

Evaluation report

Evaluated point	Grade	Comments
Scientific impact of research	Good	<p>The Technical University of Tallinn offers a large scientific spectrum in natural sciences, partly due to the needs of teaching. The scientific impact of the research is good and the list of topics given here is certainly not exhaustive among those that deserve a special mention. Many of them, even if not directly application-oriented, aim to better understand fundamental issues in engineering or environment. In particular, this concerns fundamental disciplines such as mechanics, physics and mathematics with, for instance, the study of inverse problems that serve to identify parameters of models, chemistry (green chemistry, analytical chemistry and synthetic chemistry) which is certainly one of the most competitive topics of this application, and also the more directly application oriented fields of research that are related to ecology and geochemistry of the Baltic sea. One should also certainly mention biology, in particular in relation to plants and agriculture. In addition, there are some good research groups and research activity in areas such as neurobiology, microfluidics, and structural/ synthetic chemistry. The total scale of activity is considerable with around 200 FTE research staff. The research environment generally made a very good impression. Laboratories are well equipped, and researchers demonstrate their work with passion. National Science Awards have been received on several occasions, and staff have published in high level journals appropriate to their fields of research. PhD students are well integrated into the larger operation of research groups, with regular seminars and invited talks. The foreseen appointment of a Chair in Green Chemistry should enhance scientific impact of the research and public profile of the institution.</p>
Sustainability and potential of research	Very good	<p>The first reason for thinking that this application proves sustainability of research is its quality as well as the number of projects that the application contains. Some conditions are very good, such as material conditions, library, and experimental equipment. Researchers are very much focused and in most cases enthusiastic. There are many collaborations among them and their international collaborations are numerous. Research groups have regular seminars. At the same time, it is difficult not to speak of negative issues that do not depend on the researchers. They were confronted with many changes in the organization of the university and the funding of research during the last few years. They have proved to have a remarkable capacity of adaptation. However, it is clear that more stability would be very profitable. The changes have included creation of larger units and introduction of tenure track positions. In the</p>

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		<p>natural sciences, activities have been brought under the umbrella of a School of Science as one of 4 major units of the University. This may provide an opportunity to develop the natural sciences, in terms of developing new activities and further improving visibility of the research. Another potentially negative issue concerns the decreasing number of students which is largely due to demographic reasons. If this went on, it could not only affect the research in natural sciences but the whole university by weakening the quality of teaching in fundamental disciplines. Also, probably due to financial issues, there is a lack of post-doctoral researchers. Overall, the potential for sustaining and growing research in the natural sciences is very good. Some research is clearly important and sustainable but continued success is too much dependent on obtaining research project and/or industrial funding. The development of long-term projects is also harmed by the funding schemes. In addition, there is uncertainty about how funding changes after 2020 may affect the sustainability of current research programmes. Sustainability may also be threatened by small research group sizes, recruitment difficulties and the "brain drain" to other jobs, institutions and countries.</p>
Societal importance of research	Good	<p>Much of the research assessed is of societal importance, with some relevant to industrial exploitation, e.g. microfluidics technology, and development of stress-resistant glass. One should mention especially efforts in the direction of secondary school students, for instance with the Olympiads in physics. We have already mentioned research related to the local environment, in particular in relation with the Baltic sea. This is mostly carried out in collaboration with the Marine Centre. Other hugely valuable research deals with food technology and is joint with the Competence Centre of Food and Fermentation technology or the Competence Centre of Cancer Research. If not directly, the transfer of technology is done through these centres. The research develops competences in fields of importance to society. Many of the activities directly address societal challenges, such as biomedical research on neurodegenerative diseases. There is also excellent research advancing technology with wide application potential, for example work in biotechnology on smart instruments. In addition, water monitoring is relevant to pollutant analysis, public and environmental health. Furthermore, green chemistry, and plant pathology all have potential impacts related to human and crop health, ecosystem management and identification of novel bioactive compounds. In physics, theoretical studies and in particular network analysis are applied to banking.</p>

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<p>Scientific basis in the field is sufficient to conduct doctoral studies. (This question should be answered only if: a) institution being evaluated is conducting doctoral studies and; b) The field being evaluated is proposed to grant positive evaluation. If these conditions are met then: a) If the level of scientific basis is sufficient for conducting doctoral studies in every structural unit being evaluated, then the answer should be „yes“; b) If the scientific basis is not sufficient in some structural units, then those units should be listed.)</p>		<p>Yes, the level is sufficient. The scientific basis for doctoral studies is very good. The evaluation committee has seen separately around 12 PhD students and has had an extremely positive impression. They appreciated the efforts of the university and of the different advisors to guarantee sufficient funding in complement to the state allocation. They have excellent conditions for research, with weekly seminars that they attend, good library and experimental material. Each of them attends at least one conference or summer school per year. They have no difficulty to have it financed. Among the PhD students attending the meeting, 5 of them were foreigners. All of them were extremely satisfied of their stay in Estonia, for all points of view. Natural Sciences are clearly attractive at TUT for doctoral studies. Students face challenges, such as the inflexibility of requirements for publication which can be hard to meet in some areas of science where results require longer to develop, and the need for financial support to supplement their stipend.</p>

