ESTONIAN QUALITY AGENCY
FOR HIGHER AND VOCATIONAL EDUCATION

Report for Institutional Accreditation

Tallinn University of Technology

2022

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Introduction

Institutional accreditation

'Institutional accreditation' is the process of external evaluation which assesses the conformity of a university or higher education institution`s management, work procedures, study and research activities and environment to both legislation and the goals and development plan of the higher education institution itself. This is a feedback-based evaluation in which an international assessment panel analyses the strengths and weaknesses of the institution of higher education based on the self-assessment report of the institution and on information obtained during the assessment visit, providing recommendations for improvement and ways of implementing them.

The goal of institutional accreditation is to support the development of strategic management and quality culture that values learning-centeredness, creativity and innovation in the higher education institutions (**HEIs**), as well as to increase the societal impact of education, research and development delivered by the HEIs.

HEIs are assessed according to twelve standards of institutional accreditation. Assessment focuses on the core processes of the HEI – learning and teaching, research, development and creative activities, and service to society – as well as on strategic management of the organization and resource management. The learning and teaching process is examined in more detail under five standards (study programme, teaching staff, learning and teaching, student assessment, and learning support processes). Throughout the assessment process, there is a focus on academic ethics, quality culture and internationalization.

The Institutional Accreditation Report consists of two parts: (1) evaluation of twelve institutional accreditation standards, and (2) a report on quality assessment of a sample of study programmes.

Educational institution must undergo institutional accreditation at least once every seven years based on the regulation approved by EKKA Quality Assessment Council for Higher Education Guidelines for Institutional Accreditation.

The institutional accreditation of *Tallinn University of Technology* took place in October 2021. The Estonian Quality Agency for Higher and Vocational Education (**EKKA**) composed an international expert panel, which was approved by the higher education institution. The composition of the Panel was thereafter approved by the order of the EKKA director.

The composition of the expert panel was as follows:

Robert Munn	Chair, Emeritus Professor of Chemical Physics and former Vice-President for Teaching and Learning, University of Manchester, UK
Karen Kear	Secretary, Senior Lecturer, Faculty of STEM, Open University, UK
Matthew Kitching	Student representative, Edinburgh Business School, Heriot-Watt University, Edinburgh, UK

Anthony John Vickers	Professor, School of Computer Science and Electronic Engineering, Head of School, University of Essex, UK
Jaakko Kurhila	Dr., Chief digital officer, University of Helsinki, Finland
Laurent Counillon	Director of the University Côte d'Azur Graduate School in LIFE and Health Sciences, France
Luis Carvalho	School of Economics and Business, University of Porto, Portugal
Paul Rullmann	Former Vice-President Education of Delft University of Technology, The Netherlands
Rik Leemans	Professor, Department of Environmental Sciences, Wageningen University, The Netherlands
Tanja Dmitrović	Professor, Vice-rector for Knowledge Transfer, University of Ljubljana, Slovenia
Tõnu Pekk	Employer representative, Founder and a Member of the Management Board of Tuleva (Mutual Asset Management Company), Estonia
Martin Tunér	Professor, Vice-dean, Faculty of Engineering, LTH, Lund University, Sweden
Andreas Mehrle	Director of studies & head of department mechatronics, Management Center Innsbruck, Austria

Assessment process

The assessment process was coordinated by EKKA staff – Liia Lauri and Jekaterina Masenko.

After an initial preparation phase where the distribution of tasks between the members of the Panel was determined, the work of the Panel was progressed through two online meetings, with an introduction to the Higher Education System as well as the assessment procedures by EKKA. Members of the team agreed: the overall questions and areas to discuss with each group during the site visit; and a detailed schedule for the site visit.

From Monday 4 to Friday 8 October 2021, meetings were held with representatives of Tallinn University of Technology and external stakeholders. Some members of the Panel were present in Tallinn, while others took part online. Those present in Tallinn took part in tours of the TalTech campus.

On the last afternoon of the site visit the Panel held a meeting, during which the findings of the Panel were discussed in detail and the structure of the final report was agreed. Findings of the team were subsequently compiled in a first draft of the assessment report and evaluation of the 12 accreditation standards.

In finalizing the assessment report, the Panel took into consideration comments made by the institution. The Panel submitted the final report to EKKA on 1st January 2022.

The current report is a public document and made available on the EKKA website after EKKA Council has made an accreditation decision.

Information about Tallinn University of Technology

Tallinn University of Technology originated in 1918 as an educational institution of higher technical education, and gained university status in 1936. Following the Second World War, it operated as a technical university within the USSR, when it was named Tallinn Polytechnic Institute. The name Tallinn University of Technology was introduced in 1989, and on the centenary of its foundation it introduced the official short name TalTech to be used alongside its full name [SER 1.2].

Today TalTech is the second largest public university in Estonia, with more than 10,000 students across all levels, and over 2000 employees, including some 1200 teaching and research staff. Its main site in Tallinn occupies the Mustamae campus. There are also sites outside Tallinn, as a result of other higher education and research institutions becoming part of TalTech [SER 1.2-3].

The university is divided into four Schools: Engineering, Information Technologies, Science, and Business and Governance, each under a dean, plus the Estonian Maritime Academy (EMERA), under its Director, equivalent to a dean. The Schools are divided into Departments, and some also contain Colleges primarily concerned with teaching.

The governing body of the University is its Council, which has 11 members: five appointed by the Senate, one external member appointed by the Estonian Academy of Sciences, and the rest appointed by the Ministry of Education and Research. Uniquely among Estonian universities, the Council elects the academic and administrative head of the University, the Rector, who is assisted by four academic Vice-Rectors and four Directors responsible for professional support functions. Although the Council is described in the Tallinn University of Technology Act as the highest 'management body' of the University, the fact that it has external members appointed by external bodies and that it appoints the Rector means that it performs functions internationally understood as governance; it also has responsibilities prescribed by the Act that are distinct from operational management functions and hence appropriate to a governance body. The Senate is the senior academic decision-making body; chaired by the Rector, it has 26 members, namely the Vice-Rectors and Deans plus representatives of academic staff, administrative and support units, and students. The Student Union is the body that represents students [SER 1.4].

Over the last five years, student numbers have been affected by a national decline in the age cohort. For efficiency, the university reduced its portfolio of programmes by more than 20%, while keeping the number delivered in English at over 30%. To improve progression and completion rates it increased entry standards. As a result, student numbers declined by about 9%, and drop-out rates fell, but the proportion of international students was sustained at over 13%. Income from educational services increased by more than 12% over the period. Research publications fell but then started to increase, and income from research and development increased by nearly 90%; whereas the number of doctoral theses defended fell by nearly a quarter. The University introduced a tenure system (the first in Estonia), and perhaps encouraged by this, international teaching staff numbers increased by more than 50%. The average age of academic staff fell slightly, and the proportion of academic staff with a PhD grew by four percentage points [SER 1.7].

Overall, TalTech states that, as the only university of technology within Estonia, it is "the flagship in engineering and IT science and education", as well as the most international university. As such, it aims to measure up to the very best technology universities in Europe [SER 1.1].

Main impressions of the self-evaluation report and the visit

In preparation for accreditation, TalTech produced an institutional self-evaluation report (SER) that provided numerous hyperlinks to other documentation. It also included SERs for each of the sample programmes (SPSERs). The SER was provided to the Panel in August 2021.

The SER was well written in English and clearly laid out. It addressed the Standards appropriately, each section ending with a summary of the University's perception of its strengths, areas for improvement and planned developments for that Standard. Access to supporting documents was provided by numerous hyperlinks, most of which worked well, though some needed 'tweaking'. With a few exceptions, each of the SPSERs was provided with standard annexes showing: the programme curriculum; key constituent courses; a chart showing the programme structure, skills and intended learning outcomes (ILOs); and a list of teaching staff. The exceptions were that Applied Chemistry, Food & Gene Technology and IT Systems Administration did not give ILOs on their chart; Business Information Technology had no chart, although comparable information (without ILOs) was given in the body of the text.

Overall, the SER was a helpful guide for the Panel in describing the organization and planned operation of the University. It could have provided more detailed information and evidence about how its processes work in practice, for example samples of monitoring reports and notes of meetings; but this material was readily supplied on request.

The visit was conducted in a hybrid fashion, with four of the Panel on site and the rest remote on Microsoft Teams. The on-site interviews were conducted in a room equipped for videoconferencing for the remote Panel members and for some TalTech participants (such as social partners) in interviews. The interviews were conducted in English, but some were supported by translators to ensure that those being interviewed had understood the question and had answered it as they intended. The Panel members on site took part in tours of the campus to look at facilities such as laboratories, and the whole Panel took part in an online meeting for live demonstrations of internal management tools, agreed beforehand. Overall, the hybrid format worked smoothly, with no technical problems, and the meetings proceeded in a friendly and constructive manner.

Main changes on the basis of recommendations of the previous institutional accreditation

The previous institutional accreditation in 2014 found that Tallinn University of Technology conformed to all the standards then in use, leading to a decision to accredit the University for seven years – hence the present review in 2021. The SER for the present review sets out in some detail the changes made in responding to the recommendations from the previous review. These mainly cover reforms to the organizational structure, to the programme portfolio, and to the academic career system. The work was initiated and carried forward by the previous Rector and is being further pursued under the current Rector, who took office in September 2020 [SER 2].

The University's ambition to be a leading international university has been given focus by identifying a set of reference technical universities in the region: Aalto University in Finland, Chalmers University of Technology in Sweden, and the Technical University of Denmark. These appear to be similar to TalTech in specialization and local context but are more highly ranked, so that they present

appropriate but ambitious targets. The University has sought to adopt international standards and indicators of good practice and has carefully interpreted the balance between rises in performance indicators and falls in rankings associated with more external competition and its broadened organizational structure.

The structural reforms conveyed strategic focus through reducing eight faculties to the present four schools, plus EMERA, with 60 departments reduced to 20. Attention was given to defining the areas on which research and development would focus, while programmes have been streamlined and made more interdisciplinary, so that 95% now fall within the fields agreed with the Ministry of Education and Research. Programmes are now each overseen by a director, advised by an advisory board with members external to the University.

In terms of resources, the University has introduced activity-based budgeting, with an active budgeting process that is credited with increasing the operating revenue by some 28%. This is more than the rise in the general level of state funding for higher education, which contributes over half the University's total income. Business processes for finance have been modernized, with improved interoperability.

The academic structural reform, and the introduction of the tenure system with a more flexible system of appointments, have helped to bring in new staff and change the staff profile, as described earlier. Take-up of sabbatical leave continues to be low (and at present is low anyway because of Covid-19), but more international exchange agreements have been concluded and applications for staff mobility have been made more flexible. Student outward mobility has remained stable at a low level and so needs more attention.

A 'Good Lecturer Development Programme' was launched to develop the teaching competencies of the academic staff and improve the effectiveness of teaching and learning [W: Details in Annex to Rules for requesting and taking into account feedback on teaching and courses - Legislation (taltech.ee)]. Student dropout (often to take up early employment) is a challenge, and so the University increased admission thresholds and made recruitment more of a process than an event. It also introduced more continuous monitoring of students' progress so that programme directors can identify and support students at risk. Students are offered pre-sessional courses before their programme and a variety of counselling support during it. The University reports that these measures have decreased drop-out somewhat, overall. The decrease is clearer among doctoral students, where the University took steps to revise admissions, to improve supervision, and to update and enhance attestation; admissions fell, but are expected to increase.

Feedback from stakeholders is now sought more systematically and, in particular, is now collected electronically from students; the reported response rate of 75% is good, given the absence of sanctions for not responding. The programme advisory boards provide an interactive means of collecting feedback directly from some employers.

In the area of research and development, the reorganization into fewer departments served to consolidate research areas, and research groups are reviewed regularly. The university adopted its Academic Strategic Plan in 2019, and the five research focus areas identified all serve to stimulate horizontal and interdisciplinary cooperation. Research funding has been sought from a wider range of sources, including companies with which the University has developed strategic partnerships, and central support for research was improved. Grant funding increased over the period, with an

increasing proportion from abroad, and the number and quality of publications improved. Moves are in progress to improve links between teaching and research, but are at an early stage.

To structure its relationship with business and society, the University appointed entrepreneurship cooperation coordinators in schools, with central support on intellectual property, law and marketing. The University's innovative Mektory centre now provides a showcase for its research as well as facilities for developing research towards commercialization. The TalTech Open University serves as a vehicle for continuing education for companies, including those in partnerships, as well as preparation courses for high school pupils through the TalTech Education Technology Centre. The University responded to demand for more courses in practical skills, especially IT.

Overall, the University responded appropriately across the range of recommendations from the previous review, with generally positive results.

Summary of the institutional accreditation findings

General Findings:

Tallinn University of Technology has a clear sense of its role as the only university of technology in Estonia, and its strategic planning focuses on how that role should develop to address technical issues of concern to society. That focus also includes its own activities, such as providing electronic access to all academic and administrative materials. In support of its role, the University has close and productive links with industry, and all its study programmes have a curriculum that relates to employment, making effective use of group work, projects and internships. The study programmes are supported by committed teaching staff and programme directors who are given the authority necessary to make effective changes where necessary. Research is strong, with many links to teaching, including lecturing by active researchers. Performance conforms to requirements across all areas, though naturally there are areas where quality can be further enhanced.

