

# Evaluation report

Evaluated point	Grade	Comments
Scientific impact of research	Very good	<p>The departments visited have excellent infrastructure. They are well equipped with modern instrumentation in addition to the traditional equipment necessary for an engineering and technology department. The combination enables the high quality of the research and development that is pursued by a number of diverse groups. We give a few examples below.</p> <p>A strong biomedical group has benefitted from a centre of excellence, EXCITE. It works in close collaboration with medics to introduce information technology science and engineering into hospital procedures monitoring the brain, heart, and fluids pertaining to dialysis. A number of doctors have enrolled to do PhDs with the group.</p> <p>Research in Energy Systems on power electronics focuses on optimal operation of power systems and plants and helps maintain stability in the Estonian power grid.</p> <p>Advances in power electronics for coupling solar panels to the grid and in using a low temperature CVD process for applying nano layers on flexible substrates in the production of flexible solar cells also impressed.</p> <p>Low temperature powder technology for creating semiconductors with thin films in low cost materials as alternatives to Si, e.g. for photovoltaic applications, seems promising.</p> <p>Protein imprinted polymer films for artificial receptors as interface to transducers, e.g. for medical and environmental applications have already been to some extent implemented.</p> <p>Process development in powder metallurgy and 3D printing for production of metal and polymer components with varying material properties and complex geometries was impressive. These research results are used for product development in cooperation with the TTÜ design department.</p> <p>The co-ordination of the new Centre of Excellence nZED by the Faculty of Civil Engineering is a further testament of the strengths of the different groups and will provide opportunities for collaboration between the different departments (buildings, indoor air quality, HVAC). In these and other examples the departments have pioneered the application of scientific discoveries. The publication record is good in terms of quantity and quality.</p>

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Sustainability and potential of research	Very good	<p>There exist various challenges to the sustainability of research. The current state of infrastructure and equipment is excellent but with the withdrawal of EU infrastructure funding plans are needed for maintenance, new innovative equipment and replacement of current equipment. Increase in baseline funding will help to some extent. Success in grant applications is needed. The strong record of the departments in commercializing their inventions is a cause for optimism. The departments currently benefit from experienced financial leadership.</p> <p>A steady supply of high quality PhD students is a key factor in the sustainability of research. Although the current numbers appear sufficient there are problems with the amount of time that students are able to devote to their research due to the necessity to work for financial reasons. We understand that this may in part be alleviated by the planned increase to government scholarships. Also the department is able to supplement a PhD's income from other funds. Efforts should be made to ensure that industrial work enhances a student's research experience and that departmental teaching, although a beneficial experience for a research student, does not become burdensome. Given the high teaching load of some PhD students, it may be prudent for the University to develop guidelines on the amount of teaching PhD students can undertake to overcome low completion rates or long completion times.</p> <p>A smooth succession of faculty and transfer of experience from retiring professors also needs management. Different groups face different challenges, from lack of new staff to too many young staff with concerns on the transfer of know-how and experience from experienced staff close to retirement. The university's ambition to have comprehensive strategic planning concerning professorial positions after retirement, whether to continue within the same field or to change to a new research direction with higher potential, would be very important.</p> <p>Collaboration across departments, e.g. as noticed, between the FCE and FPE, or FCMT and other laboratories is commendable and should be encouraged to ensure optimum use of equipment, which would support further maintenance of the resources.</p> <p>With respect to research potential the wide variety of current research topics that are in important and challenging areas, are likely to produce new science and relevant applications in the near future. The faculty also is alert to changing opportunities and has the background and experience to exploit them.</p>

