

# Evaluation of Mathematics, ICT and Technology 2023-2024

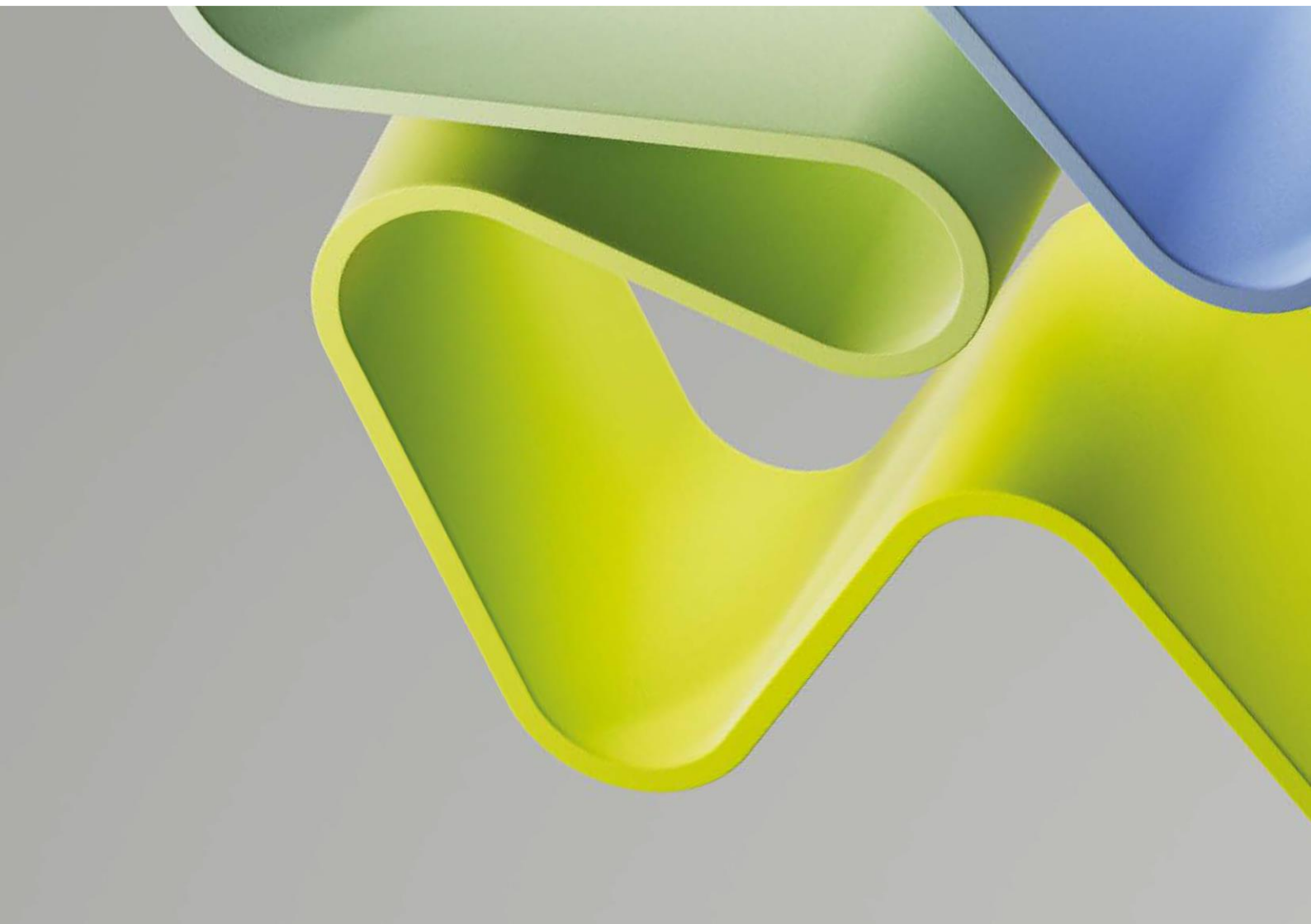
## Evaluation Report for Administrative Unit

Administrative Unit: **Department for Mathematics and Statistics (IMS)**

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

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 unit:

- 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:

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## Description of the Administrative Unit

The Department of Mathematics and Statistics (IMS) is organised into four research groups, with three involved in the assessment. The department loosely organises research activities, granting research groups and individual researchers considerable autonomy in defining their profiles and strategic priorities. The department provides support for funding initiatives without managing independent budgets. Faculty members allocate their time equally between research and teaching.