Commendations:

- The University's comprehensive web-based system *SMART*, which helps management to follow the University's progress against targets, making management better informed and better able to assure and enhance performance.
- The University's very ambitious and concentrated focus of resources on the things that are essential: teaching and learning, research, staff development, digitalization, and supportive infrastructure.
- The University's comprehensive quality concept enabling internal evaluation that addresses key questions in quality management.
- The University's membership of the EuroTeQ alliance and other international partnerships that provide it with both visibility and opportunities.
- The University's move to create instructional designers and the establishment of School-based teaching excellence centres.
- The University's effective development of connections between its programmes of study and society and business, including through programme advisory boards and external participation in the courses that make up programmes.
- The University's introduction of e-learning to support all compulsory courses, many of them quality certified by EKKA.
- The University's well-defined set of policies for assessment, including for the accreditation of prior learning and for PhD studies.
- The University's coherent approach in offering a comprehensive set of student counselling services with a clear strategic aim and clear metrics, with good links between the central student counselling office and the academic counselling in study programmes.
- The University's strong focus and commitment to place RDC at the centre of its mission, with a wide package of formal and informal incentives and well-formulated strategic goals, including a focus on research development and knowledge commercialization.
- The University's business centre Mektory that provides facilities and know-how for the Estonian technology start-up scene

Worthy of Recognition:

The University has demonstrated its ability to conduct and successfully implement a thorough and wide-ranging reform and streamlining of its organizational structure, programmes and research groupings, responding effectively to the recommendations of the previous institutional accreditation and to the changing external environment.

Areas of concern and recommendations:

Learning outcomes

Understanding and use of intended learning outcomes (ILOs) is variable across the University, whereas Estonia's *Standard for Higher Education, Annex 1* and the *Standards and Guidelines for Quality Assurance in the European Higher Education Area* (ESG) expect ILOs to be central to the design of programmes.

Recommendation: TalTech should produce and implement a process to ensure that, by a specified date, all programmes and their constituent courses:

- have ILOs stated using active verbs that are appropriate to their level;
- offer learning opportunities that demonstrably enable students to achieve all the ILOs;
- use assessment methods that explicitly relate to the stated ILOs; and
- set out in detail (for example, by a mapping) how, between them, the course ILOs deliver all the programme ILOs for any student study plan.

Internationalization

The University understands the importance of internationalization and actively engages in a wide range of partnerships from which it derives benefit. However, the benefits are mainly in research; and, in particular, student mobility is weak across most programmes.

Recommendation: TalTech should take steps to remove barriers to student mobility by:

- making credit transfer arrangements so that spending time abroad need not increase the overall time taken for a student to complete their programme;
- seeking to increase financial support so that time abroad need not increase the overall cost of a student's programme;
- exploiting further the role of virtual mobility, as tried during the Covid-19 pandemic, so that students can gain experience of international environments without additional study duration, cost or disruption of domestic arrangements.

Pedagogical training

The University is in a transition stage in relation to the pedagogical training of teaching staff, with several promising new initiatives; but there is no systematic monitoring of take-up and effectiveness of the training, e.g. in supporting constructive alignment and student-centred learning approaches.

Recommendation: The University should ensure that pedagogical training meets all the requirements of a student-centred learning approach, and should establish University-wide metrics

to monitor the take up of pedagogical training by teaching staff and its impact on student-centred learning.

Dropout

The University experiences high levels of dropout from its programmes, thus wasting time, effort and resources. Although this is not an issue unique to TalTech in Estonia, it merits attention. The University is trying to improve the quality of its intake and is also offering additional support to students once they enrol, but it is clear that a major factor in dropout is the burden of studying while working.

Recommendation: The University should explore means of improving students' opportunities to finish their degrees, by involving external stakeholders and Estonian society to develop a 'social contract' to sustain students who are simultaneously working and studying, in order to maintain the benefits to all parties.

Green and digital transformation

The University has set, as one priority, supporting society in green and digital transformation, and has taken initiatives in research and teaching to support it. However, the priority does not feature very clearly in the University's strategic plan and KPIs.

Recommendation: The University should revise its Strategic Plan and associated KPIs to feature supporting society in green and digital transformation more explicitly.

	conforms to requirements	partially conforms to requirements	does not conform to requirements	worthy of recognition
Strategic management	☒	☐	☐	☐
Resources	☒	☐	☐	☐
Quality culture	☒	☐	☐	☐
Academic ethics	☒	☐	☐	☐
Internationalization	☒	☐	☐	☐
Teaching staff	☒	☐	☐	☐
Study programme	☒	☐	☐	☐
Learning and teaching	☒	☐	☐	☐
Student assessment	☒	☐	☐	☐

Learning support systems	☒	☐	☐	☐
Research, development and/or other creative activity	☒	☐	☐	☐
Service to society	☒	☐	☐	☐

Key to evidence

SER: Self-Evaluation Report

SPSER: Self-Evaluation Report of the Study Programme

W: Web-based evidence

1.1. Strategic management

Standard:

Development planning at the higher education institution is purposeful and systematic, involving various stakeholders.

The higher education institution regularly evaluates the achievement of its stated objectives and the impact of its activities.

Guidelines:

The HEI has formulated the objectives and key results for its core activities – learning and teaching; research, development and creative activities, and service to society – taking into account national priorities and the needs of society, focusing on its strengths and reducing unnecessary duplication both within the HEI and throughout higher education in Estonia.

The HEI is managed in accordance with its mission, vision and core values, as well as objectives set out on the basis of those principles. Responsibility for implementation of the goals and action plans of the development plan are clearly specified. Achievement of the objectives and effects of the activities are evaluated regularly. Creativity and innovation are supported and given value in both core and support activities.

Membership of the HEI (including students), as well as external stakeholders, is involved in developing and implementing the HEI's development plan and action plans. The HEI members share the core values that serve as a basis for the institution's development plan.

Indicators:

- The rate of achieving the objectives set in the development/action plan (key results)
- Other indicators depending on the HEI

Evidence and analysis

The University Council has a strong membership and takes an active interest in TalTech, holding meetings as often as monthly. It actively interacts with the external environment by making contacts with business, industry and government, and it feeds that understanding back into the University's strategic planning. It approves the University's budget and the Strategic Plan, on which it clearly had an influence, for example over the choice of performance indicators. The Council is clear that its responsibility is for oversight rather than management, and to that end it carefully monitors the performance of the University [E: Meeting 20]. However, the Panel felt that the Council's strong and active engagement in the interest of governance and oversight might present some risk of encroaching

on the management and operations of the University, and that explicit agreement on where the boundaries lie might be helpful.

The University's current Strategic Plan runs from 2021 to 2025 [W: Strategic Plan of Tallinn University of Technology 2021–2025 - Legislation (taltech.ee), 'glossy' version https://taltech.ee/en/about-the-university/strategic-plan]. Under the heading 'Innovative and enterprising university' it sets out four broad aims:

- We teach to solve real-world problems.
- Applications and teaching are based on high-level research.
- We contribute to the economy and society.
- A sustainable and inclusive university.

Each aim is discussed in broad terms, and each has a set of three or four associated goals about enhancement and relevance. The last aim includes sustainability; this is given more prominence in the online version of the Strategic Plan, which is headed "The cornerstones for the next five years of the University of Technology are smart solutions for creating a digital and climate neutral future." This sustainability agenda spans all the aims, and is given practical force by the recent appointment, to a new position, of the Vice-Rector for Green Transformation. The University has also recently appointed a new Director for Administration, set up an international advisory council to provide input on strategic development, and updated its risk management [Ref: Follow-up report].

The Strategic Plan leads to an Implementation Plan that in turn leads to action plans for the academic and support units, which are reviewed annually. The Plan and its implementation documents define the key values, goals and indicators of the core activities, while impact is assessed using key performance indicators. This is pictured in Annex 2 to the SER. Neither the Plan nor the SER provide direct links to these documents, but the Implementation Plan dating from June 2021, provided to the Panel at its request, is a substantial spreadsheet that shows each goal with performance indicators; the associated development plan; the deadline; the project owner; and the project manager. The SER also refers to the University's strategic management process, showing how various inputs, people and processes combine [SER 3.1].

The University's Academic Strategic Plan sets out strategic areas of research and development for the period 2020–2030, noting that its achievements tend to lag behind those of its chosen comparator universities [Academic Strategic Plan - Legislation (taltech.ee)]. It sets out five objectives mainly covering impact and relevance, but without quantification. It then defines five priority directions for research and development:

- Smart and energy efficient environments
- Dependable IT solutions
- Valorization of natural resources
- Future governance
- Innovative SMEs and digital economy.

It was not clear what consultation took place during the development of these objectives and priorities, but some respondents told the Panel that they did not see how their areas related to the priorities. Without good buy-in from the academic community, the plan risks being less effective than intended in steering research and development.

The SER says this plan covers "other academic activities" beyond research and development; it does not state what these are. What they might be is not clear in the plan, so that the document does not appear to be an "academic" strategic plan but rather an (academic) research and development plan, not least since the SER says it is implemented by departmental research groups. To that extent, the name 'Academic Strategic Plan' is misleading and unhelpful, in particular since TalTech lacks a comparable teaching and learning strategic plan.

Strategies to support other areas include the budget strategy, now being prepared for 2023–26, and one in preparation for the estate [SER 3.1]. Nevertheless, the Panel learned that, in general, the University's policy is to set out principles that regulate areas of activity but not necessarily to develop those into detailed strategies. Among other things this allows local policies to be devised that recognize differences between academic disciplines, for example a plagiarism policy for the Law discipline that allows for the extensive citation that is customary in that discipline but is not usual and not allowed in other subjects. This approach introduces appropriate flexibility into regulations, but the Panel also heard about other examples where students in different areas were given different deadlines for the same work, which disadvantages those with shorter deadlines. It was not evident that management monitors the divergence between local implementation of central principles for any possible disadvantages to the students and staff affected.

According to the SER, the Strategic Plan is guided by the University's mission and vision. The Plan gives the mission as "to be a leading provider of engineering and economic education, a leader in engineering sciences and smart technologies", but does not state any explicit vision. On its website the University further gives what it calls its purpose (but this reads like its vision): "We want to stand out, to distinguish and be equal to the best technology universities in Europe thanks to our smart solutions for creating a digital and climate-neutral future" [W: Projects – TALTECH]. The Plan says, "the slogan '*Mente et manu*' reflects the university's values, attaching equal importance to critical and creative thinking as well as entrepreneurial and practical action, openness, reliability and cooperation" [SER 3.1]. The SER, the Strategic Plan and the website together give a clear sense that TalTech is set on a well-understood path and is carefully managed accordingly.

The University's Strategic Management Process is depicted in a diagram on the TalTech website [W: https://smart.taltech.ee/en/]; the same diagram is reproduced in the English version of the University's Quality Concept [W: Quality Concept of Tallinn University of Technology - Legislation (taltech.ee)]. It shows the primary activities (learning, research and development, and business activities) leading through support activities into general management and thence into the objectives of the university development plan. For each process, a map is constructed showing the owner, the structure of the process and its environment, and relevant parameters and indicators, along with responsibilities of individuals. This complements the Implementation Plan spreadsheet already mentioned.

The Rector presents the University's Annual Report to Council [W: TalTech_annual_report_2020.pdf]. Of broadly conventional form, it contains a variety of quantitative and qualitative information. This includes changes in senior personnel; new legislation; and a qualitative account of progress against

the five aims in the Strategic Plan and their goals. This account is expressed as evaluative statements but without any of the underlying evidence on which the evaluations rely. The Annual Report also covers matters related to research, to students, and to partnership with society (where it gives more quantitative detail but does not explicitly identify KPIs); after this each school gives its own report. The Annual Report concludes with a fully detailed financial report, starting with an analysis of performance against clearly stated financial KPIs and targets.

The SER Annex 1 shows the performance against KPIs and targets for the years 2015 to 2020, which it notes were not all fully met. The KPIs were analysed as input when drawing up the new Strategic Plan, and for each indicator the analysis yields a reasoned decision on whether it will continue to be used (and several will not). However, the Annex gives no indication of revised targets for those KPIs that are continuing to be used or of whether new KPIs and associated targets are to be introduced. The SER does not give any clear statement of the full set of KPIs and targets that the University now uses, but these are clearly set out in the Implementation Plan.

The Quality Concept clearly sets out the system that monitors performance across all the University's activities. Under the heading 'Management of the Development and Changes of Administrative Support Processes' it also gives a diagram captioned 'Management of Changes and Areas for Improvement', indicating a general structure for processes. The Panel saw a demonstration of the University's comprehensive web-based system *SMART*, which gathers, analyses and presents management information. Though still being finalized, this helps the University management and other interested parties to follow the University's progress against targets, especially through a series of dashboards; this enables TalTech's management to be better informed and better able to assure and enhance performance [Meeting 25].

Innovation and enterprise feature among the aims of the Strategic Plan, while creativity is mentioned in several of the SPSERs. Innovation features strongly in the University's understanding and account of itself and is characteristic of its research and development. TalTech has an Innovation and Business Centre 'Mektory'; invention and innovation are included in the expectations specified for different levels of academic appointment [SER 3.6.3.1]; and some staff serve on external bodies concerned with innovation [SER 3.11.3]. The Annual Report celebrates the winners of 'Best at TalTech' awards for researchers, research articles, development projects, lecturers, programme directors, support staff, students and student activities, showing that the University recognizes and appreciates outstanding contributions to its life. There are also open invitations to the University community to provide ideas and contributions, such as students suggesting design ideas on how to modernize buildings and the campus, and projects to improve services [Ref: Follow-up report].