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Societal importance of research	Very good	<p>As one would hope and might well expect from engineering and technology departments there is extensive close collaboration with industry. We distinguished three dominant collaborative modes.</p> <p>The first, where the department collaborates closely with an existing industry, is well exemplified by the Energy Systems long term collaboration with the national transmission system operator, Elering AS. The involvement of the civil engineering group in the development of various legislative documents and technical specifications, e.g. for near zero-energy buildings, or improvements in specifications of asphalt-pavements are further examples of such work.</p> <p>There are examples of development of devices leading to the foundation of spin-off companies. The method for coupling solar panels to the grid is being launched in this manner with the CTO of the company also working in the department. Biomedical research has also resulted in a spin-off company. Patent activity, assisted by the University's IBC, is evident but there is a desire to increase the commercialization of the departments' discoveries.</p> <p>The third mode is where the department acts as service provider to industry for a fee, for example in testing of building materials, and in measurements made by the Department of Materials and Environmental Technology. Certification procedures and accredited staff and equipment enable such activities and can place the university in a strong position to provide such services in the national landscape, and have potential for long-term collaborations. Such accreditation processes can be further extended with the development of the nZEB Centre of Excellence.</p> <p>Another product of the Departments that impacts beneficially on society is in the training of well qualified scientists. Of the graduated PhD students 25% stay in academia, the other 75% find employment in a wide variety of industry and business.</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		<p>Yes.</p> <p>Our response to the question of sustainability and potential of research evidences the strong scientific basis for conduction of graduate studies.</p>

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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.)		

## Summary assessment

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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.)		Graduate schools are working well and evidently are much appreciated by the students. They enable presentation of their research to an audience of their peers, attendance at seminars, and travel to international conferences. All provide essential networking for students who may be working in a small research group. It is important that funding for graduate schools is maintained. Cooperation with other research groups, in Estonia and internationally, is evident, and is to be encouraged.
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.)		As mentioned above it is essential that PhD students have sufficient financial security to be able to devote themselves to their research project.
Assessment proposal to the Minister of Education and Research	To grant positive evaluation	We found E&T to be very strong at TTÜ

# Feedback

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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>1. Should the doctoral study programmes be more interdisciplinary or more focused on a narrower field?</p> <p>We assume that this question refers to the courses that PhD students have to undertake as part of their programme. We found considerable apathy on the part of the students with respect to their courses. This was in strong contrast to their enthusiasm for the Graduate School activities, which undoubtedly enhanced their research experience. While availability of a wide range of courses is desirable, the faculty should examine its own courses and ensure that they are interesting and relevant.</p> <p>Students may well also need advice as to the timing of their course work and the relevance of specific courses. A tendency to cram them all into the first year may interfere with getting to grips with their specific research problem.</p> <p>2. What are your recommendations for further development of the support system for foreign researchers; what are the key elements that should be given greater attention to?</p> <p>Given the big emphasis the University places on welcoming international staff and students, appropriate mechanisms should be put in place to enable their swift integration into the university, particularly regarding accommodation.</p> <p>The type of support necessary is a function of the level at which the foreign researcher is entering the University.</p> <p>For a PhD student coming from abroad accommodation is key. Foreign students should have priority in University dormitories and not be left to search for their own accommodation on arrival. Access to a mentoring system to assist their integration into society is also desirable.</p> <p>For a post-doctoral worker the above also applies but in this case assistance with finding accommodation, when a family might also be involved, is likely to be more relevant than rights to a place in a University dormitory.</p> <p>For faculty the salary offered should be competitive with other European universities. Start up funding, in order to ensure the necessary research equipment and funds for co-workers, is key. Also assistance with finding accommodation is helpful.</p>

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<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>A note for the University:</p> <p>In the context of diversity and inclusivity and the European Disability Strategy priorities, accessibility requirements for wheelchair access may need to be revisited and the buildings adapted accordingly. It is commendable that the University provides ramps and appropriate lifts to enable wheelchair navigation on the ground floor and in between different floors. However, along many of the upper floors, access to wheelchairs appears more difficult through door frames which have stepped access. Such doors are found on the main corridors as well as in the labs, offices, etc.</p> <p>We would encourage the development of a focus group to review provision in the light of appropriate standards and best practice guidelines.</p>