The research personnel include professors, associate professors, Postdocs, PhD fellows, adjunct professors, university lecturers and researchers, totalling approximately 44.7 full-time equivalents. As of November 2022, the department's gender balance was 28% women, with recent hires improving this ratio through the addition of a female professor and a female associate professor. The department actively promotes gender equality by forming search committees for new permanent positions to encourage female applicants.

The department engages in research across various branches of mathematics and statistics, as well as in mathematics education at the university level. The research activities include both applied and fundamental realms. Fundamental research undertaken by the department spans a wide array of mathematical and statistical areas, whereas their applied research focuses on critical areas aligned with the strategic direction of the university, such as climate science and health sciences.

The research is organised in the following research groups:

- Applied and Computational Algebra (ACAG)
- Geometry and Mathematical Physics
- Complex Systems Modeling (CoSMo)

A fourth group, focusing on mathematics didactics, has only recently been established and is thus not part of this evaluation.

The department focuses on expanding national and international collaborations, which are essential for its research growth and success. The overarching goal is to produce high-quality, internationally recognized research outcomes and to conduct applied research with significant societal relevance. The unit further aims to foster greater cross-institutional collaboration to strengthen mathematics and statistics education, while enhancing its research profile and remaining to be a competitive partner in large-scale international initiatives.

National and international collaborations have been crucial for the department's growth over the last decade, with most research projects relying heavily on external partners for successful execution. Most researchers maintain extensive connections with other universities and research institutes, fostering a collaborative environment both domestically and globally. While there are some formal partnerships, much of the collaboration occurs through established informal networks. Key partnership includes the University of Bergen, with efforts to apply for a Center of Excellence through the Lie Størmer Center. Additionally, collaborations with other mathematics departments in Norway have grown, bolstered by support from Tromsø Forskningsstiftelse and Bergen Forskningsstiftelse, aimed at advancing pure mathematics in the country.

## Overall Assessment

The administrative unit is dedicated to producing high quality research. The three groups evaluated are doing very well each (to be detailed below), especially given the remote location and the limited personnel resources. With regard to the special aspects for consideration from the ToR, the AU:

1. Is doing well promoting mathematical research and increasing its visibility, primarily by way of their publications, but also through outreach and the outstanding level of interdisciplinarity;
2. Maintains many national and international collaborations (though mostly on the level of individual collaboration);
3. Serves the strategic goals of UiT, especially in the direction of climate change (and also promotes the high quality and accessibility in research and higher education, as per the Norwegian long-term plan for research and higher education);
4. Maintains a relatively stable support of its research groups, thus securing continuity in fundamental research.

### Strengths:

1. The strong groups make good use of the autonomy granted by the AU to continuously produce research of high individual quality.
2. They maintain many national and international collaborations on the individual level; in fact, the collaborations with partners from top international institutions as documented in the publications rank the AU very highly among its competitors.
3. Success in acquiring external funding, mostly national, greatly helping to stabilize and even raise the groups' sizes.
4. High level of interdisciplinarity, especially in the direction of climate change, granting the AU an outstanding position within Norwegian mathematics departments.
5. Recruitment of several internationally recognized female researchers as adjunct professors, and lately on the level of associate professors, enhancing the group's research profiles and serving as role models.

### Weaknesses:

1. Missing long-term strategy asking for an overall professionalization, to be detailed below
2. No personnel strategy, especially with regards to succession plans, which is quite critical in view of the small group sizes – also evidenced in the unclear situation with the plasma physics section
3. 2 teams in COSMO underperforming without evident counteractions
4. Limited level of transparency, most visible in the rules for sabbaticals and teaching reductions
5. Low ratio of publications in the top 10% international journals
6. Small scale international funding record, mostly on individual basis
7. Gender balance offering much room for improvement, especially with respect to permanent positions
8. No effective mentoring scheme for PhD students and postdocs

### Prospects:

The groups are doing very well on an individual level which would leave the evaluation committee viewing their prospects very optimistically if this were not counteracted by the missing personnel strategy and the obvious challenges caused by the decline in student

numbers. It remains to be seen whether the AU (or the faculty or UiT) is willing and able to invest some money here or keep the budget stable (per the 4<sup>th</sup> special aspect of the ToR). Otherwise, restructuring the groups, possibly involving some cuts or even terminations, is unavoidable.