A wide range of stakeholder and interest groups, including employees, students and alumni, was involved systematically in preparing the current Strategic Plan, which was approved by the Senate and then the Council. The SER gives a helpful diagram to illustrate the process as a whole. The SER says a similar process was used to develop the implementation plan and KPIs; it notes that some KPIs have been retained and some more qualitative and people-centred ones have been introduced [SER 3.1.2]. Later it tabulates them under the headings of Teaching & Learning, Research, Entrepreneurship, and General, but as already noted, the full list accompanies the Implementation Plan [SER 3.1.3].

The University's values have already been mentioned. Although the SER does not report on how far the members of the University share those values, it identifies communicating and contextualizing them as an area for improvement. Nevertheless, the many members of the TalTech community who

met the Panel clearly shared a broad understanding of TalTech's position in Estonian higher education and of the strategic thrust of its planned development; and they were supportive.

Conclusion

The University conforms to requirements under Standard 1.1. Overall, the University undertakes systematic planning and development, and was careful to involve a wide range of stakeholders in drawing up its current Strategic Plan. It has a well-defined calendar and processes for monitoring performance and impact across its range of activities, in order to improve them. In responding to the previous Institutional Accreditation, the University made significant structural and operational changes, cutting in some areas and expanding in others. While commitment to the Strategic Plan was clear from the SER, it tended to concentrate on describing activities and reaching conclusions on their effectiveness without supplying enough of the evidence and analysis on which those conclusions rely; but upon enquiry the Panel was provided with the Implementation Plan. In that context, the Rector's Strategy Office, established in 2021 to "improve cross-disciplinary management and tackle external challenges", driving improvement, including systematic monitoring and analysis, developing a quality system, and devising policies, should help to systematize and consolidate the University's strategic management.

Strengths

- The University's well-defined and effective system for engaging all its stakeholders in its new Strategic Plan.
- The University's ability to conduct and successfully implement a thorough and wide-ranging reform and streamlining of its organizational structure, programmes and research groupings, responding effectively to the recommendations of the previous institutional accreditation and to the changing external environment. *[This could be included in the summary of findings under 'Worthy of Recognition', unless other Standards reveal big holes in the structure.]*
- The University's comprehensive web-based system *SMART*, which (by aggregating, analysing and displaying information in a series of dashboards) helps management to follow the University's progress against targets, making management better informed and better able to assure and enhance performance.

Areas of concern and recommendations

- The University should monitor how its central regulatory principles are implemented locally, for example between different schools, to assure itself that the divergences which its policies permit do not disadvantage the students and staff affected.

Opportunities for further improvement

- The University Council and the Rectorate may wish to adopt a protocol defining where the boundary lies between governance and oversight, on the one hand, and management and operations on the other.
- For clarity, the University may wish to consider renaming the Academic Strategic Plan something like the 'Research and Development Plan', given that the major academic area of teaching and learning is not included in it. In implementing the plan, the University may find

it beneficial to continue dialogue with the academic community about how every area can align itself with the priority objectives, and contribute towards achieving them.

- The new Strategy Office under the Rector can play an important role in further systematizing and consolidating the University's strategic management processes.

1.2. Resources

Standard:

The higher education institution develops its staff and manages its physical and financial resources in a purposeful, systematic and sustainable manner.

Internal and external communications of the higher education institution (including marketing and image-building) are targeted and managed.

Guidelines:

The HEI has an efficient staff development system in terms of both academic and support staff. The principles and procedures for employee recruitment and development are based on the objectives of the HEI's development plan and are fair and transparent. The principles for employees' remuneration and motivation are defined, available to all employees, and followed.

Allocation of the HEI's financial resources is based on the objectives of its development plan. The management and development of its infrastructure (buildings, laboratories, classrooms, IT systems, etc.) are economically feasible. Sufficient resources are available for updating the infrastructure for education and research, and/or a strategy exists enabling the HEI to acquire them.

The HEI has a functioning system for internal and external communications, relevant to the target audiences. The information made public about HEI's activities (including study programmes) and the findings of external evaluations is correct, up to date, easily accessible and understandable. The HEI has a system to popularise its core activities and academic career opportunities. The HEI members are informed of the decisions relevant to them in a timely manner.

Employee satisfaction with management, working conditions, information flow, etc., at the HEI is surveyed regularly and the survey results are used in quality improvement activities.

Indicators:

- Distribution of revenues and costs
- The results of the staff satisfaction survey
- Other indicators depending on the HEI

Evidence and analysis

TalTech seems to have a clear grasp of HR matters, including appointment, competences, appraisal, development and remuneration. Structural changes in administrative and support staff in 2016, and in the academic units in 2017, have made a positive contribution.

The university's human resources policy is an important key to developing the professional potential of its employees; the university seems fully aware of this. The HR Office recently moved to a position

directly under the new Director for Administration. Thus, all administrative support functions are concentrated in one unit. A Human Resource System is in place to recruit, manage, reward and evaluate academic and support staff. It is presented in a range of written documents and procedures, such as

- Academic career management
- Rules for remuneration, including salary grades for the different categories
- An award system for those who accomplish something acknowledged and noteworthy
- Rules for the organization of staff training.

The documents are clear, detailed and available online; the first and third were formally approved by the Senate and the other two are directives of the Rector.

The TalTech HR documents breathe ambition. Central in the recruitment and development of academic employees are high quality, international experience, enthusiasm and an entrepreneurial/creative mind. The recruitment aims at a diverse and inclusive workforce with an even age structure.

The Human Resources Office coordinates the recruitment process for all academic and non-academic positions, working closely together with departments and schools, in order to ensure fair and transparent recruitment processes.

An extensive and very promising monitoring system has been built and is still in progress, partly offering real time information. It covers not only HR, but nearly the whole university, from general level to research groups and programme level; from Teaching and Learning to HR; from IT to Finance and Real Estate.

In order to develop the potential of its employees, many training opportunities are organized centrally and in the units. All academics are expected to teach and research. Pedagogical training is mandatory for every academic employee who wants to take a career step. TalTech even trains its academic staff in curriculum-based engineering pedagogy. That is quite rare, even among universities of technology, and deserves wider publicity. The number of training courses decreased in 2020 due to the Covid-19 pandemic but use of electronic means led to a clear increase in the number of participants (1519 participants from a total of 1897 employees).

TalTech wants to be a competitive and top-paying university in Estonia, and can demonstrate success in this. The gross salary increased significantly between 2016 and 2020, and has regularly been approximately 10% higher than the gross salary of other comparable national universities. This is remarkable when we realise that a large part of the funding of the University is based on temporary project money. TalTech takes pride in these salary levels, which shows that academic competition is primarily considered at a national level. Furthermore, staff are also allowed to use part of their research grants to top-up their salaries. Although this contributes to the attractiveness of the salary policy, it is a tool to use with caution, as lack of transparency in this matter might impact staff cohesion. TalTech is also fully aware of international competition, and intends to attract international staff, using its tenure track as a tool.

The university regularly conducts employee satisfaction surveys via an independent market research and consulting company. The results include comparative data regarding European universities. Since 2018 employee engagement in the survey increased from 53 on the index to 61. The next survey is due in autumn 2021. The goal is to reach the international average (68) by 2025.

Bottlenecks cited in the SER are information flow, involvement of members of the university in management, reliability of central management and remuneration. The university has, since 2018, taken steps to improve the flow of information, enhance employees' development and career opportunities and make management more inclusive. It is not easy to pinpoint where the university is now in this process, but the review committee met several academics who spontaneously expressed their pleasure in working in TalTech with the current board, vice rectors and coherent organization. They felt supported.

Since 2014 TalTech has invested substantially in the university infrastructure, supported with European money from the Regional Development Fund. Recent investments concern the Small Craft Competence Centre in Saaremaa and a smart design centre. All real estate is owned by TalTech. There is a focus on IT infrastructure, on e-learning facilities and support (with all 1500 compulsory courses on Moodle), and on research infrastructure.

In terms of real estate, the campus at Mustamae is unique and was a prize winner in 2013. The university puts effort into keeping this unique position: there are new classrooms with innovative IT possibilities, including rooms which are open 24 hours a day. There is growing energy-efficiency by using LED lights, adaptation of indoor climate systems, etc. In order to manage real estate more efficiently the university concentrated all activities in the Real Estate Office. There is not yet a comprehensive overview of infrastructure needs and financing requirements. This is part of the new Strategic Plan and still in progress.

The university would like to have more long-term sustainability of its real estate. The goal of the university is to become climate-neutral by 2035, so a long-term estate plan will be prepared and implemented, and a vision document will be drawn up. This is all much needed but also all very much at the beginning. At the moment the infrastructure is, overall, up to date. The big challenge is to maintain this situation, not only with regards to the real estate, but also to the equipment and the move to a green transformation. This challenge will become even bigger after the period for European funding has stopped. Recently Tallinn was elected European Green Capital 2023. That is a benefit that could focus the efforts of the city and the university.

The situation of the digital infrastructure is similar. IT operations management, IT architecture, IT development and administration, IT infrastructure and IT helpdesk have been consolidated as Information Technology Services. The university is constantly upgrading its digital infrastructure. It has set a goal in the new Strategic Plan to be a leader in the digital revolution; and a long-term IT architecture roadmap is under preparation to better assess the development needs of the IT infrastructure. So, all in all, this is up to standard and ambitious, but at the same time with a lot of uncertainties when it comes to funding these developments.

The university has clear and sound financial management. There are a large number of documents, online, that give detailed information on how the budget is divided, who is in charge of what, and what the key financial processes are. All these are approved by the Council. Examples include

- Budgetary Strategy

- Accounting Policies and Procedures

- Financial Management Process.

The performance indicators show a healthy financial situation, which has improved over the last few years. The same applies to the prospects for the coming years, with a fine balance between depreciation costs and investments (annual reports are available on the website). TalTech mentions that its income increased from 91.3 million euros in 2015 to 117.2 million euros in 2020. This is a percentage increase comparable to the increase in nominal gross domestic product (GDP) in Estonia, and better than other universities. The state budget funds form over 50% of TalTech's budget revenue. Compared to that of other Estonian universities this governmental funding of TalTech seems relatively low. It forces TalTech to behave more as a business and to actively attract extra funding, which it has done with remarkable success. In order to fulfil its ambitions in teaching and learning, research development, university infrastructure, etc., the university wants to increase revenue faster than Estonia's GDP growth, and therefore wants to attract even more additional funding sources.

The present growth in funding is a considerable achievement. However, it is a liability at the same time, due to the incidental/project-related character of the outside funding. The university is well aware of this.

External communications are targeted, managed and evaluated. Public communications are focused on explaining the university's admission and study programmes, research news and participation of researchers in areas of social importance. The use of e-channels is analysed, and development is based on user needs. Reputation is rising (with a dip in 2020), the new brand 'TalTech' gave a positive boost to its image, and students evaluated the campaign positively (it was awarded 'Best Digital Advertising Campaign in 2020' in Estonia).

The development of the new external website was more difficult than expected and suffered from a lack of specific technical competences in the beginning. But it is now stable and is often visited, with an increase of 18% compared to the previous year. Internal communications increasingly use digital formats: briefings, newsletters, consultations, forum sessions, etc.

Last, but not least, is the remarkable role of the University Council. The Council explores its own network actively to foster and stimulate its thinking about the strategic direction of the university, and to strengthen the university's network.

Conclusions

Based on the self-evaluation and additional documents, the Panel draws the conclusion that the University (in the context of this particular standard) conforms to requirements.

Strengths

- A very ambitious and concentrated focus of resources on the things that are essential: teaching and learning, research, staff development, digitalization and supportive infrastructure, visible in:
    - an elaborated tenure track system and a supportive HR recruitment approach
    - a strong and distinct salary policy

- healthy business operations based on successful fundraising
- up-to-date infrastructure and equipment
- a very complete digital monitoring system.

Areas of concern and recommendations

- Those who attract funding can get an award, sometimes a top-up to their salary. It would help transparency if it was made clear when and to what extent this practice is applied.

Opportunities for further improvement

- TalTech has in mind to become one of the best European Universities of Technology and makes plans accordingly. The new Strategic Plan is an opportunity to set further cohesive and innovative steps in that direction. The University is encouraged to continue developing tools and procedures, and searching for funding.
- Continuing capability needs to be put in place for maintenance and future development after the European structural funds have stopped.
- TalTech wants to become climate-neutral by 2035. Recently Tallinn was elected European Green Capital 2023. This is an opportunity for the city and university to collaborate and intensify their cooperation.

1.3. Quality Culture

Standard:

The higher education institution has defined the quality of its core and support processes, and the principles of quality assurance.

In the higher education institution, internal evaluation supports strategic management and is conducted regularly at different levels (institution, units, study programmes).

The findings of internal and external evaluations are analysed and quality improvement activities implemented.

Guidelines:

Members of the HEI have agreed upon definitions for the quality of their core and support processes and are guided by them in their daily work. The HEI has established its policies and procedures for internal quality assurance (internal evaluation). The regular internal quality assurance both at the institutional and study programme level takes into account, inter alia, the standards set out in these Guidelines. All members of the HEI, including students and external stakeholders, participate in internal evaluations.

