

Evaluation report

Evaluated point	Grade	Comments
Scientific impact of research	Very good	<p>Under the banner of Engineering and Technology we visited the Institute of Technology (IT), the Institute of Physics (IP) and the Institute of Chemistry (IC). Historically IT was founded to manage outreach to industry and IP and IC were concerned with Basic scientific research but currently all three conduct fundamental research much of which has resulted in practical applications.</p> <p>In all three departments the infrastructure and instrumentation was of high quality, enabling a wide variety of activity from robotics, through material sciences to biotechnology and synthetic biology. Access to the Estonian beamline at the Lund synchrotron is also secured.</p> <p>The basic research presented was of high quality and cutting edge. A high proportion had already found industrial application.</p> <p>Some examples of basic science with particular technological focus were as follows.</p> <p>In IT the robotics group had developed a robotic mannequin for e-shopping and, in stark contrast, in cooperation with a group at Austin Texas, a mobile robot for use in hazard environments.</p> <p>Again in IT studies in plant biology, with aid from robotics, systems have been developed for the study of plant growth under controlled conditions. Thus the effect of genetic engineering on plant growth and the behaviour of stomata is carried out. Studies on genetically modified barley are being applied to rice in collaboration with IRICE in Malaysia.</p> <p>Synthetic biological research involves modification of yeasts to produce target molecules for biofuels and synthons for pharmaceuticals.</p> <p>Materials research in IT involves smart materials based on soft polymeric composites, production of aerated concrete that is lightweight, strong and insulating for building, and fibres for armaments.</p> <p>The electrochemistry group in IC has developed super capacitors and solid state batteries. Work on solid oxide fuel cells, where collaboration with TTU is involved, is implemented by Elcogen. Novel designs for the solar driven catalyzed production of syngas from CO₂ and H₂O are in progress.</p> <p>Measurement of gas phase acidities and basicities by ion cyclotron resonance techniques are world leading, complement more conventional solution techniques, and have potential application in catalysis.</p>

Evaluated point	Grade	Comments
		<p>It is evident that research in these departments benefits from close collaborations both nationally and internationally. Such collaborations are often initiated by study abroad at both the doctoral and post-doctoral level.</p> <p>The research achievements are evidenced by an increasing number of high level publications.</p>
Sustainability and potential of research	Very good	<p>From the teams we met and labs we visited, it appears that the recent investment from structural funds has resulted in impressive infrastructure facilities and equipment.</p> <p>There are teams of high scientific calibre with national and international collaborations, and an extensive range of industry links from SMEs to large organisations, where the PhD students get the opportunities to engage with state-of-the-art developments. The removal of structural funds does not appear to pose a great threat, and along with the expected increase in baseline funding, there is a sense of optimism for the future.</p> <p>The number of PhD students is healthy, contributing to the vibrancy of the Institute, however, long completion times are a concern. The planned increase to government scholarships along with the provision of supplementary funds by the hosting labs will alleviate the pressures for students to work externally to support themselves. Nevertheless, it is also advisable to provide a tighter framework for monitoring students' progress and expectations, to ensure completion within the four years.</p> <p>It is encouraging to see knowledge that has arisen from research grants is used for further collaboration (e.g. with the International Rice Institution in Malaysia for the plant molecular biology group; with US and European partners for the synthetic biology group, along with the newly established and rapidly developing pharmaceutical industry in Estonia, to advance the biotechnology industry nationally with a prominent position in the Baltic region; with Japanese company for clothing mannequin and Texas Austin for robots in hazardous environments for the intelligent materials and systems group, a largely interdisciplinary lab; various links with companies from starts ups to larger ones for contract work and problem solving for the materials science group, etc.).</p> <p>Given the extensive research potential of the different strands of work, it is likely the Institute will keep developing knowledge and applied research in the future.</p>
Societal importance of research	Very good	<p>Much of the impact on society from these units is direct in transfer of technology to industry.</p>