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

## **Recommendations**

1. Main message: Professionalize, aiming for a high level of transparency
2. Develop a mid-to-long-term strategy for the development of the groups on the level of:
  - Personnel involving succession plans (to serve the 4<sup>th</sup> aspect of the ToR).
  - Research directions (guiding towards the strategic goals of UiT when applicable, as per the 3<sup>rd</sup> aspect of the ToR).
  - Taken together, consider the options of restructuring or cutting groups which are underperforming or vacant.
  - Alternatively, develop a plan to support them to become more competitive.
3. Aim more for publications in the top 10% of international journals, possibly through some incentivisation. This will substantially promote the visibility of research.
4. Promote international collaborations to an institutional level to preserve or improve your very good track record in this regard, again increasing the visibility of research.
5. Raise the level of international funding acquired by providing support and guidance – this could come with the points above and should be supported by transparent rules for sabbaticals and teaching reductions, including reductions granted for grant applications or the initiation of new institutional collaborations or research directions.
6. Keep your prime position in interdisciplinary research, for instance, by fostering research collaborations towards health (as per the 3<sup>rd</sup> aspect of the ToR).
7. Proactively layout and trace PhD students' and postdoc career paths, especially for women.
8. Continue your efforts to increase the gender balance (which could go well with strategic succession plans).
9. Try to further boost outreach activities in order to promote the recruitment of students and raise the visibility and relevance of mathematical research.

## **1. Strategy, Resources, and Organisation of Research**

The Department of Mathematics and Statistics at UiT is divided into four research groups:

- Applied and Computational Algebra (ACAG)
- Differential Geometry and Mathematical Physics
- Complex Systems Modelling (COSMO)
- Quality in Mathematics Education

The last group has only recently been established and is thus not part of this evaluation.

The department grants research groups and individual researchers considerable autonomy in defining their profiles and strategic priorities, owing to the general fact that the main requirement for resources in mathematical research and teaching lies in funding for personnel. While some PhD positions and travel funding are allocated directly to researchers, overseen by the research group leaders and the department council, the research groups do not have independent budgets.

The department is engaged in a broad and continuous commitment to both, applied and fundamental research. It aims for high quality, international recognition and societal relevance. It fosters connections and collaborations between the department's research activities, many of which have a computational foundation, to create a dynamic environment that continually evolves and adapts in response to emerging research questions, notably in climate change. This strategy appears cohesive and adequate, but also quite ambitious given the small size of the department (and not all positions filled again after retirement in recent years).

### **1.1 Research Strategy**

The research strategy is in alignment with the institutional strategies (as per the ToR) and adequate for mathematical research. Priorities are set when recruiting new permanent staff; this appears natural, but remains vague – in particular when considering that some retiring researchers have not been replaced as of late. One may miss a long-term strategy, if not a vision for the strategic development of the department, but one can concede that the AU is doing quite well in serving the special aspects from the ToR, also witnessed by the bibliometric data.

The research strategy supports the continuation of high quality research of international relevance - which is admittedly easier within mathematics than in other areas, given that one essentially only needs personnel, but then implicit budget cuts implemented by postponed or cancelled new hirings replacing retired researchers threaten to have a negative effect which cannot be expected to be compensated by extended external funding over a long period (cf. The 4<sup>th</sup> key aspect of the ToR).

The research over all groups is innovative, with a recent rise in societal impact due to a focus on climate change. It remains unclear, however, whether or how this was fostered by the department or whether it relied on the individual research group's initiative (as per the 'considerable autonomy in defining their profiles and strategic priorities'). Either way, this should be seen as an excellent example of developing the research agenda, in alignment with the strategic goals of the university.

The publication output per researcher of the AU is comparable to other mathematical units, but it falls behind in the top 10% publications. Copublication rates are good, but the AU stands out with a very good score at top international collaborations and even more at internationality.

### **Recommendations**

- The department is short on permanent positions; to reach the ambitious goals, in line with the university strategy, their number has to be increased. In particular, retiring staff should be replaced properly in due time, to maintain stable group sizes as in the 4<sup>th</sup> special aspect of the ToR (possibly with adjusted scientific focus, taking into account the 3<sup>rd</sup> aspect of the ToR). This should be embedded in a mid- to long-term strategy for the development of the department, based on the SWOT analysis and taking into account the current challenges such as gender / diversity and the critical group sizes.
- There is high potential for research into health (one of the strategic goals of UiT) which should be exposed and facilitated.
- The department should develop a short- and mid-term strategy how to support the teams in non-linear modelling and in mathematical physics within COSMO in order to increase their impact and visibility – as per the 1<sup>st</sup> special aspect of the ToR (or make a proper decision to take a different approach to deal with these issues).