Summary assessment

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<p>Areas of special note as appropriate (Where necessary indicate sub-fields, assessment criteria, and/or structural units which, in the committee's opinion, were of a notably high level.)</p>		<p>Across the board the research groups appear to do good research with some activities being particular impressive like neurobiology, synthetic chemistry and microfluidics. Laboratories appear well-equipped and have relevant basic equipment for the research we were shown. Staff and PhD students were enthusiastic and committed to their research. The high proportion of students from abroad, and the initiation of English language courses to further aid such mobility is commendable.</p>
<p>Areas in need of improvement as appropriate (Where necessary indicate sub-fields of the field being evaluated, assessment criteria, and/or structural units which, in the committee's opinion, revealed significant shortcomings.)</p>		<p>The transition to a new structure is a work in a progress. It was not clear how the new structure would benefit the research groups, and promote joined-up thinking as a larger unit. A key area in need of improvement is communication of research. Research groups need to communicate what they do in an effective manner. This is completely underdeveloped and hampering visibility and impact of the research. A potential problem is also that PhD students are pressured by the requirement to have three papers published from their work which increases the overall publication count of the institution but does not guarantee a deep understanding.</p> <p>There did not appear to be a clear plan or rationale for recruitment of new staff to reinforce key areas or increase critical mass of researchers in key areas. The university should be careful in recruitments in all areas of natural sciences. The choice of topics is important, even if the recruitment is not carried with respect to a specific programme. Indeed, each group of research is small and it is important to choose future colleagues that are able to collaborate significantly. For mathematicians, for instance there is a risk to have no connection with the rest of the university, and also to have very weak connections between them, even if their own research is of quality. This is a serious issue, particularly when their number in a department is small and cannot lead to the creation of groups of sufficient sizes in different sub-domains. This problem has to be seriously addressed for new recruits, which should be encouraged. Fourier analysis in relation with image and signal processing, numerical analysis and partial differential equations in relation with mathematical modelling, are sub-domains that can be valuable for interactions.</p>

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Assessment proposal to the Minister of Education and Research	To grant positive evaluation	The development of research in natural sciences overall is very good, with original applications linked with the specific geographic position of Estonia as well as its economy. It contributes to ensure a real place for Estonia in the international scientific community. The research environment is good, and the panel is generally impressed by the different research activities. It is clear there is research potential within natural sciences disciplines, and a good learning environment for graduate students.

Feedback

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<p>Feedback for institution (This question should be answered only if the institution asked for feedback from the evaluation committee in the self-report (about up to three specific areas of R&D which it finds to be currently important, e.g., related to its development plan).)</p>	<p>Sciences and technology interact in a permanent way. Future developments and applications will be based on basic research previously carried out and require solid training in fundamental disciplines. In this context, helping to develop natural science aside from engineering and technology is an important part in the development of TUT. Therefore, shifting the emphasis too much to interdisciplinary research exposes the danger of cutting the fundamental approach. Inventing many fashionable names for departments instead of using the names of the disciplines makes disciplines like pure physics and mathematics less visible and perhaps less attractive in the long term, which would also have a long term negative impact on interdisciplinary science.</p>
<p>Suggestions for unit, institution, state etc. (As appropriate, committee can give additional feedback for the structural unit, the institution, or the State (please specify whom feedback is directed to) according to the directive assessment criteria for regular evaluation (article 7).</p>	<p>In summary, we recommend that the structural changes in the university on the school and department levels should be stabilized for a longer period of time so the new structure should have time to develop. It seems that the situation is too fluid at the moment to create stability. There is a clear need for postdoctoral positions in the research groups.</p> <p>There is a need for a long term structural plan including strategic appointments to address the problem of the small size of some of the groups in natural science, so that these groups do not fall below critical mass.</p> <p>An important point also concerns the uncertainty of future funding in particular in terms of state funding. The state should provide clear and definite plans for the funding schemes and the funding levels for mid-term and long term timescales to remove this uncertainty. Funding uncertainty always hinders long term development of research directions and long term projects.</p> <p>The financing of PhD students via (insufficient) stipends and additional contracts leads to very unequal situations for the students. Some are paid for the doctoral research for the institution and some have to seek part-time jobs within and outside the university, which clearly creates an imbalance.</p> <p>Researchers should be encouraged and supported by the institution to create more visibility on the web. It is very hard to gather information about the research activities on the level of individual groups, which is important in terms of visibility.</p>