

University of Tartu

1. Scientific Impact of Research

1.1. Positive aspects

The University of Tartu (TU) has a broad scientific spectrum in the natural sciences that is represented in eleven institutes: Institute of Computer Science (ICS), Estonian Marine Institute (EMI), Institute of Physics (IP), Institute of Chemistry (IC), Institute of Genomics (IG), Institute of Mathematics and Statistics (IMS), Institute of Molecular and Cell Biology (IMCB), Institute of Technology (IT), Institute of Ecology, Earth Sciences (IEES), Tartu Observatory (TO) and since 2024, the Institute of Bioengineering.

The scientific impact of the research is very high. Evidence for that is the large number of very good projects ranging from fundamental research to applied science. It constitutes the largest program in Natural Science in Estonia with both strong projects within the individual disciplines and with strong interdisciplinary projects. Science and Technology is the biggest Faculty with ~40 % of the university's academic staff.

Scientific impact is considerable through a large output of publications. The research of TU in natural science is well recognized internationally. The number of publications and especially the quality of publications has increased a lot. Convincing evidence of this is 20% of publications are among the 10% of most cited publications in the field of natural sciences. The fact that eight ERC grants have been given to researchers of TU in the area of natural science in the reporting period underlines this. In addition, more than 25 researchers have received national awards.

TU trains a large number of PhD students in diverse fields of natural sciences, with the Faculty of Science and Technology producing the highest number of graduates in the university.

1.2. Areas for improvement

It seems that the opportunities and challenges of artificial intelligence have not fully been realized at this point. Especially in the areas beyond the Institute of Computer Science this technology and its use is not very well recognized.

1.3. Recommendations

Given that funding agencies and government politics emphasize interdisciplinary research the program at TU should stay well balanced and a further strengthening of fundamental research should be considered.

In addition, the fast-moving development in artificial intelligence research and its application should be put more in focus, because a lack of action could very quickly lead to a situation of missed opportunities. As stated in the self-evaluation form core areas such as machine learning, artificial intelligence, and cybersecurity should be strengthened.

Assessment of the scientific impact of research

Exceeds threshold.

2. Sustainability of Research

2.1. Positive aspects

Natural sciences at TU developed greatly in the review period. Not only was Tartu Observatory and the Estonian Biocentre integrated, but many other substantial developments underpin the sustainability and widen the research portfolio. The possession of a fairly long list of significant cutting-edge infrastructures across the disciplines is an important basis for the sustainability of the research in natural sciences and allows for long term research programs in certain directions.

Examples of these infrastructures are the Estonian Biobank, the infrastructure at Tartu Observatory, the European Life Science Infrastructure, the UT Delta Center, the High-Performance Computing Center, the laboratory of ultrasensitive measurements, and the Center of Nanomaterials Technologies and Research (NAMUR+). In summary, the infrastructure is at excellent level being competitive to almost any other multidisciplinary university in Europe.

In addition, the researchers in natural sciences at TU possess and maintain several important databases and collections. There are several Centres of Excellence in natural science led by

researchers of UT: Centre of Excellence for Personalized Medicine, Centre of Excellence for Transdisciplinary Studies on Ethnogenesis and Cultural Diversity, Estonian Centre of Excellence in Artificial Intelligence, Centre of Excellence in Sustainable Green Hydrogen and Energy Technologies, Centre of Excellence of Energy Technologies, Centre of Excellence on Foundations of the Universe and Centre of Excellence for Sustainable Land Use. Connections between R&D activities and doctoral studies have been improved by establishing industrial PhD-concept. There have been five doctoral schools, but the plan is to form a single PhD school for all PhD students in Estonia. In summary, PhD-education seem to be effective and new routes to enhance it further are in active search. The shift from scholarships to salaries has been implemented. Lot of effort have been done in order to ensure equal opportunities for personal as well as for students. These include, for instance, university level guidelines for equal treatment and gender equality plan.
2.2. Areas for improvement
It appears that one of the biggest limitations and a future threat for sustainability is the lack of personnel at several levels due to the demographic situation in Estonia.
2.3. Recommendations
Since lack of personnel is a serious problem, programs to attract more students in natural science need to be implemented. These should include early interactions with schools and involvement in school education. In terms of researchers the most important issue is to be attractive and active on the international level. Programs need to be installed that target especially this problem. Since that is a general problem in Estonia this might need actions also on a nation-wide scale.
Assessment of the sustainability of research
Exceeds threshold.

3. Societal Impact of Research

3.1. Positive aspects

The research conducted in the natural sciences at TU has a broad societal impact, locally, nationally and internationally. TU's research in biology and ecology has significantly contributed to the understanding of biodiversity in the Baltic region and beyond. Researchers focus on conservation strategies, which help in maintaining ecological balance and supporting sustainable development.

Environmental science research at TU addresses climate change, providing valuable data for policymakers and contributing to global discussions on climate action. This includes research on greenhouse gas emissions, carbon sinks, and the impact of climate change on local ecosystems.

The natural sciences faculty collaborates with health sciences, focusing on genomics, personalized medicine, and the development of new diagnostics and therapies. This research directly impacts public health by improving the understanding and treatment of various diseases. During the COVID-19 pandemic, Tartu University played a pivotal role in Estonia's response to the crisis through research, public health initiatives, data analysis, and policy support. The university's involvement encompassed various aspects, from epidemiological studies and testing to public education and advising government bodies.

Tartu University has a vibrant ecosystem that fosters innovation and entrepreneurship. Several spin-offs and start-ups emerged from the research conducted in natural sciences. These companies contribute to the local and national economy by creating jobs and attracting investments.

Research in physics and material sciences leads to technological advancements that impact industries such as electronics, energy, and materials engineering. This includes the development of new materials, nanotechnology, and energy-efficient solutions.

Adult education and outreach programs are also parts of the societal impact of research.

3.2. Areas for improvement
Since there is a lack of students in the field of natural sciences it is obvious that the efforts regarding engagement with schools and the wider public in general are not sufficient yet.
3.3. Recommendations
Interactions with schools should be emphasized and done on a regular basis leading also to collaborations between school and TU. Young researcher programs that allow school students to visit labs at the university and participate in small research tasks can have a deciding effect on the subjects these school students may later select for their studies. Also support for teaching natural science in school should be considered by TU natural science researchers. In addition, regular interactions with local industries (especially the ones with research) should be established to develop mutual interests and create collaborations. This might be done by bi-annual symposia where researchers of the university and industry developers and -researchers meet and discuss. This is a successful format known from other countries.
Assessment of the societal impact of research
Exceeds threshold.

4. Assessment proposal

4.1. Proposal summary
In accordance with Section 8.4 of the Regular Evaluation Guidance 2024, the research and development activities of the University of Tartu in the field of Natural Sciences are proposed to be evaluated positively , as all assessment criteria meet or exceed the established thresholds.

5. Additional Feedback

5.1. Feedback on the institution's additional questions that are described at the final page of the report

Question: Natural sciences are very hungry for resources (financial and human). However, it is becoming increasingly difficult to find funding for fundamental sciences, as both in Estonia as well as Europe, funding mechanisms seem to be more and more oriented towards applied research. In which direction would experts recommend setting the development plans of the field in the described situation?

Answer: The question deals with a central problem of basic research and its funding. Research in fundamental science is very important to fuel future technological developments. Since the funding schemes nowadays often favor applied sciences, it is important to have research projects that connect both aspects. For example, quantum computing is a field which promises large economic impact at some point and needs both substantial basic research and already applied research in some areas. This is just one example, where it might be possible to find funding for fundamental research.