- The AU should aim substantially higher in order to reach publication outlets of top quality while maintaining its excellent level of high profile international collaborations and interdisciplinary projects.

## 1.2 Organisation of Research

Research activities are mostly planned and executed on the group level; this appears fully adequate, though the departmental role in identifying and fostering areas of synergetic potential remains unclear.

Recruitment on permanent positions seems to follow the standards (as set by the faculty or university), but there is no special strategy displayed in the self-assessments. On the positive side, there have been two recent hiring's of female professors (full / associate), helped by an organized search committee. On the negative side, positions have been effectively cut in the ACAG group (by not replacing professors after retirement) without an evident strategy (except for the null phrase that 'the most important priorities are made when recruiting new permanent staff, and in these occasions the strategic considerations are made together with the leaders of the Faculty of Science and Technology'). Obviously, this does not align very well with the 4<sup>th</sup> aspect of the ToR.

In a different direction, the unit pursues a rather offensive strategy by hiring adjunct professors, currently totalling to a number of 5 positions, each worth 20%. Notably these bring a great share of women to UiT who serve as role models and contribute to the teaching programme by offering advanced courses. While this may be exactly the right strategy for the AU (especially, to promote the 1<sup>st</sup> and 2<sup>nd</sup> aspect of the ToR), the evaluation committee invites the AU to evaluate in due time whether a full permanent position (or more, depending on budget availability) might not be more beneficial to the unit (especially with regard continuous presence, sustainable teaching contributions, as per the 4<sup>th</sup> aspect of the ToR). Ideally, the AU could even try to hire one of their outstanding adjunct professors to a full position.

The department is good at providing start-up packages and career opportunities for professors, especially for women. Same for creating mobility opportunities, thanks to a raise in the travel budget, though a good part of it may be counterbalanced by the remote location of the institution – as in the strategy towards developing the 'High North'. It thus appears fair to say that the unit is good at internationalisation (which also is in the groups' compositions and international collaborations). A prototype example is the opportunity for PhD students to apply for funding for an extended stay away from the faculty (which, the evaluation committee takes, means inside academia, but outside UiT, ideally abroad; precise figures or evaluations would have been interesting).

On paper, professors and associate professors are allowed ample time for research (50%). One cannot help but wonder how this can be maintained with groups growing, but permanent positions not replaced after retirement. There are different means to lighten the load for successful researchers, notably sabbaticals and reductions of the teaching duties, but the criteria to fulfil remain a bit vague as displayed, and prone to lack of transparency (in particular the decision 'based on priorities [of] the department').

It is also not clear why the publication criteria can be disregarded for first time applicants – one would expect that these would be recent hiring's who have been selected in good part based on their publication track record. As an overall observation, the rule to grant a full sabbatical every fourth year appears quite generous (and attractive), but then the of constraints may suggest that this is too good a promise to keep.

The institution supports the education of Master students and PhD students by standard means, helped by the extra mobility opportunities for PhD students and extra PhD positions provided by the faculty, but effectively counteracted by the small group sizes (even if the student-professor ratio may be very good). The support of postdocs, however, is almost



vacuous, as per the self-assessment, with 2 postdocs in total. It would be interesting to hear an explanation how this complies with the general career perspectives in Norwegian academia. The evaluation committee did not find any information about mentoring of PhD students and postdocs, especially with regard to career perspectives. Setting this up professionally could help improving the AU's visibility and impact, as per the 1<sup>st</sup> aspect of the ToR.

#### Recommendations

- Explore ways to permanently increase the group sizes; in particular, replace professors after retirement in due time – ideally based on a long-term strategy to develop the department.
- Lay out career paths for staying in academia, especially for women, and consider how this should be reflected in the support of postdocs (especially).
- Embed this in a mentoring / counselling scheme for PhD students and postdocs, and monitor its success.
- Develop a transparent and sustainable scheme for teaching reductions and sabbaticals, allowing for special considerations whenever there are specific reasons (not only for first time applicants).

### **1.3 Research Funding**

The groups have been quite successful in acquiring external funding, mostly national, but also smaller international grants in the cotutelle direction. This clearly reflects the quality of research and contributes to the development of the unit, not only on the plain level of personnel numbers.

The administrative unit seems to support funding applications, without any means being specified. Somewhat to the opposite it 'does not seek to regulate or control these efforts. This attitude appears a bit too defensive, to say the least.

