on the learnings from research at the University of Bergen.

Overall, this is an excellent example of a long-term project of national interest in which the researchers involved have engaged with both their professional community as well as the general public.

Comments to impact case 2: Statistical methods within laboratory medicine

Laboratory medicine is a medical science focusing on analyzing laboratory tests in e.g. blood and urine samples, to aid in the diagnosis, monitoring and treatment of diseases. In this domain, statistics is fundamental to maintain quality control procedures. Over several years, the research collaboration between the Statistics and Data Science group and The Norwegian Organization for Quality Improvement of Laboratory Examinations (Noklus) in Bergen, has impacted the way it uses statistical techniques in its work. This has directly benefited laboratories and receivers of healthcare.

This impact case comprises a number of subprojects conducted over a long period of time and involving both national and international partners. Several students have been directly involved in the project.

The project is highly visible, initiated in 2014 and ongoing.

The project has led to a number of high-quality publications and a direct impact in the way its external partner works. The direct beneficiaries of the impact of the research are Noklus itself and medical laboratories across the world, and clinical guideline developers who are now able to perform the statistical analysis in a better way. However, indirectly the work benefits the general public by seeking to improve patient care.

There is no element of broader and direct engagement with the general public but otherwise the impact of the work is clear and significant.

Comments to impact case 3: Arkimedes labyrinth

The focus of this impact case is the mathematical outreach towards schools and society through two different: The construction of a mathematical maze named “Arkimedes Labyrint” in the botanical garden of Bergen; and the Mathematics Circle, an educational program for high school students aimed at recruiting talents.

During the performance period of 2015-2018, there was coverage in various media such as Science Magazine, national and international newspapers. In particular the “Arkimedes Labyrint” has become a popular site for outreach activities with various activities of mathematical flavor over the years. This has also been covered by the international press.

The *Mathematics* Circle is for a select numbers of high schoolers and organized during 2015-2018. About 20 highly motivated high-school students met once a week, two semesters, to study mathematics at beginning university level. Topics included group theory, symmetries, theory of tessellations, coding theory and cryptography. The students took an

exam in the end. Many of the students continued to study mathematics, at UIB, NTNU and Cambridge, among others. It is unclear why this program was not continued

The impact case has a strong community element but appears to have been terminated in 2018.

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 and asked for the following changes:

- Indicate that the AU started using a gender bias decoder in 2022
- Indicate that NORCE is one of the major collaboration partners
- Indicate that as from 1st October 2024, the Faculty has changed name to "Faculty of Science and Technology"

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

List of administrative unit's research groups

Institution	Administrative Unit	Research Groups
University of Bergen	Department of Mathematics	Analysis and PDE
		Fluid Mechanics
		Algebra, algebraic geometry and topology
		Statistics and data science
		Porous Media Research Group

Terms of Reference (ToR) for the administrative unit

The board of the Department of Mathematics, University of Bergen, mandates the evaluation committee appointed by the Research Council of Norway (RCN) to assess the Department of Mathematics, 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 Mathematics as well as its relevance to institutional and sectoral purposes, and to society at large. You should do so by judging the unit's performance based on the following five assessment criteria (a. to e.). Be sure to take current international trends and developments in science and society into account in your analysis.

a) Strategy, resources and organisation

b) Research production, quality and integrity

c) Diversity and equality

d) Relevance to institutional and sectoral purposes

e) Relevance to society

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

1. In 2020 the DoM started a reorganization process. A structure in 4 larger groups (Pure mathematics, Applied and computational mathematics, Statistics and data science, Mathematics education) was approved by the Department board February 2023, motivated in part for administrative reason and in part for shared responsibilities for delivering education. Several ongoing research activities, though, originated across the groups structure, and the leadership supports this interdisciplinarity. A strategy process started in April 2023 and still ongoing.

2. The research group in Mathematics education has not been registered for the evaluation since at present it did not meet the minimum requirements for research groups as stated in the evaluation protocol.

3. The DoM delivers extensively on education, not only for its own BSc, Master and PhD programs in mathematics and statistics, but is also responsible for delivering mathematical education to all the disciplinary programs administered by the 7 Departments within the Faculty of Mathematics and Natural Sciences. In addition, the DoM is one of the two institutions in Norway offering an integrated 5-y MSc- program in Actuarial Sciences and is also responsible for the integrated 5-y MSc in teacher's education in mathematics and sciences. The DoM is also engaged in continued education and offers several courses to mathematics teachers as well as offering courses in statistics and data science.

In addition, we would like your report to provide a qualitative assessment of the Department of Mathematics 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
- Extract (Section 1.6) from Research Council Self-evaluation 2011-2012, DoM strategy for 2012-2016. See attachment to the present document.
- Strategy 2016-2022, DoM
- Revised strategy MNF 2020-2022: Kunnskap som former samfunnet. Natur - teknologi – bærekraft. https://www.uib.no/sites/w3.uib.no/files/attachments/mn_strategidok_2010-22_web.pdf
- Strategy MNF 2023-2030: Et realfaglig kraftsentrum. https://www.uib.no/sites/w3.uib.no/files/attachments/mn_strategi_2023-2030.pdf

Interviews with representatives from the evaluated units

Interviews with the Department of Mathematics 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 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 DoM and RCT. The DoM 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 DoM and the RCN no later than two weeks after all feedback on inaccuracies has been received from DoM.

Appendices

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

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