Internal evaluation of study programmes results in feedback from experts within the HEI and/or from outside it. Regular reviews and enhancements of study programmes ensure their relevance, including their compliance with international trends. In the course of internal evaluations, peer learning, comparisons with other HEIs regarding their results and means for achievement, as well as a sharing of best practices take place, among other things.

Internal evaluation is based on the following key questions in quality management: What do you want to achieve, and why? How do you want to do it? How do you know that the activities are effective and will have the desired impact? How do you manage the quality improvement activities?

Indicators:

- Improvement activities implemented based on the analyses of internal evaluations in the HEI's core and support processes (examples from different areas)
- Other indicators depending on the HEI

Evidence and analysis

TalTech proposes to be a university where research, study, innovation and contribution to society are equally valued, balanced and interrelated. Therefore, the quality assurance system has to encompass all of these areas. During the previous assessment (in 2014), the Panel recommended several quality enhancement measures aimed at improving opportunities for in-service development of academic staff, feedback loops (collecting feedback from various stakeholders and acting upon findings), and the quality of R&D activities, which would result in an enhanced research profile for TalTech, as well as promote research-based teaching. The response to these has already been noted in detail above.

To address these gaps, TalTech has:

- Introduced survey-based feedback from all stakeholder groups
- Implemented rules regarding feedback loops
- Implemented a year-round admission process, a monitoring system to track the progress of students, and a student-counselling mechanism. Audits have led to improvements in administrative processes.
- Reformed the academic structure, which now connects newly formed departments to relevant research groups
- Introduced a tenure-based academic career system
- Established centres of excellence in strategic interest areas.

In June 2021 TalTech adopted a new "Quality concept of Tallinn University of Technology" which has replaced the previous "Management System Manual". The new concept encompasses quality management principles, organizational structure, the monitoring system, and management of change [W: https://oigusaktid.taltech.ee/en/quality-management/]. Monitoring of KPIs, set out in the Strategic Plan 2021-2025, is included in quality assessment.

The system is comprehensive but also very complex. There is a strong focus on metrics, which places quite a heavy administrative burden on all internal stakeholders. To streamline the processes, TalTech developed a web-based system *SMART*, which serves as an entry point for data collection and enables the production of Business Information reports, also in the form of dashboards. These provide transparency with regard to achieved outcomes, and serve as a useful managerial tool for decision-makers at various management levels.

Sufficient instruments are in place to facilitate internal assessments: definitions, 'plan-do-check-act', monitoring, feedback surveys, etc. Quality feedback loops exist and, based on the interviews with various stakeholders, they are in fact implemented. The quality management system is supplemented by the annual monitoring calendar.

TalTech's feedback system regularly collects feedback from the stakeholders as follows

- The student feedback survey on the content and organization of studies is conducted once a semester. The survey is compulsory; if students do not respond to survey, they cannot enrol in the next semester [M]. This practice (introduced based on recommendations in the previous institutional assessment) certainly improves response rates, but on the other hand it poses some ethical questions.
- The graduate satisfaction survey provides a comprehensive overview of the entire study period.
- The alumni survey provides an overview of the activities of the alumni, their labour market performance and assessments of the quality of studies. TalTech analysis indicates that salary level of TalTech alumni is above the national average for comparable jobs [M].

- Employer feedback is collected regularly through programme advisory boards, practitioners involved in teaching, and internship enterprises. The Panel found ample evidence that external stakeholders' views are collected on a regular basis and implemented at the programme level.
- The employee job satisfaction survey is conducted every two years.

The highest governing body, the University Council, actively participated in the development of the most recent Strategic Plan, and closely monitors its implementation. TalTech management is expected to report on achieved KPIs in Spring 2022, one year after the adoption of the Strategic Plan [M].

TalTech's study programmes are reviewed annually, following the guidelines set out in the "Rules for Requesting and Taking into Account Feedback on Teaching and Courses" [SER p. 17]. The Programme Director prepares an annual evaluation of the study programme based on student feedback and discussions with teaching staff. Findings are presented to the Programme Advisory Board and are published also in the Student Information System (SIS). Students are thus informed about programme development activities through the programme advisory boards and SIS. In the past, one of the obstacles to implementing changes in a study programme was a lengthy procedure, which ultimately required approval of the Senate, even for minor changes. Now the programme director has authority to change several elements in the programme, including replacing lecturers who perform below expectations (in agreement with the head of the respective department). Although the procedures are in place, there is some variation in their implementation across study programmes. TalTech recognises the importance of programme directors for study programme success, and endeavours to empower them. However balancing programme directors' responsibilities with their power to enact changes is still a challenge.

Audits are performed to assess the work organization, the effectiveness of the programme directors' work, and the role of the office of academic affairs in supporting programme directors. The schools submit an annual feedback report for regular internal evaluation. This self-analysis should include an assessment of the achievement of the different performance indicators, the development of the programmes, and an action plan with the most important objectives. The report for the previous year pointed out the need to address dropout rates; in response, a tool was developed for programme directors to track students' mid-term grades. To further analyse the effectiveness of the study programmes, the schools draw up programmes management reports, monitoring the implementation of action plans. The programme directors were provided with a desktop tool in SIS during 2021 so that they can better track the indicators of the study programme on a daily basis, to aid decision-making. Power BI reports provide a comprehensive overview of the performance indicators of the study programmes.

There is high quality ambition in the development of academic staff. The tenure-based academic career model, established in 2017, aims to promote new research directions and increase quality of academic staff by attracting new, talented applicants. To evaluate academic staff, TalTech introduced an academic evaluation matrix, which includes a large variety of activities that bring value to the institution. Performance of research groups is monitored through the Research Group Atlas, which includes business information reports enabling benchmarking of individual research groups against the average TalTech research performance.

Conclusions

TalTech's quality assurance system is consistent with requirements and standards set by international and national bodies (ESG, EKKA, and the Estonian Rectors' Conference). In the period since the previous accreditation (2014), several structural and organizational changes have been successfully implemented. Many new initiatives, support activities and organizational units (offices) were established to support various stakeholders across all primary activities. An evaluation system that encompasses all domains (study, research, innovation, service to society) and all organizational levels (university, school, department and programme) has been put in place. Feedback loops are established. A new information system (*SMART*) has been introduced to support monitoring of all aspects of TalTech activities, including the effectiveness of quality improvement measures.

Strengths

- TalTech has developed a comprehensive quality concept enabling internal evaluation that addresses key questions in quality management: setting the goals and means of quality improvement, monitoring results and measuring effectiveness of adopted measures, managing quality improvement activities.
- The web-based *SMART* solution is a useful management tool for monitoring performance in various domains.

Areas of concern and recommendations

- The emphasis of the quality system lies heavily on knowledge and facts, on monitoring and control. TalTech should introduce alternative quality enhancing incentives, geared towards community-building, mutual learning, and sharing of good practice, rather than focusing primarily on fostering internal competition.

Opportunities for further improvement

- The quality assessment system appears very complex and taxing. It is important that TalTech keeps developing IT solutions and integrating/connecting processes to alleviate the administrative burden for all stakeholders.
- Compulsory student feedback surveys can be counterproductive (can the results be trusted?) and pose ethical concerns if students cannot enrol in the next semester without submitting course feedback. As described under 1.10 Learning support systems, students do use existing feedback channels, and Student Union workgroups summarize mandatory feedback it for programme directors, so that TalTech could continue to engage with students to explore additional means of obtaining meaningful feedback.

1.4 Academic ethics

Standard:

The higher education institution has defined its principles for academic ethics, has a system for disseminating them among its members, and has a code of conduct including guidelines for any cases of non-compliance with these principles.

The higher education institution has a functioning system for handling complaints.

Guidelines:

The HEI values its members and ensures that all its employees and students are treated according to the principle of equal treatment.

Employees and students of the HEI are guided by the agreed principles of academic ethics in all their activities.

The HEI respects fundamental values and policies of research set out in the document, 'Research Integrity', issued jointly by Estonian research institutions, the Estonian Academy of Sciences, the Estonian Research Council and the Estonian Ministry of Education and Research.

The HEI supports its students and teaching staff in their understanding and responding to ethical issues. Teaching staff and students do not tolerate academic fraud, including cheating and plagiarism, and they will act immediately upon any such occurrence.

Management of complaints from HEI members (including discrimination cases) is transparent and objective, ensuring fair treatment of all parties.

Indicators:

- The percentage of student papers checked by plagiarism detection systems and the percentage of detected plagiarisms
- Other indicators depending on the HEI, for example statistics about complaints (total number, the proportion of decisions taken in favour of the applicant)

Evidence and analysis

The University has a sound and comprehensive understanding of the European and national ethical framework within which it is working, informed by the European Charter for Researchers, European Code of Conduct for Research Integrity and the Estonian Code of Conduct for Research Integrity. This framework is distilled into policies and procedures, including the Principles of Academic Ethics (Code of Academic Ethics), at university level. For instance, the values stressed in the Estonian Code of Conduct (freedom, responsibility, honesty and objectivity, respect and caring, justice and openness and cooperation) are embedded in the University's Principles of Academic Ethics. The University has a published Scheme of Management for handling academic ethics, which is accessible on the University website, as well as procedures for handling student violations of good academic practice. This policy framework actively governs the work of all students, staff and researchers at the University.

The University's management and committee structure oversee the implementation of these policies and procedures. There is a clear division of management responsibility for academic ethics. With respect to research, the Vice Rector of Research has oversight; whereas, for student ethics, including issues such as plagiarism, the Vice Rector of Academic Affairs is responsible [SER p 34.]. The University's Academic Ethics Committee has been established, with its own statute, to help *'settle disputes regarding the principles of academic ethics arising between the members of the university, assesses compliance of research projects with the ethics requirements and discusses other academic ethics matters'* [W]. Members of this committee informed the Panel that, while it oversees the management of academic ethics, supports the University leadership and offers advice, it does not discuss every case of misconduct. Instead, the Committee becomes involved where students and staff have been unable to resolve issues at the school level [M, T].

The University's Code of Ethics states that '*any disputes and disagreements arising at the university shall be resolved by ascertaining the truth, the actual state of affairs as far as possible. All the parties shall be involved in identification of their errors and mistakes and admit them. Refuting an argument by attacking the other party's personal qualities (argumentum ad hominem) is unacceptable'* [Code of Ethics]. Instead of the Academic Ethics Committee handling all disputes, each school has the delegated authority to develop their own procedures for addressing violations [M]. The Panel viewed a sample of these procedures and found that some variability exists [School Procedures for Academic Integrity]. The University responded to variability by stressing that this is, in part, due to the needs of individual disciplines and subject clusters [M, T]. While the Panel recognizes the legitimacy of this rationale, it does not concur that this should extend to timeframes for acknowledging, investigating and responding to allegations, where consistency would help ensure an equitable experience. Notwithstanding this, and even if variability in timescales continues between schools, this should not prevent the University from explicitly referencing each school's timescales in their respective policy and procedure.

The Academic Ethics Committee witnessed an increase in misconduct cases from 2 in 2017 to 13 in 2019. That the University has only witnessed such a small increase in the number of cases during a period where use of detection software has increased is, in part, attributed by the University to an increase in awareness among students about good academic practice, making them less likely to commit offences [SER pg. 35, M, T]. Although the Panel agreed that this could potentially explain the modest size of the increase in cases, the University did not appear to have fully considered alternative explanations. For example, worldwide there is an increase in new forms of academic misconduct (e.g. essay mills, collusion and collaboration) which can be harder to identify [M, T].

Linked to this, the SER (Table 14) demonstrates that there is variability in the 'reprimands' issued across schools; for instance, between 2017 and 2021 there were 24 reprimands issued in the School of Information Technologies and none in the School of Science. The Panel asked the University whether there were data that showed trends among particular groups of students, to which TalTech responded that they did not believe this to be the case [M]. Clearly, however, the data in Table 14 of the SER (p. 35) shows that such variability does exist. A number of factors could account for this, including: the size of each school; the threshold for issuing reprimands being different in each school's procedure; and insufficient detection systems. Whether or not any of these apply, the Panel found that there was limited analytical oversight to understand how misconduct was being dealt with in different parts of the University, and that procedures could be enhanced. The Panel also considered that the University may benefit from reflecting on how it encourages staff to report academic fraud.

It is a burdensome process, and lecturers may feel inclined to overlook a student's offence, unless it is very serious and evident misconduct. Therefore, clearer incentives for staff to report such instances may strengthen oversight.

The new Academic Ethics Committee has recently been appointed. They informed the Panel that they are looking to expand their work in this respect, including through the development of publicity videos, collating information on ethics embedded in the curriculum, and involving the Didactic Centre in work on academic integrity [M]. While this is reaping some positive initial results (for instance increased staff participation in relevant training sessions), the Panel concluded that greater emphasis could be placed on academic misconduct in the broadest sense, together with deeper reflection as to how the University can strengthen the security of its assessment, considering these developments.