#### Recommendations

- The administrative unit should increase its efforts in supporting grant applications on all scales, like EU-projects, ERC, FRIPRO. To this extent, consider taking a more active role in guiding the unit members to write applications, for instance by offering them teaching reductions during the write-up phase (or partial funding if an application is rated very good, but does not receive funding – even if one may view this incentive a task for the faculty or university, as it serves indeed all special aspects of the ToR - or for RCN).

### **1.4 Research Infrastructures**

On the national level, researchers in the department use the e-infrastructure for computational science provided by Sigma2. High-performance computing and data storage is used for numerical experiments in The Community Earth System Model (CESM), The Norwegian Earth System Model (NorESM), and the PISM Ice Sheet Model. Most of the supercomputing is connected to PhD projects and the RCN project Stability of the Arctic Climate. There is no participation in international infrastructure, but still this appears fully appropriate.

The department encourages researchers to comply with the FAIR principles, but it does not systematically work towards these goals (though the university's efforts in this area seem to show).

#### Recommendations

- Consider working actively and systematically to comply with the FAIR principles.

## 1.5 National and international collaboration

The department maintains a large portfolio of individual collaborations which is essential for conducting fundamental research in mathematics and thus surely represents added value as it serves the 1<sup>st</sup> and 2<sup>nd</sup> aspect of the ToR. This is documented explicitly in the very high level of top collaborations evidenced by the unit's publications. The collaborative efforts are supported by providing opportunities for mobility and sabbaticals; beyond this, it remains unclear how the department 'actively encourages national and international collaboration'.

The department seeks to strengthen its collaboration with the University of Bergen in both research and education, particularly through the Lie Størmer Center for Fundamental Structures in Computational and Pure Mathematics. This partnership has led to pursuits such as an application for a Center of Excellence which advanced to the final round of the selection process. There are also collaborations with other Norwegian universities, for instance as part of the 'Pure mathematics in Norway' project, but the long-term impact of this remains to be seen (or documented).

On the international level, there are established collaborations supporting cotutelle or double degree arrangements, postdoc mobility and teaching collaborations. All of this makes perfect sense but remains on a relatively small scale (but reasonable).

Collaborations with other sectors have been limited to a couple of energy companies, without any details being provided (notably no impact cases). Not only could this have much more potential, especially in light of the expertise and ongoing activities on climate change, but there is also high potential in other directions such as health research (one of the strategic goals of UiT). It should be emphasized that the unit scores very well on the interdisciplinarity level.

### Recommendations

- Lift existing individual collaborations to an institutional level or initiate new ones, especially with international partners.
- Seek more collaborations with other sectors, or try to reinforce existing ones, ideally involving joint supervision agreements (with partial funding).
- Consider establishing precise and transparent means to support the initiation and maintenance of (international) collaborations.
- Develop further international teaching collaborations to attract more international students to UiT (in the long run).

## 1.6 Research staff

The unit's recruitment policy is to set priorities according to the needs related to research and teaching, but it stays rather vague, especially if it comes to succession plans.

Gender balance is taken serious, recent efforts leading to two hiring's of female professors (full / associate). Given the small size of the unit, proportions (of positions, e.g.) and distributions (of age, e.g.) are hard to regulate, or to judge.

On paper, professors and associate professors are allowed ample time for research (50%). There are different means to lighten the load for successful researchers, notably sabbaticals and reductions of the teaching duties, but the criteria to be met remain a bit vague as stated, though the main point (decent teaching & active research) serves the unit's goals. Detailed criticism concerns a lack of transparency (with decisions 'based on priorities [of] the department') and the question why the publication criteria can be disregarded for first time applicants (only) – the evaluation committee would expect that these would be recent hiring's who have been selected in good part based on their publication track record while others may equally well have good specific reasons for not fulfilling some criteria. As an overall observation, the rule to grant a full sabbatical every fourth year appears quite

generous (and attractive), but then the many constraints may suggest that this is too good a promise to keep.

### Recommendations

- Design timely succession plans – sustainable both for the unit and the single groups, embedded in a mid- to long-term vision for the strategic development of the department.
- Evaluate the scheme for granting teaching reductions and sabbaticals, ideally including reductions writing substantial grant applications or initiating institutional collaborations or new directions (as in the strategic goals of UiT or in the special aspects of the ToR); aim for transparent and sustainable rules taking into account special situations for all group members equally.

### **1.7 Open Science**

The unit's policies, approaches and activities appear perfectly reasonable. There are also activities towards open teaching materials, but this is still in the making. The institution's researchers also seem to use the preprint platform arXiv although this was not explicitly pointed out in the self-assessment. There is no information about institutional courses or advice offered towards the unit members regarding skills and training for Open Science, but the AU maintains a very good ratio of 85% open access publications.