Evaluated point	Grade	Comments
		<p>The institute of Computer Science (ICS) is strongly related to companies, with one person handling these connections.</p> <p>Other examples of industrial exploitation are the Institute of Chemistry's (IC) super- and ultracapacitors with Finnish company Skeleton technologies, fuel cells (both polymer electrolyte and solid oxide types) with Finnish company Elcogen and with Japanese companies, as well as new Li-ion and Na-ion batteries.</p> <p>IC is further developing the processes for extracting valuable rare earth metals from the residuals from oil shale energy production. These processes are used by industry, e.g. Estonian company Silmet and Boliden in Sweden.</p> <p>The Institute of Physics (IP) is a partner in the Max IV synchrotron beamline at Lund University, Sweden. IP is also cooperating with universities in UK and University of Löwen, Belgium. Integration of wind and solar power to the electrical grid is carried out in cooperation with the Estonian utility company Elering.</p> <p>The research group in Robotics within the Institute of Technology (IT) has developed a robot mannequin project for tailor-made clothings. This project was however recently purchased by a Japanese company and was then terminated at the university. The Robotics group has also cooperated with University of Texas, Austin, on a mobile robot for use in hazardous environments. Another cooperative project within the Robotics group was the EU FP7 SPACE project SHEE (Self-deployable Habitat for Extreme Environments), the "Mars" habitat for humans in hazardous environments (e.g. in space, in extreme environments on earth, or during disaster mitigation).</p> <p>The research group in Smart Materials (IP and IC) has developed aerated porous and permeable concrete for improved insulation and climate adaptation in light weight load carrying building structures, now being implemented. They also do much contract work for companies, e.g. in material related problem solving, often carried out by students.</p> <p>The research group in Molecular Biology / Plant Photosynthesis is cooperating with IRICE in Malaysia.</p> <p>The research group in Synthetic Biology is working with yeast engineering to produce more valuable chemicals and biochemicals, they cooperate with labs in the EU and US. A pilot plant for up-scaling is planned. The emerging pharmaceutical industry in Estonia will build a production unit close to the UT institute.</p> <p>The Faculty of Science and Technology (FST) has a separate unit for handling patents and industrial applications. This unit</p>

Evaluated point	Grade	Comments
		<p>will transfer requests from companies and establish contacts with the relevant institutes and research groups.</p> <p>The Institutes also have an extremely valuable input in the high quality of education provided at the doctoral level. Their students are valued as employees in both industry and academia.</p>
<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</p> <p>The research in engineering and technology, which is current in all three institutes, is challenging, productive and of good quality. Confidence in the sustainability of the infrastructure is evident. Supervision of students appears to be good. We have no hesitation in recommending that these departments can continue to provide doctoral studies.</p>

Summary assessment

Evaluated point	Grade	Comments
<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>The enthusiasm and high quality of the young academic staff of the Institute was particularly impressive.</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>Convenient space seems to be lacking for teaching purposes, within the Institute of Technology. This is due to the fact that the institute was originally formed to provide a link between research and industry, and has only recently been involved in teaching. Teaching facilities (labs and auditoriums) are however available in other institutes and buildings at UT.</p>
<p>Assessment proposal to the Minister of Education and Research</p>	<p>To grant positive evaluation</p>	

Feedback

Evaluated point	Comments
<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>Technology fields are rapidly expanding in UT (environmental, nano- and bio-technology, robotics, new energetics), all based on solid natural science foundation. Should this be reflected in government policy? Government policy should be open to new directions in research when they have the potential to present solutions to problems for society.</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>Suggestion for the institution.</p> <p>The Institute of Technology is moving from being a purely research department to involvement in teaching, for example, for second year Bachelors students they are providing an International Science and Technology course and for Masters programmes lab space is required. Space is lacking within the Institute for this type of activity. Also additional research space for repatriation of postdoctoral scientists is highly desirable. We support this case for expansion. Currently, the required lab and office space can however partly be found in other institutes and buildings at UT.</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. Currently all new buildings and some historic buildings have wheelchair access. It is however commendable that the University provides ramps and appropriate lifts to enable wheelchair navigation in all premises. However, along some of the floors, access to wheelchairs appears more difficult through door frames which with have stepped access, e.g. in some labs and offices.</p> <p>Work on this issue was reported to be in progress, but the development of a focus group to review provision in the light of appropriate standards and best practice guidelines could be considered.</p>