The Committee are also responsible for evaluating, where necessary, the compliance of staff research and development projects with the principles of research ethics. A specific tool has been developed to support this evaluation. With respect to staff ethics more generally, the University has actively participated in the development of the new Organization of Research and Development Act, with other Estonian universities, influencing the content and enforcement measures linked to research ethics legislation. A range of training is also in place for staff, which includes in-service modules delivered by the Estonian Centre for Engineering Pedagogy and sessions organized by the Human Resources Office. As with student ethics, the Committee only seek to involve themselves where support provided at a local level, by administrators and research groups, needs reinforcing or reviewing. [SER, Additional Evidence, M]

Staff and students confirmed that lecturers are responsible for advising students about academic misconduct during the first session of each course [S, T, M]. The Panel found that this is working well in some programme areas, but could be strengthened in others. In particular, some postgraduate students reported a level of expectation among staff that students should be familiar with issues of integrity from their bachelor's studies [S]. While this is the case for many students, the Panel concluded that the University should nevertheless ensure all students access the same baseline information on integrity, irrespective of their level of study or any other factor.

Suitable arrangements are in place to support academic integrity among research (PhD) students, who are treated as early-stage researchers, subject to the European Charter and codes of conduct. Training is provided for researchers; and supervisors play a critical role in ensuring that students understand the ethical implications of their work. The University confirmed to the Panel that they have the expected arrangements in place in terms of the General Data Protection Regulation (GDPR), together with special guidelines for personal and research data, and procedures to establish ethical approval for research involving human research subjects [M, T, S].

Conclusions

The Panel concluded that the University conforms to requirements under Standard 1.4. This decision was based on the fact that the University has defined its principles for academic ethics and disseminates them through its website, programme staff and PhD supervisors. The new formation of the Academic Ethics Committee is also aimed at bolstering dissemination of this information. While the University could do more to reflect on the impact of forms of academic misconduct beyond plagiarism, each School has a code of conduct that outlines processes in the case of non-compliance. This system is in operation and the University compiles data on documents processed through its

plagiarism detection software, and the reprimands issued across its provision. However, the University could be more analytical about identifying patterns across its schools, and any associated reasons. The University also has a functioning system for handling complaints, which is readily available on the TalTech website.

Strengths

- Attempts by the new Academic Ethics Committee to strengthen dissemination of relevant information across the University.

Areas of concern and recommendations

- Ensure that all students, irrespective of their level of study, receive the same baseline information about academic integrity at the start of each course.
- Ensure that all School procedures include timescales for acknowledging, investigating and responding to allegations of misconduct, so that all staff and students have a comparable experience.

Opportunities for further improvement

- Improve monitoring and analysis of trend data on academic misconduct offences across the University.
- Increase the focus on new and additional forms of academic misconduct, for instance essay-mills, and collaboration and collusion.
- Provide incentives for staff to report suspected cases of academic misconduct.

1.5 Internationalization

Standard:

The higher education institution has set objectives for internationalization and assesses the attainment of these objectives regularly.

The higher education institution has created an environment that encourages international mobility of students and teaching staff, supporting the development of learning, teaching and RDC activities, as well as the cultural openness of its members and Estonian society in general.

Guidelines:

The HEI creates opportunities for international student exchanges by offering study programmes and/or modules taught in English. The learning environment at the HEI supports internationalization and cultural openness.

Recognition of qualifications and recognition of prior learning and work experiences for student admission and programme completion are in accordance with the quality requirements set by the HEI, are systemic and consistent with the expected learning outcomes and support international student mobility. The organization of studies at the HEI facilitates student participation in international mobility (e.g., study programmes enable mobility windows). The HEI has agreements with foreign higher education institutions and, through international exchange, sends its students abroad to study and undertake internship, providing comprehensive support for this. Members of the teaching staff encourage students to participate in international mobility.

International lecturers participate in the process of teaching, including supervision of doctoral theses.

The HEI supports and recognises the participation of its teaching staff in international teaching, research or creative projects, as well as their teaching, research or creative work and personal development which are performed at HEIs abroad.

Indicators:

- Teaching staff mobility (in-out)
- Student mobility (in-out)
- Other indicators depending on the HEI, for example:
  - Number of English-taught study programmes by main units and levels of study
  - Percentage of foreign students (by study programmes, levels of study, in total in the HEI)
  - Percentage of study programmes that include English-taught subjects (of at least 15 ECTS) Number of ECTS acquired through external mobility

Evidence and analysis

The University considers international development as a priority for its global visibility. It aims to develop this aspect in its different sectors using a combination of actions **:** (i) participation in several networks of universities; (ii) a strong effort to increase the collaboration and signed Memoranda of Understanding with foreign universities; (iii) language rules that promote the use of English and

English language studies from master's level; (iv) increasing recruitment of foreign staff (v) increasing the share of international students; and (vi) stimulating staff and students' international mobility. Pertaining to these aspects, the University has an active policy to use its new 'TalTech' name as a very recognizable brand that should help it to be more visible internationally. As for most higher education institutions, the present Covid-19 pandemic strongly impaired the development of the international mobility strategy, but in the meantime catalysed the ability to deliver online courses that can be used for an international audience. As the present evaluation of TalTech's internationalization activities aims at addressing the HEI results and strategy for the future, it will not focus on the Covid period but instead on the normal operation before and (as it can be possibly anticipated) after the crisis.

The level of achievement of these different points is monitored by specific indicators for internationalization: (i) the share of international students in the total number of students; (ii) the number of study programmes taught in English; (iii) the mobility of students and teaching staff; and (iv) the share of international graduates in the total number of graduates. Of note, these topics are not present in the KPIs of the University as a whole.

In the meantime, the University clearly identifies that some priorities must be taken in these actions, both to make the international strategy more workable and to achieve better efficiency.

The University has set up strong objectives to integrate within international university networks, in very good accordance with the accreditation standard of having agreements with foreign education institutions. This is clearly the right strategic move, as a significant part of the future development of higher education institutions is going to take place through such networks.

In this context, TalTech has taken an excellent step by recently integrating into the EuroTeQ consortium that groups together some of the best European Technology Institutions (DTU, TUM, Ecole Polytechnique Paris, and TU/e, with Technion and EPFL as associate partners). Within this alliance TalTech will be the main contributor in three focus areas: Electrical Engineering, Mechanical Engineering and IT. The main initial actions are the construction of online and hybrid courses, as well as MOOCs. This will be accompanied by short inward and outward mobility exchanges for students and staff [Additional document to SER; interview 22B]. A longer-term goal would be to create a path to a joined diploma in which students stay for one semester at the different partners.

At this stage, these are realistic objectives that fit well within the possibilities of TalTech. The bottleneck that prevents achievement of more ambitious goals within this prestigious alliance is that there does not seem to be additional funding to add to the existing resources from the Government and other sources.

TalTech is also a full member of the Nordtek network of technical universities from the Nordic/Baltic countries, where it develops three main strategic axes (Engineering education, content and pedagogy; Entrepreneurship and Innovation; Mobility) and will continue to work with these partners. To achieve these goals, they have obtained European funding from Horizon 2020 and in the form of an Erasmus+ project that serves as the platform for most of the staff and student mobility.

The University has also witnessed a very significant increase in the number of cooperation agreements with other Universities, from 521 to 728 in the last five years, and has made a strong effort to invite foreign delegations to build international cooperation (about 150 in the past period [SER p 43]. It is also a member of the global network of education, research and innovation Science Business Network and of the global network for quality enhancement in engineering education (CDIO).

While all this shows a very positive dynamic, it is extremely difficult to actively enforce such a large number of agreements. The University is perfectly aware of this problem and the SER (p. 38) states that the University intends to "focus on reducing the number of contract partners to focus on strategically important cooperation".

The SER shows that more than 65% of TalTech scientific publications are from international collaborations, with an increase of 15% since 2016; this is a significant achievement.

TalTech participates in international research infrastructures: Nordic e-Infrastructure Collaboration, EMBL, European Organization for Nuclear Research. It participates in 74 Horizon 2020 projects and is coordinator on 23% of them. This brought 35.9 million euros for the 2014-2020 period, i.e. more than twice the FP7 income for the previous period (11.73 million euros) [SER p. 70]. In the present Horizon 2020 the university has one ERC grant, one Teaming project, three ERA Chair projects and four Twinning projects. A nice indicator of this very dynamic activity is the increased number of shared international publications from 868 to 1151 [SER Table 19].

Furthermore, the University has ambitious goals in attracting international scientists, mostly in the early part of their career. The numbers given in the SER for international staff (e.g. Table 15) show a very strong increase (approximately 70%, from 171 to 297); this is said to originate from the international open competition to recruit tenure academic staff. Taken together, there were 23.3% international members in the academic staff in 2020, compared to 13.3% in 2016. As this tenure system has only recently been put into action, there is as yet no perspective on how stable these recruitments will be over time. Staff interviewed by the Panel indicated that life in Estonia was very attractive and that TalTech should offer short visiting scientist invitations to promote this aspect. Another colleague indicated that he had rapidly obtained funding for two postdocs and two PhD students after his arrival, and that it helped him to rapidly establish his research. A possible strategy to promote this policy would be to advertise these in the form of packages (e.g. tenure, lab space and equipment, PhDs and postdocs) that would be offered with the recruitment of foreign scientists. This might not be costly, as it is simply a way to promote what already comes with the tenure position.

TalTech language policy is very well described and is another strong point concerning the internationalization of programmes, students and staff. Although bachelor's level study is virtually all taught in Estonian, the University provides courses to improve levels of English. Master's level promotes international programmes taught in English and all the PhD programmes are fully taught in English. As an example, the International and Business Administration programme is fully taught in English with nearly 90% international students. This programme has undergone an international EFMD accreditation in 2021. Employees and students must be at least of B2 level in English, and C1 if they teach a program in English. To achieve the desired language competencies, the university provides free English courses, and free Estonian courses for foreigners. As a result, in the academic year 2020/2021, 4 bachelor's, 18 master's and 9 doctoral programmes (37% of all the programmes) are taught in English. This is a very good record that must be noted. Despite this success, some schools, such as Science, show lower numbers [SER Figure 9]. One possible bottleneck explained during the interviews [22B] is that this sector has witnessed the merging of several programmes into larger ones, where different specialities still coexist, making the ensemble awkward to convert simultaneously to English.

There is a good increase of staff mobility (at least till the Covid-19 crisis) mostly thanks to the Erasmus+ programme [SER Table 20 and in the Erasmus+ website]. Staff can also use additional funding for

mobility, such as the Dora+, Mobilitas/+ programmes and specific exchange agreements that are available at TalTech.

Figure 11 of the SER shows an increased trend in both ingoing and outgoing mobility, mostly to European countries but also significantly to the rest of the world. Several programmes have privileged collaborations with colleagues from foreign universities (e.g. Industrial Ecology [SER p.98], with colleagues from universities in the USA, Great Britain, or Ukraine). Another interesting tool for mobility is the employment contract of TalTech academic employees that guarantees a free semester once in five years; this can be used for academic mobility, as is the case in the Business and Information Technology programme which supports this with financial resources [SER p. 91].

While the indicators for students' mobility are clearly documented in the SER (e.g. p. 40), the results are somehow not fully satisfactory, for several reasons. As might be expected, the highest numbers for external mobility are for PhD students, with more than 27% of them having been abroad for at least a semester. Most of these exchanges are funded by the Erasmus+ programme, and a very low proportion are through the direct bilateral agreements of the University [Table 17 of the SER].

In contrast, the SER states that the number of taught students participating in international activities in general is not satisfactory (2% outgoing and 4% incoming students for exchange studies, which is far below the ambition of TalTech). These are stable figures over the last 5 years [SER p.42]. From the different interviews, several factors (of which the University is well aware from internal surveys on this topic) contribute to this situation: (i) external mobility would prolong the duration of studies (ii) family or personal reasons (several students mentioned that they were comfortable at home) (iii) they cannot leave their jobs (iv) Erasmus scholarships are insufficient to cover the mobility costs.

While it seems difficult to act on the personal and job issues, the two other issues are in principle in the University's hands. The first one concerns recognition of the credits obtained outside TalTech. From the interviews and SER (Figure 10) it is clear that an accurate procedure and service allows the students to prepare a study plan that should allow credit recognition. However, the final decision on this recognition is left to the departments, which to the Panel seem to seek overly tight alignment with the exact contents of their courses rather than just the intended learning outcomes. Often, courses taken abroad are taken as free choices or electives to make it easier for students to suit their interest and broaden their study plan, but this results in a loss of the semester, cascading into a year for the student. The answer given during the interviews was that a solution would be short stays abroad, but we also encourage TalTech senior management to push towards more flexibility in credit recognition. This should promote longer term student mobility, which is an invaluable asset in terms of personal experience and network building.

The other bottleneck is the fact that Erasmus funding does not cover all expenses. As previously mentioned, more state funding to reinforce TalTech success in international consortia could be very well used here.

The statistics given in the SER Figure 7 show a steady increase in the percentage of international students every year, with a maximum of 20% international students in 2020. This percentage of international students nearly doubles for doctoral studies (39%), which shows a very good dynamic for both teaching and research. These students are of about 100 different nationalities. The proportion of TalTech PhD students who are international has more than doubled (from 14.5% to 38.9%) between 2015 and 2020) [Table 18 of the SER]. This is rather problematic as it shows a relative lack of interest

from Estonian students in PhD study, which is the top qualification of reference internationally. Student and staff interviews indicated that this can be explained by several factors, but nevertheless the Panel recommends that a strong promotion of the PhD should be made among national students.