### Recommendations

Establish courses and information material for all unit members regarding skills and training for Open Science, ideally separately geared towards the respective group.

Make sure to promote the publication of preprints on arXiv (or similar platforms) and try to raise further the ratio of open access publications.

## **2. Research production, quality and integrity**

The unit comprises three groups (to be evaluated) whose research is mostly based in mathematics, but there are also activities in physics and geosciences, as well as some multidisciplinary research, informatics, and health science.

1. Applied and computational algebra. The group has broad expertise centred around applications of applied, computational and real algebraic geometry. Research projects are focused on combinatorial aspects of algebraic geometry in coding theory, applications of real algebraic geometry to numerical analysis, and algebraic structures in computational algebraic problems arising in polynomial optimization and computational topology.

2. Complex Systems Modelling. The group has specialized expertise in Bayesian statistics, nonlinear dynamical systems, partial differential equations, and machine learning. The research is concentrated on computational methods and data analysis methods within these fields and their application to climate science, epidemiology, nonlinear optics, and research on energy networks. On paper, there is also plasma physics section, but this seems to be essentially vacuous due to sick leave.

3. Geometry and Mathematical Physics. The group has a broad profile in differential geometry and mathematical physics, with specialization in the following research topics: Lie Theory, Cartan and Parabolic Geometry, Tanaka Theory, Geometry of Differential Equations, Supergeometry, Classical and Differential Invariants, Integrable Systems, and Twistor Theory. The group members are international experts in some of the specified fields.

UiT is dedicated to upholding national and international integrity standards and research ethics. There is a particular focus on research integrity and ethics within PhD projects as part of an overarching culture of transparency and openness. The evaluation committee wonders whether the department has considered installing the position of a person of trust for all PhD students to contact in case of need for independent considerations.

## **2.1 Research quality and integrity**

The groups carry out basic research and publish their results in international journals. Publications are mostly open access, and their numbers per researcher are on par with the national average, but they fall behind in the top 10% of publication outlets. Plenty of individual collaborations are building on the unit members' broad international network; their high profile is evidenced in the many publications with collaborators from top institutions. The interdisciplinary collaborations, notably towards climate change, have a particularly high potential impact; this also shows in the unit's outstanding interdisciplinarity score.

### **Research group Applied and Computational Algebra (ACAG) overall assessment**

The overall impression is that the organisational dimension and environment of the research group are both excellent. The group's activities are very well organised and supported by grants, making it very likely that the group will achieve its goals. The quality of the publications is high, and the research group's contribution is excellent, testifying to the group's strength on national and international levels. The group's contribution to the educational and economic development of Norway and internationally is very considerable. The group regularly engages with high school students and is involved with mathematics education in developing countries through the Centre International de Mathématiques Pures et Appliquées (CIMPA). In addition, the project with Tromskraft has a relevant impact on the economic development, in relation to renewable energy sources.

**Strengths:** The ACAG group assembles members with different expertise and a broad spectrum of research activities in applied algebra, algebraic geometry, and computation. In particular, the expertise of the group in algorithms and complexity theory, optimisation, cryptography and coding theory are reinforcing an active collaboration with the department of Computer Science. The good mixture of members with different expertise makes for an excellent environment for PhD students and postdocs (and also for Master students). In recent years the group has an increasing number of PhD students and postdocs thanks to their great efforts for a significant increase in external funding as well as strategical funding from the university. The research results of the group are of high quality and internationally recognised. The group is actively involved in different scientific collaborations, and research networks, both at the national and international level. As a future perspective, the group is working to establish a Norwegian Center for Mathematics in Tromsø and an Erasmus Mundus Master program in computational Algebra.

**Weaknesses:** During the last 3 years, 3 permanent members of the group have been retired and these positions have been replaced only partially. It will be challenging for the group to maintain the same level of research activity, external funding and teaching on all levels without additional permanent positions (which could also help improve on the gender balance).

The size of the student pool, both on the bachelor's and on the master's level, is quite small, with a downward tendency, making it harder and harder for the group to regularly offer high level courses on specialised topics.

## **Research group Geometry and Mathematical Physics overall assessment**

The level of the group's research is excellent, with also a strong impact, as indicated by the excellent publications. The group, already highly international by its composition and its research interests, has strong international collaborations. The research of the group has been supported by several relevant grants, like the GRIEG project SCREAM 2021-2024, joint with Center Theoretical Physics Warsaw, which reinforced the quality and the interdisciplinarity of the group's research. The contribution of the group to the societal and cultural development in Norway is very considerable, as demonstrated by the involvement of the group in mathematical education and in popularisation activities in the North Norwegian Science Center directed towards children and families, which are quite relevant for societal development in Norway.

**Strengths:** The group is strong with competitive research on a national level, and it has a well-recognised international expertise. The quality of the research is excellent, supported by excellent publications. The group has an increased number of relevant funded projects (like for instance the Bridge project). In particular, some postdoctoral and professor II positions have been supported with research projects. The group is very active in the organisation of research seminars. The Sophus Lie Seminar is a great opportunity for the group to share the research activities. The IMS and the infrastructure give excellent support for virtual collaboration and exchange of visits. The research objectives of the group are of very high quality and very relevant at the international level. The group is highly international because of its composition, research, and collaboration. The visibility of the group's research is very high at the national and international levels. The interdisciplinary aspects, particularly the applications of the group's research in Mathematical Physics, Integrable Systems, and Nonlinear Sciences, give the group the opportunity to become an internationally recognised node. The goals of the group are very well-identified and can be achieved. The organisational environment in supporting the production of the group's research is excellent in terms of funding to support research of PhD and postdoc positions.

**Weaknesses:** The research group needs new permanent positions. Most of the group members are in junior temporary positions, so the number of permanent members is still low. This problem was already highlighted in the evaluation report of 2012. With a few permanent members, the group may have difficulties supervising PhD students and higher-level education in case of sabbaticals or leaves of absence. The number of students in pure mathematics is decreasing, so there could be a risk that the group can be further reduced.

## **Research group Complex Systems Modeling (CoSMo) overall assessment**

This is a group that works on mathematical modelling using techniques from statistics and applied mathematics. The group is very organised and has a clear strategy for working on socially important problems such as climate change. The group is very successful at securing funding and, in some aspects of its research, is at a high international level. Still, much of the research has yet to have a significant academic impact.

The group's benchmarks include publishing in top-tier publications and engaging with the broader public. It is unclear how the group will decide if they have met the benchmark.

The group is very strong in climate modelling and will get stronger, given the momentum of the research group and the number of grants that have been obtained. The group could develop some of its other modelling topics, such as its applications in health and medicine. By its very nature, mathematical modelling is interdisciplinary, and the group collaborates with the relevant experts in the area. It is unclear how much of an international impact the

work on non-linear modelling and mathematical physics has and how this fits the group's overall strategy.

### **3. Diversity and equality**

The university and the Faculty of Science and Technology have regulations and action plans to improve gender balance and diversity, prevent discrimination, and provide equal opportunities. For a big part, these are standard and perfectly reasonable, for instance, the requirement to specifically search for female candidates for permanent faculty positions (or all positions where women are underrepresented?!) or rules for gender balance in evaluation committees (which hopefully don't fire back on the female unit members by way of an increased work load).

One subtlety lies in the selection of interview invitees. While the rule of inviting at least one qualified applicant with immigrant background makes perfect sense, the same restriction should apply to applicants with a gap in their CVs: they ought to be qualified in the first instance. (Hopefully this is already part of the rule but got lost in the write-up.)

As a general means, the department (or the faculty or UiT as a whole) could deem it mandatory for every professor (to take part in a hiring or evaluation committee) to take a course on unconscious bias.

### **4. Relevance to institutional and sectorial purposes**

The department is committed to 3 main purposes set by the HEI-Act relating to universities and university colleges:

1. Producing research at a high international level (in pure and applied mathematics as well as statistics) – here the unit clearly contributes to the sector's objectives.
2. Transmission of knowledge, by way of research driven education starting from the Bachelor programme – this may be stretching the meaning / intention of knowledge transfer, but there doubtless is a transmission, also towards future teachers.
3. engagement with society and dissemination of knowledge – here the unit contributes appropriately by outreach activities (especially for school children), by a growing network of industrial cooperations and by activities in different national and international organizations.

There is little experience with innovation and commercialisation, quite common in mathematics, though maybe asking for a culture change (also in order to increase the visibility of the AU's mathematical research, as per the 1<sup>st</sup> aspect of the ToR).

The unit is doing a good job at educating master students and PhD students, though maybe the training and mentoring scheme could be extended to include information and assistance on career development. The department is a node in two EU-funded Innovative Training Networks, and there are several international agreements for cotutelle, or double degree PhD works supported by the strong international network of the individual unit members. It also regularly organizes summer schools and conferences. All of this appears very adequate.