Conclusions

The HEI has set up very ambitious objectives, and has developed a multilevel strategy to achieve them. TalTech has been very successful at entering into multi-partner international alliances. Furthermore, it has Erasmus+ and EraNet programmes that bring a consistent platform and funding for international exchanges. It has also established a tenure track strategy that enables it to be more attractive to foreign scientists. This results in a very significant increase in important indicators. This very good performance is also served by a clear policy for English, which enables curricula to be opened to international students, and by a good international dynamic in research that also results in an increasing share of international publications.

Strengths

- Membership of the EuroTeQ alliance, and other international partnerships, that provide both visibility and opportunities.
- Very good percentage indicators of internationalization, e.g. percentage of international students, percentage of international staff etc.
- Very clear and active language policy, leading to a large percentage of courses in English.
- A tenure track system that can attract talented young international scientists.

Areas of concern and recommendations

- Too low percentage of external long-term mobility for bachelor's and master's students; this could be improved by making the credit transfer more flexible.
- The added value of this ambitious international strategy could be improved by leveraging funding in different strategic places, such as in the EuroTeQ alliance, to support long-term external mobilities.

Opportunities for further improvement

- The main opportunities for further improvement seem to mostly depend on additional funding: to top up several actions for long term mobility, to attract foreign tenure track applicants with attractive packages, or to add funds to the EuroTeQ alliance. The University could therefore seek additional external funding from agencies that wish to foster internationalization.
- Packages given to tenured international professors could be advertised and possibly benefit from further funding.

1.6 Teaching staff

Standard:

Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of learners and value their own continuous self-development.

Guidelines:

Distribution of teaching staff by age and the percentage of young members of the teaching staff ensure the sustainability of studies. The career model of academic staff motivates capable young people to start an academic career and creates opportunities for their advancement.

The HEI supports systematically the development of its teaching staff. Members of the teaching staff engage in development of their professional and teaching skills, improve their supervision competence, and share best practices with one another.

Teaching staff's participation in research, development and/or creative activities supports the teaching process and ensures competence for the supervision of students' theses (including doctoral theses).

Members of the teaching staff collaborate in fields of teaching, research and/or creative work within the HEI and with partners outside the HEI, e.g. with field practitioners, public sector organizations, companies, other research and development institutions, and lecturers from other Estonian or foreign higher education institutions. Qualified visiting lecturers and practitioners participate in the teaching process.

When assessing the work of teaching staff (including their periodical evaluations), the effectiveness of their teaching as well as their research, development and creative work is taken into account, including student feedback, the effectiveness of their student supervision, development of their teaching and supervisory skills, their international mobility, and their entrepreneurial experience or other work experience in their fields of speciality outside the HEI.

Indicators:

- Competition for elected academic positions
- Number of students per teaching staff member in full-time equivalent (FTE)
- Percentage of teaching staff holding a PhD degree
- The results of the students' feedback about the teaching staff
- Teaching staff participating in continuing training or other forms of teaching skills development
- Other indicators depending on the HEI

Evidence and analysis

Academic staff numbers [SER pp.13-14] have been around 1000 over the past 4 years, with total student numbers at approximately 10,000, giving a student staff ratio of 10:1, which is very good. Recruitment of new staff is mainly successful but the number of candidates per competition indicated

in the SER (Table 23) is low, at just over 3. Academic staff make up around 54-55% of the total employees of TalTech and around 61% of them hold a PhD, which is low internationally. However, if early career researchers (who are included in the teaching staff numbers above) are excluded, the percentage of teaching staff with a PhD rises, for example for 2020 to 78%. The percentage of academic staff with a PhD in each School varies and, taking the 2020 figures, is lowest in the Estonian Maritime Academy (24%) and highest in the School of Science (72%). Overall, the number of academic staff is very good in relation to the number of students, and the number of staff with a PhD has increased over 4 years; but more staff should be enrolled on PhD programmes, and recruitment of new staff should specify a PhD as a requirement. Over the last 5 years the average age of the academic staff population has fallen steadily from 47.2 to 45.15, indicating a clear move towards sustainability in teaching staff.

The professional competence of the teaching staff is a major goal of the university's Strategic Plan 2020, in which the specific aim is to focus on staff motivation, international openness, and targeted recruitment of staff. Staff motivation is driven by a clear academic career path, introduced in 2017, and opportunities created for self-improvement. International openness is driven by an expectation that staff have international work experience and actively engage in international research, development and teaching.

Apart from the measure of staff with a PhD, and in some schools opportunities to gain external pedagogical awards (International Engineering Educator) in recognition for teaching professional competence, there are no University-wide external measures of professional competence in teaching. No mention of external recognition of teaching was made in any of the interviews with teaching staff.

The University Strategic Plan 2021-25 sets out a goal of ensuring that "our graduates are able to solve real-life problems with their evidence-based mindset, practical engineering skills, good self-management and cooperation skills and entrepreneurial spirit". Achieving this goal through the actions of the teaching staff is stated as being driven by staff engagement in research closely related to their teaching, and through student involvement in that research. Staff are also encouraged to engage in research through cooperation with other academic staff both inside and outside the University. Inside the University this is achieved through interdisciplinary courses and projects. Teaching staff also have opportunities to discuss and collaborate on teaching through events held by one school but open to other schools, such as a Teaching Day held by the School of Business and Governance. Evidence was not provided of this practice being widespread.

During the interviews with teaching staff [5A-5D, 10A-10D] in the study programmes, several staff indicated that they were aware of internal training opportunities, some of which were training in their field of expertise, and some were aware of pedagogical training events. Staff also indicated in these interviews that they were aware that completion of training courses was used in any promotion applications. There is some good practice in mentoring (e.g. at Virumaa College), which could be widened across the whole university. From the interview on study processes [15A] the Panel learned that five instructional designer positions had been created across Schools to assist with pedagogical development of teaching staff. These posts were new and were changing from a technical support focus to both pedagogical and technical focuses in their support of teaching staff.

In relation to the academic quality and development of the teaching staff, there is quite some difference between the programmes in how many of the teachers have PhDs and are experienced and active researchers; also, within all programmes there are large variations in the level of completed

pedagogical training (see programme reports). There are indications that not all teachers and staff understand how to design programmes systematically or, for instance, the meaning of "*the development of a self-directed learner is a natural part of the study programme"* [Interviews 5C, 8C, 10C, 15A]. Most of the teachers in the interviews were positive about modern educational methods, but they did not raise pedagogical concepts and theories such as constructive alignment. Although they were aware that pedagogical training is both important and available, none of the teachers claimed that it is mandatory [Interviews 5B, 5C, 5D, 10B, 10C]. There are practical hurdles for engaging in training, such as available time or clashes with lecturing or other commitments, and it appears that the lecturers who would need training the most may not be interested [Interviews 10C & 11C]. These issues suggest that a more coordinated and supportive approach towards pedagogical training is needed. The Panel nevertheless appreciates the efforts of the programme management to motivate and develop their staff, as one of the ongoing steps to improve the programmes further [Interview 15A, 11C]. Examples include the opening of didactic centres at each school [Interview 15A] and the new promotion system that provides credits for pedagogical training [Interview 10A].

From the interviews it was clear to the Panel that overall, teaching staff are fully committed to the development of their students as potential entrants to their own professions and are committed to their own professional development, but they have some difficulty in navigating between the competing demands of pedagogical and technical self-development. As a result, their formal understanding of student-centred learning, intended learning outcomes and the principle of constructive alignment is generally not strong, even though the Panel saw evidence for all of these being used in practice in the study programmes reviewed.

A new scheme, the Good Lecturer Development Programme, has been established, based on student feedback. The University recognises [SER p.49] the weakness of the programme being dependent only on student feedback. A further limitation identified in the SER is that the training activities of the programme seem to only be available to those teachers identified with poor feedback from students. The University should consider whether the programme should be developed into a programme that all staff must complete, to different levels of competence as their career develops. The SER indicates a plan to create a network of didactic experts in Schools, and for this network to support the development and self-improvement of the teaching staff. There is an opportunity for members of this expert group to be used as benchmarks for different levels of competence, and to disseminate best practice to other staff. The focus of the programme, set out in the goal above, is laudable and would provide strong evidence that teaching staff can support learners, with a consistent strategic approach.

Self-development can be measured by:

- engagement in research to maintain an expert standing;
- taking of sabbatical leave;
- and engagement with development opportunities.

In the case of engagement in research, this needs to be measured using an international index (such as the h-index). Table 25 of the SER attempts to provide some indication of level of fulfilment of the expectations set for each post. The data does not seem to reveal a strong, wide level of engagement with research. This could be improved by ensuring that teaching-focused staff have sufficient time available for research.

In the case of taking a sabbatical year, the results in Table 26 of the SER show a low take up by academic staff, and the reason cited is the practical problem of arranging cover for staff. This would indicate a lack of resourcing for the sabbatical leave system. In the case of engagement with development activities, Table 26 of the SER shows a decline in the number of courses available, and a fall in the number of participants, although this is likely due to the pandemic. More positively, the number of teaching staff undertaking mobility, both nationally and internationally, was rising healthily until 2020. The fall in 2020 is no doubt due to the pandemic.

Overall, the SER, the interviews with teaching staff [5A-5D, 10A-10D] and the study process interview [15A] reveal that TalTech is in a transition stage in relation to the pedagogical training of teaching staff. There are didactic centres being established in Schools, along with the retention of a central pedagogical support unit. There is the establishment of the new instructional designers, and there is the clear link between promotion and teaching excellence. However, there is no proposed systematic aggregation of data on take-up of the training offered. This is needed to allow TalTech to measure effectiveness of the training in meeting the needs of a student-centred learning approach. For example, it is not clear that consistent and robust training is in place to ensure the linking of programme level and course level learning outcomes, and the constructive alignment of assessment with course level learning outcomes.

The major evidence provided to support the premise that staff value self-development is the link to their career progression. However, the career model still favours research over teaching and professional practice, as it seems that a full professor post is only achievable through research, and not through teaching or professional practice alone. In the interview with the Rector [2] the new promotion structure was discussed in relation to the routes to a Professor title. The Rector indicated that the new system was being monitored. The Panel learned in a teaching staff meeting [10B] that some teaching staff were preparing applications for the new Associate Professor grade. As well as the career model of teaching staff being designed to support quality-assured education, research staff are also obliged to undertake teaching, and therefore their numbers are included in the teaching staff numbers. This is good practice as it helps develop early career researchers and researchers for teaching posts. It is not clear if the Good Lecturer Development programme is available to research staff. From the work procedure rules, the hours available for classroom teaching and supervision vary from a maximum of 692 for a lecturer to 186 for researchers and early-stage researchers: nearly a 4 to 1 ratio. If this factor was scaled into the teaching staff numbers, the student to staff ratio would be very different.

The SER indicates that evaluation (attestation) of teaching staff is undertaken formally every 5 years using 11 criteria spanning research, teaching and public engagement. Since 2017, 159 staff over the full range of academic posts have been assessed in this way. As well as being used for assessment of performance in a current role, corresponding data is also used to assess candidates for academic post competition. The SER states that a new version of the matrix, assessing 6 instead of 11 criteria, was to be approved in May 2021. The data in Table 25 of the SER indicates that researchers and senior researchers are the only groups with positive scores for all the criteria. Full Professors are the only group to gain negative scores on 5 of the 11 criteria; Associate Professors scored negatively on 4 of the criteria. This evidence seems to indicate that the most senior posts are achieving the greatest number of negative scoring criteria, but time did not allow the Panel to explore possible reasons for this pattern. It may have to do with the relevance of the criteria, and the University may wish to discuss this with staff and check whether the situation changes with the new set of criteria.

Teaching staff are also assessed annually by their line manager, although the SER states that this practice has not been consistently applied, and the Panel was not able to establish a clear line management structure. Written evidence of two annual interviews was provided as additional information. In the study processes meeting [15A] it was stated that data on training was held by HR. However, the form of the annual interview notes would indicate that no aggregation of interview data was being undertaken to provide annual anonymous data. The annual interview results are required for the 5-yearly attestation, with a job description agreed with each academic staff member under an open-ended employment contract, reviewed each year.

Data was provided on levels of teaching staff job satisfaction. The University uses staff feedback data to create a 'TRIM' index (maximum 120) for each staff group. The average TRIM index across all groups is 57.5, which appears to indicate low satisfaction, and the figure is not evidenced in the SER. Untenured professors appear to have the lowest satisfaction levels (SER Figure 16). Time did not allow the Panel to explore possible reasons for low satisfaction, which may reflect staff concerns about status and rewards, and the University may wish to discuss this with staff.

The SER indicates a healthy programme of academic visitors, with a rise from 291 to 427 per year from 2016 to 2020. Several visiting academics, roughly 25% of the total, have a recurring agreement with the University. In 2019 visiting lecturers represented around 25% of the total lecturer population and covered 14% of the volume of scheduled face-to-face teaching. Visiting lecturers are not usually responsible for a course as a whole, and mainly provide practical training.

Conclusions

In conclusion, the teaching staff are appropriate and sufficient for the task of teaching the range of study programmes and courses offered by TalTech. They have suitable professional competence and a range of opportunities for career progression; staff development opportunities are available for both technical and pedagogical enhancement. However, uptake of teaching development opportunities is patchy. Formal understanding of modern pedagogic theory does not appear to be widespread or strong, but importantly, student-centred learning, intended learning outcomes and the principle of constructive alignment are all evident somewhere among the study programmes reviewed. Teaching staff are complemented by a strong programme of academic visitors to enhance the student experience. The evaluation of staff is through a 5 yearly attestation and annual appraisals with line managers. Advancement to full Professor requires a strong research profile, and it is not clear that the new category of Associate Professor has sufficient status and job security to motivate and satisfy staff.

The strengths and areas for improvement identified by TalTech for this standard [SER p. 50] are very suitably selected. Overall, the conclusion of the Panel is that TalTech conforms to the requirements of Standard 1.6 Teaching Staff.

Strengths

- The move to create instructional designers and the establishment of School teaching excellence centres.
- Teaching staff are committed to providing high quality learning opportunities for students.

Areas of concern and recommendations

- At present, becoming a full professor requires a strong research profile, whereas the University also needs leaders in teaching and practice. The University should introduce the opportunity to become a full Professor through a strong practitioner role or a strong pedagogical role.
- The University should ensure balance between teaching, administration, and research, to enable all staff to engage in international standard research.
- Staff understanding of student-centred learning, intended learning outcomes and the principle of constructive alignment was not strongly evident to the Panel. The University should ensure that its pedagogical training addresses all the requirements of a student-centred learning approach, including constructive alignment.
- It should also establish University-wide metrics to monitor the take up of pedagogical training by teaching staff and its impact on their teaching skills and student-centred learning.

Opportunities for further improvement

- The Panel encourages the further development of pedagogical training centres within Schools, and suggests any training offered by these centres is offered across TalTech as a whole.
- The University could consider whether to develop the Good Lecturer Development Programme into a programme that all staff must complete to different levels of competence as their career develops.
- The University could understand its staff performance and satisfaction better by discussing with staff the data it collects.

1.7 Study programmes

Standard:

Study programmes are designed and developed while taking into account the expectations of stakeholders, higher education and professional standards, and trends in the relevant fields.

The objectives of study programmes, modules and courses and their planned learning outcomes are specific and coherent.

The study programmes support creativity, entrepreneurship and development of other general competencies.

Guidelines:

In planning and developing study programmes (incl. programmes conducted in a foreign language), the HEI is guided by its objectives, its competence areas and the needs of the labour market, and takes into account national strategies and the expectations of society. The study programmes are based on up-to-date sectoral know-how and research.

The planned learning outcomes are in accord with the requirements for the corresponding level of the Estonian Qualifications Framework, and in planning them the HEI has taken into account the future needs, among other things. In developing study programmes, the HEI has conducted a comparative analysis of similar programmes in leading foreign higher education institutions.

The objectives of the study programme and its modules, the planned learning outcomes, theoretical and practical learning, the proportion of independent work and internship, and the assessment of the achieved learning outcomes form a coherent whole.

The development of general competences (incl. creativity and entrepreneurship) and support for the development of a self-directed learner is a natural part of the study programme, and these are integrated with speciality studies.

Expected student workloads defined in the study programmes are realistic and consistent with the calculation that, on average, 1 ECTS credit equals 26 student learning hours. The study programme offers sufficient challenge for learners with different levels of knowledge and skills.

Indicators:

- Number of students per study programme
- Other indicators depending on the HEI

Evidence and analysis

TalTech is the only technical university in Estonia, and has the goal to be the leading university in engineering, smart technologies and in business education [Interview 2]. It is a key enabler in green

and digital transformation of Estonian society and fosters entrepreneurship and innovation. TalTech is thus a critical part of Estonia's Higher Education system.

The study programs have seen a reform (2015-2018) since the previous Institutional Accreditation, based on the goals of the strategic plan from that time. The process included several stakeholders such as staff, students and others, according to the SER. The result has been a 18% decrease in the number of study programmes (99 to 81). This meets the changing national demographics, with fewer future Estonian students, but also ensures that each individual study programme has a sufficient number of students to be viable. The numbers of students per programme have increased; the programmes currently have about 60 to 230 students each. The goals of the revision were also to: improve the relevance of the programmes to societal and business needs; introduce more project-based education; increase practical training; increase students' options and the share of independent work; provide better coherence between courses; and increase interdisciplinarity. The main goals of the study programme development were to achieve broad-based programmes, improve competitiveness of graduates, and provide a transition to programme-based management and development.

The positive intentions at TalTech continue to the next level with the strategic plan for 2021–2025 where, among other things, the performance indicators have been adjusted in relevant directions to include *"Share of students graduating within the nominal period of study" and "At least 75% of the volume of the master´s programmes is taught by academic staff members with a PhD or an equivalent qualification"* The new strategic plan for 2021-2025 "*places emphasis on academic performance at all levels of higher education and responsiveness to the needs of the economy and society"*.

However, the Panel has observed that since the reform, the number of programmes has increased to 83, and during the visit the Panel was informed that another programme is in the process of splitting into two. While the number and structures of programmes is an ongoing process at most universities, after the reform TalTech still has a large number of programmes relative to the number of staff. The consequence is that the majority of academic faculty have to teach a considerable number of courses, especially if TalTech wants to have different specializations and offer electives to students to construct their degrees in a student-centred way. This leads to fewer resources to meet TalTech's ambition to become a research-intensive institution. Any further increase of programmes could thus be counterproductive to TalTech's development.

The current organization of the programmes means that each of the 80+ programmes is managed by one of the five schools. The courses are managed by the departments. Each programme is managed by a Programme Director who reports to the Dean of the relevant school, usually via the Vice-Dean. The programme director has a say in the selection of teaching staff, and discussions are ongoing to extend the authority of the programme director in influencing course content and selection of teaching staff.

Programme directors are responsible for the functioning, development, quality and sustainability of the programme, and are expected to analyse future trends and needs in society and the labour market. Programme directors are allocated resources for the programmes. 12% of overall funds are allocated to the schools based on performance indicators, and then distributed to the programme directors according to the Dean's wish. The best programme directors can win a monetary award. The programme directors have a network to reduce duplication of courses, and to exchange information and experiences. To involve various stakeholders in the design and development of the study

programmes, staff, students, and experts from various fields are part of the programme advisory board for each programme.

The Panel participated in interviews with students; teaching staff; alumni and partners; programme management at the eight investigated programmes; and TalTech management [Interviews 3B, 3C, 4C, 5C, 6C, 8A, 8B, 8C, 9C, 10A, 10C, 14]. These conveyed a picture that the reform has been successful, and that the interaction with key stakeholders on the development of the programmes is an active, integrated and continuous process, through the advisory boards, the feedback processes and evaluations. The review of the eight sample programmes does indeed confirm that they are mostly comprehensive, well structured, coherent and also work well (see programme reports and interviews 8C and 11C). The reform has worked in practice, although the theoretical pedagogical foundation is more uncertain; for example, at no time during the interviews or in the SER could the Panel find any mention of the concept of 'constructive alignment', or of any equivalent concept. Constructive alignment would see intended learning outcomes stated for the programme and for its constituent courses, with a demonstration that the course learning outcomes between them deliver all the programme learning outcomes at the right level, that the intended learning outcomes match the learning opportunities offered to students, and that the assessments explicitly test attainment of the learning outcomes. The programmes reviewed are each carefully put together, and some elements are consistent with constructive alignment but apparently not always as the outcome of a deliberate approach.

With respect to the development of general competences, interviews 3D, 5B, 6B, 8C, 9C, 10C demonstrated that the students mostly acquire these. Interviews 3D, 4D, 5D, 11C, the tour of facilities and exploration of SIS and Moodle show that the students are exposed to a great deal of creativity in their learning and assessment experiences. Entrepreneurship seems to be a natural element in several of the programmes through their close collaboration with companies, and the high degree of practical learning, with up-to-date sectoral knowledge [Interviews 3B, 3D, 4D, 5D, 6C, 8B, 8C, 9C, 10C, 10D, 11C]. One risk of such emphasis is insufficient depth in the education, as reported by the students in the Telematics and Smart Systems programme [Interview 8D]. Another weakness, unfortunately shared by most programmes, is the low level of internationalization, to the detriment of the development of the students. The Covid-19 pandemic has prevented student and staff mobility in recent years, but the partnership in the EuroTeQ Engineering University will hopefully provide opportunities to develop the programmes' internationalization. The pandemic has been a test of the ability of universities all over the world to provide online teaching. Before the pandemic, TalTech had already started to strengthen the programmes' capabilities for e-learning; the Panel could see for themselves the high standard of relevant equipment in lecture rooms, and also hear from students that TalTech managed well during the pandemic. When it comes to self-directed learning, there is evidence that it is working [Interviews 3A, 3D, 8C, 10C]. Several students praised the support from the teaching staff.

Based on the sample of programmes that the Panel reviewed, there are still variations in how well the revisions are embedded, which may have brought disadvantages; this suggests that it may now be time to perform a systematic evaluation of how far the changes have achieved the desired effects. In the case of Applied Chemistry, Food and Gene Technology, the Panel found evidence that Food Technology considers itself disadvantaged because of its difference from the other specialities, and could become a separate programme again, while exploiting the many teaching overlaps with Applied Chemistry and Gene Technology [Interview 5A]. In the case of Telematics and Smart Systems, the

Panel found that its two specialities are still taught separately at the two participating distant colleges, with little exploitation of synergies at the operational level. Common courses in this programme are duplicated at the two colleges and do not even use the same assessments; so that treating the specialities as separate programmes with more shared teaching, or at least harmonizing them, more could be more efficient.

The understanding and use of intended learning outcomes (ILOs) is variable across the University [Interviews 5A, 6A, 10A, 11A], whereas Estonia's *Standard for Higher Education, Annex 1*, the *Standards and Guidelines for Quality Assurance in the European Higher Education Area* (ESG) and the European Credit Transfer System (ECTS) expect ILOs to be central to the design of programmes. The specifications for the programme, modules and courses would be improved by writing them all in a common format. In the spirit of constructive alignment, this format should require intended learning outcomes to be expressed as what students should be able to do after engaging fully with the learning opportunities provided. It would also require assessment criteria to specify how students' achievement of the ILOs will be tested. Clarifying the curriculum in this way should help the teachers focus their teaching and assessment more clearly and help the students understand better what is required of them.

The programmes monitor student workload in correspondence to ECTS through the feedback systems. While this practice seems to work well, other underlying problems with student workload are much more severe. The market competition means that a majority of the students work in parallel with their studies, or drop-out from their studies (see interviews 4C, 5B, 6C, 10A, 11C, 11D, 16A). Some programmes accommodate working students and run at evenings and weekends. This seems to the Panel to be unsustainable in the longer run, with extreme workloads for some students and difficult working hours for teaching staff [Interviews 3C, 5B, 8B, 8C, 8D, 9C, 10C, 11C]. High workloads and high numbers of dropouts is not only a matter of wellbeing and the careers for students and staff; high numbers of dropouts also put TalTech at risk, since the number of graduates is one of the indicators that decide the funding of public universities in Estonia.

The matter of students working in parallel with their studies is complex [Interview 10A]. The closely knit relationship between TalTech, students and business is clearly one of the strengths of TalTech. In the ideal case, employment and studies go hand-in-hand for a profound and efficient education, as well as work experience and careers for students, and a well-educated workforce for business and Estonian society [4D, 9C, 10C]. But such schemes also limit the ability for international mobility within the programmes for the students, and for those students where work tasks and programme topics do not match, there are few benefits, if any. The Panel appreciates that all stakeholders are aware of the challenges, that the programme management staff are working to find solutions, and that the partner organizations and business are willing to support students to finish their education [Interviews 6C, 9C, 11C, 11D]. Still the problem is becoming out of hand for TalTech. The Panel therefore recommends that TalTech works to involve external stakeholders and Estonian society to develop a 'social contract' for a sustainable interaction where benefits of the collaboration can be maintained while the students' opportunities to finish their degrees are greatly improved.

The basic principle of education at TalTech is to have broad programmes with a variety of options, especially after the first year. There are requirements for interdisciplinary courses, especially in the first year. Theoretical courses with low pass rates have been replaced with more practical courses. Workload in courses is adjusted after indications from student feedback. The Panel has observed, in

the interviews with several of the programmes, that students are offered options based on their interests and are supported by the teaching staff in selecting from these [3A, 6A, 8C]. For example, in the Applied Chemistry, Food and Gene Technology bachelor's programme "*Students choose their internships and their graduation thesis supervisor, who may be outside the department but supported by a co-supervisor inside*"; this practice is common with the other programmes.

Conclusions

TalTech's study programme conforms to requirements. The study programmes are designed and developed taking into account the expectations of stakeholders, higher education and professional standards, and trends in the relevant fields. The objectives of study programmes, modules and courses and their planned learning outcomes are specific and coherent, with an increased focus on student-centred learning, but still do not fully reflect a common underlying conceptual framework. The study programmes support creativity, entrepreneurship and development of other general competencies. The successful reform of the structure with schools, departments and programmes, with clear roles for deans, heads of departments and programme directors, makes for efficient problem and opportunity identification and decision making. The changes involved some mergers intended to utilize synergies between subjects and make teaching more efficient. This process naturally took some time, but the revised programmes have now been running long enough to produce their first graduates. However, not all the changes have been as beneficial as intended, and there remain issues with the allocation of ECTS credits to courses.

Strengths

- After an impressive reform of the organization and programmes, TalTech is in a good position, with an agreed functional study programme structure.
- TalTech seems to deal well with the important connections to society and business, including through programme advisory boards and external participation in the programme courses.
- Networks for programme directors are valuable, particularly for reducing issues with duplication of courses.