Indirectly, the unit is also contributing to mathematics education by helping to improve educational methods in higher education.

## **5. Relevance to society**

The department directly contributes towards one goal in the Norwegian long-term plan for research and higher education, namely high quality and accessibility in research and higher education. Arguably, higher education in mathematics and statistics also enhances Norway's long-term competitiveness and innovation capacity. As for environmental, social and economic sustainability, there are clear contributions through the research projects related to climate change and to public health. For a math department, this is quite remarkable.

### **5.1 Impact cases**

The AU did not submit any impact case, much to the evaluation committee's surprise in the first instance. After the interview, however, it has to be conceded that this fits well into the AU's general strategy of granting the groups large autonomy. This leaves ample room for improvement, also with a view towards the special aspects of the ToR.

## 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.

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
The Arctic University of Norway	Department of Mathematics and Statistics	Applied and Computational Algebra
		Geometry and Mathematical Physics
		Complex Systems Modeling

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

The rector at UiT the Arctic University of Norway mandates the evaluation committee appointed by the Research Council of Norway (RCN) to assess the Department of Mathematics and Statistics at UiT The Arctic University of Norway 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 and Statistics 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 natural sciences 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. Promotion and visibility of mathematical research*

Promotion and increased visibility of mathematical research are crucial for ensuring its relevance and impact. However, disseminating and publicizing such research poses a considerable challenge in the field of mathematics, thus requiring concentrated efforts. Over the past five years, the Department of Mathematics and Statistics has endeavoured to enhance the relevance and visibility of its research by improving communication with the public and various user groups.

#### *2. National and international cooperation*

Mathematics and statistics transcend geographical boundaries and nationalities. Additionally, the nature of research in these fields typically does not necessitate costly infrastructure. Consequently, mathematics and statistics benefit strongly from collaboration across institutions and borders. The evolution of mathematical ideas often involves the sharing and merging of concepts among researchers, a process further enhanced by modern communication technology. Recognizing this potential, the Department of Mathematics and Statistics at UiT sees these trends as a chance to support ground-breaking research despite the city's remote northern location.

#### *3. Adaptation to strategic goals and societal needs*

Research in applied mathematics and statistics can be tailored to align with the strategic objectives of the university and various funding sources, as well as the immediate and long- and short-term needs of society. UiT has explicitly outlined its strategies for advancing research in the Arctic, climate change, renewable energy, and health. The Department of

Mathematics and Statistics aims to ensure that a portion of its research remains versatile and responsive to meet emerging strategic goals and societal demands.

#### *4. Continuity in fundamental research.*

Developing expertise in specific areas of mathematics and statistics requires consistent efforts over time. Consequently, the Department of Mathematics and Statistics aims to provide stable support of strong research groups, regardless of fluctuations in external financial resources.

In addition, we would like your report to provide a qualitative assessment of the Department of Mathematics and Statistics 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. 3

## **Documentation**

The necessary documentation will be made available by the natural sciences secretariat at Technopolis Group.

The documents will include the following:

- a report on research personnel and publications within natural sciences commissioned by RCN
- a self-assessment based on a template provided by the natural sciences secretariat
- the strategies of UiT The Arctic University of Norway “Developing the High North – UiT’s strategy towards 2022” and “Eallju – Drivkraft i nord: UiTs strategi mot 2030”

## **Interviews with representatives from the evaluated units**

Interviews with the Department of Mathematics and Statistics will be organised by the evaluation secretariat. Such interviews can be organised as a site visit, in another specified location in Norway or as a video conference.

## **Statement on impartiality and confidence**

The assessment should be carried out in accordance with the *Regulations on Impartiality and Confidence in the Research Council of Norway*. A statement on the impartiality of the committee members has been recorded by the RCN as a part of the appointment process. The impartiality and confidence of committee and panel members should be confirmed when evaluation data from Department of Mathematics and Statistics 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 natural sciences secretariat. The committee may suggest adjustments to this format at its first meeting. A draft report should be sent to the Department of Mathematics and Statistics and RCN by [date TBD in dialogue with the RCN]. The Department of Mathematics and Statistics should be allowed to check the report for factual inaccuracies; if such inaccuracies are found, they should be reported to the natural sciences secretariat no later than two weeks after receipt of the draft report. After the committee has made the amendments judged necessary, a corrected version of the assessment report should be sent to the board of UiT The Arctic University of Norway and the RCN no later than two weeks after all feedback on inaccuracies has been received from Department of Mathematics and Statistics.

## **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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