Areas of concern and recommendations

- For more obvious alignment with the ESG, TalTech should design and implement a process to ensure that, all programmes and their constituent courses: have ILOs stated using active verbs that are appropriate to the level of the course and programme; offer learning opportunities that demonstrably enable students to achieve all the ILOs; use assessment methods that explicitly relate to the stated ILOs; and set out in detail (for example, by a mapping) how, between them, the course ILOs deliver all the programme ILOs for any student study plan.
- The high rates of drop-out, related to the very high external workload of students, need to be addressed. The Panel therefore recommends that TalTech should involve external stakeholders and Estonian society to develop a 'social contract' to sustain students at work and in study to maintain the benefits that all parties derive from the collaboration while greatly improving the students' opportunities to finish their degrees.

- The ‘creep’ towards a higher number of programmes risks countering the positive outcomes of the reform, and reducing the ability for TalTech to become a more research-intensive university. Having been in operation for a few years, the programme structure is ready for further consolidation and advances in some weaker areas that have not been fully addressed yet.

Opportunities for further improvement

- Sufficient experience and graduates now make it a good time for TalTech to review all its programmes systematically.
- The study programmes would now benefit from a more structured and coordinated approach towards internationalization.
- An evaluation of the role of the programme directors could be timely. They have a critically important role but also a difficult one, with responsibilities both to the school Dean for the programme curriculum and to one or more heads of department for staffing it.

1.8 Learning and teaching

Standard:

Admission requirements and procedure ensure fair access to higher education and the formation of a motivated student body.

The higher education institution systemically implements a student-centred approach that guides students to take responsibility for their studies and career planning, and supports creativity and innovation.

Graduates of the higher education institution, with their professional knowledge and social skills, are competitive both nationally and internationally.

Guidelines:

Admission requirements and procedure are fair and impartial. In the admission process, student's ability for academic progress on the chosen programme is assessed.

The academic recognition of foreign qualifications is based on international conventions, agreements between countries, and the Estonian legislation.

Learning and teaching process takes into account students' individual abilities and needs and supports their development. Learning offers sufficient challenge for students at different levels. Students participate in planning and implementation of the learning process. Organization of independent work and face-to-face teaching motivates students to take responsibility for their studies.

Teaching methods and learning aids used in the learning and teaching process are modern, appropriate and effective and support the development of digital culture, contributing – among other things – towards the development of a self-directed learner, creativity, innovation and the development of other general competencies.

The internship is integrated with speciality studies, the requirements for the internship are defined and the student's supervision ensured.

Students are motivated to learn and contribute to improving the quality of their studies by providing meaningful feedback on both the learning and teaching process and the organization of studies.

Doctoral students plan their studies, as well as their research and development activities, in collaboration with their supervisor(s), setting specific objectives for each year and assuming responsibility for achieving those objectives.

Indicators:

- Student satisfaction with the content and organization of studies
- Alumni satisfaction with the quality of studies
- Employer satisfaction with the preparation of the graduates
- Other indicators depending on the HEI

Evidence and analysis

TalTech has developed a year-round admission process with transparent and impartial student-admission criteria to attract and select the best academically able and the most motivated students to its programmes (SER). The criteria listed in the SER are strongly based on the state examination in mathematics (beyond a certain threshold) and medal winners at Olympiads. Olympiad winners are rewarded with a dedicated scholarship. International applicants have to pass an entrance test. Specific admission criteria can be developed for each study programme and school (SER). Additionally, motivation letters and interviews are increasingly used as part of the selection process for students. This admission process is well developed for the bachelor's and master's levels.

The admissions criteria are also used to control the number and quality of the students [Interview 7]. Recently, tighter criteria were applied, and this led to fewer and hopefully better students, with a lower drop-out rate. However, such a filter system is not fully adequate for reducing drop-out rates, as it does not address the diversity of causes (e.g. workload) and solutions (e.g. better combining work and study; inspiring teaching methods). The Panel considers that, while the admission system evidently does reduce drop-out rates, it also excludes some students who might succeed but whose entry grades are reduced by causes such as poor teaching in high school. So admissions should also allow an applicant's context to be taken into account. Once admitted, students also need to be supported by: help in better combining work and study; advice on independent study; and inspiring teaching methods.

Admission at the doctoral level differs because the university strategically wants to reward excellent and impactful research [SER]. Supervisors can therefore submit research applications to apply for central funding, and, when selected based on excellence of the proposal and the supervisor as a researcher, find the appropriate PhD candidate for this internal funding. When selected, each PhD student prepares an action plan for his/her research activities, and also for seminars to attend. At the end of the first year the necessary progress is evaluated by the supervisor and checked by an attestation committee.

To improve supervision quality, a supervisor has no more than five PhD students at a given time [SER]. Additionally, currently PhD students can participate in peer-seminars, to learn from experiences outside their individual research area. There are also mandatory general courses across all departments to broaden students' knowledge and expertise, and enhance their employability after graduating.

When admitted, bachelor's and master's students develop their own study programme and timetable, which are available and monitored in the SIS system [SER]. A yearly obligatory student satisfaction survey is also done through SIS. Grades and comments are given through SIS and this helps the programme director, course coordinators and lecturers to improve courses and teaching approaches. An individual student's file (courses, planning, grades and emails) will soon be made available in TalTech's newly developed *SMART* system [Interview 25].

TalTech strongly invests in e-learning supported courses (including a dedicated Moodle platform) [Interview 7]. Students are satisfied with the progress in e-learning, which also helped to cope with the teaching and lock-down difficulties during the recent Covid-19 pandemic [Interview 7]. Best-practice guidelines have been developed and many of the courses are awarded the EKKA quality labels. Lecturers can apply for funding to enhance their skills [Interview 7].

In terms of learner-centred teaching and learning, there are two key aspects which TalTech applies: student choice and flexibility; active learning and collaboration. In all programmes students have considerable leeway to design their own study routes, studying core courses but supplementing these with a wide choice of elective courses. In addition, flexibility of the timing of study is provided: for example, weekend or blocks of study which students can fit around their work commitments. Good use is made of problem-based and project-based learning, group work, practical work and internships. Many courses now use these approaches, and students seem very satisfied with them. In summary: TalTech uses many student-centred learning approaches; there would be value in exploring the concept of 'student-centredness' further with lecturers, so that these approaches are further embedded, and lecturers understand the educational principles on which they are based. This could be done as part of TalTech's pedagogical training.

The internship system is guided by the curriculum statute and specific guidelines for each school. An internship coordinator helps students to find appropriate internship positions, relevant to their interests. All schools have dedicated internship portals [SER].

Graduates are generally very satisfied with their education [Interviews 4 and 9]. Most have quickly obtained employment, and generally they obtain a higher salary than graduates from other Estonian universities. Although it is not clear how their academic qualities and competences compete internationally, TalTech's graduates are competitive in the national labour market [Interview 1].

Conclusions

TalTech's admission, learning and teaching approaches conform to requirements. The admission process is based on transparent and impartial criteria at BSc and MSc levels. Admission of PhD candidates is based on the quality of research proposals submitted by supervisors, and the supervision quality is guaranteed. Students can develop their own study programme and timetable. Progress is monitored. Best-practice guidelines for courses (including e-learning courses) are available and many courses obtained the EKKA quality label. Ample opportunities exist to improve the lecturers' skills. TalTech's graduates are satisfied with their education and competitive in the national labour market.

Strengths

- A year-round admission process with transparent and impartial student-admission criteria attracts and selects the most academically able and most motivated students.
- E-learning supported courses have been implemented and many are quality certified by EKKA.
- Problem-based and project-based learning and learner-centred teaching methods, combined with practical training and theoretical studies, are introduced and stimulated.
- Research quality and impact of PhD supervisors is stimulated.
- TalTech's graduates are competitive and successful in Estonia.

Areas of concern and recommendations

- Using the admission criteria to reduce drop-out rates excludes some students who might succeed but whose entry grades are reduced by causes such as poor teaching in high school; so admissions should include a contextual factor. Solutions that address the diverse causes of drop-out after enrolment should also be used.

Opportunities for further improvement

- Indicators for the efficacy of e-learning and other contemporary teaching methods can be further developed.

1.9 Student assessment

Standard:

Assessments of students, including recognition of their prior learning and work experiences, support the process of learning and are consistent with expected learning outcomes.

The objectivity and reliability of student assessments are ensured.

Guidelines:

The assessment criteria are understandable to students and students are informed about them in a timely manner. Members of the teaching staff cooperate in defining assessment criteria and apply similar approaches.

Assessment methods are versatile and relevant, assess the degree of achievement of learning outcomes (including general competencies), and support the development of a self-directed learner.

If possible, more than one staff member is involved in the development of assessment tasks and student assessments. Along with assessments, students receive feedback that supports their individual development.

The HEI supports the development of teachers' assessment competencies.

Evaluation of doctoral students is transparent and impartial. Its purpose is to support the development of doctoral students, to assess the effectiveness of their current work and to evaluate their ability to complete the doctoral studies on time and successfully defend their doctoral theses.

When recognising prior learning and work experience towards the completion of the study programme, results obtained through the studies and work experiences (the achieved learning outcomes) are assessed. Students are aware of their rights and obligations, including the procedures for challenges regarding assessments.

Indicators:

- The number of credit points applied for and awarded under the accreditation of prior and experiential learning scheme (APEL)
- Other indicators depending on the HEI

Evidence and analysis

Assessment policies, including APEL, are included under TalTech's Academic Policies (W https://taltech.ee/en/academic-policies-taltech, §15 to 30). The minimum necessary ECTS points in order to pass a semester are listed for full-time, part-time and PhD students. Lecturers are expected to inform students about assessment methods and criteria at the beginning of the course, and the

arrangements must be fixed for that semester (though this requirement was relaxed – in students' favour – when Covid-19 struck, and teaching was reorganized). Agreement between the announced and actual assessment method was highly rated by students, but there were criticisms of the differences between the actual and the published criteria and changes in the criteria during the semester [SER p. 60]. The University will no doubt wish to ensure that the criteria published at the start of the semester do not normally change and are those used in practice, and that if – exceptionally and for good cause – the criteria are changed, then students are fully aware of the changes and accept them. Graduation theses and occupational qualifications are assessed by specific committees. Assessments are graded (in about 75% of courses), with passing grades from A to E plus F for fail, or non-graded, i.e. pass/fail at some threshold. The policies specify how final grades and grade-point averages are to be determined, and rubrics are provided [W https://taltech.ee/en/academic-policies-taltech, §16]. A need has been identified for better cooperation among staff in assessing programmes, but only a "possible solution" (designation of one main responsible person; SER p. 61) has been identified.

Assessment methods can be defined by the lecturer, and vary between courses. Methods must assess attainment of intended learning outcomes (ILOs), and although lecturers must specify the assessment methods they use, the Panel found no evidence that they must also show how the specified methods do in fact assess achievement of the ILOs. Indeed, although assessment is generally appropriate, the process of systematically aligning it with ILOs is unclear. In particular, no process is systematically implemented to show how, together, the course ILOs deliver all the programme ILOs for all possible student study plans on the programme, although some programmes do map them together. In order to foster more interim continuous assessment, assessment is no longer confined to the end of the semester period, and this is appreciated by the students (e.g. SER p. 130).

Assessment is mainly done by a single person, except for graduate theses. Feedback on assessed work is not given to the students individually, especially in large classes. The University sees introduction of the e-learning system as a remedy here, based on early positive experiences [SER p. 60]. As already noted, a need has been identified for better cooperation among staff in assessment for programmes, especially on larger courses taught by teams of lecturers, where the course coordinator will manage the duties.

Results of written assessments must be provided within two weeks. Students have complained that the detailed feedback they receive is not always developmental, but it is being improved orally as well as via Moodle and seems to work very well in selected programs [S 8D]. Students may query grades [SER p. 60].

Feedback on assessment is sought from students every semester via SIS, and on graduation it is sought in the graduate survey. Satisfaction is generally high, with some positive comments, and analysis is conducted to show where improvements can be made. In particular, satisfaction is lowest (but still 3.93 on a scale from 1 to 5) with finding a topic and a supervisor for the graduation thesis. However, students may pick external topics from their working environment [S 3B]. In general, student feedback is sought systematically, and analysed carefully, but it is less clear how it is routinely acted upon.

Assessment criteria were reviewed in the course of the reform of programmes during 2016–2018, which, among other things, led to larger courses taught by teams of lecturers. Staff training and advice on assessment is available in several forms from various sources, including as an elective during doctoral study. In 2019 the University published a handbook on engineering pedagogy, covering

effective teaching and learning of STEM subjects. The SER says that assessment is addressed during mentoring, advising staff and feedback from lesson observations. During the interviews the Panel learned that pedagogical training is compulsory for newly hired faculty and is part of the periodic evaluation for others [M 22A]. Development of assessment skills is a key part of the Good Lecturer Development Programme, but the agreed measures are not yet fully implemented. Overall, it appears that assessment is recognized as an essential component of the lecturer's role.

Doctoral assessment follows a national agreement, and attestation (routine evaluation of progress) is done by a committee with one member from outside the student's school, twice in the first year and once (or sometimes, for a good reason, twice) in subsequent years. The evaluation follows set criteria based on the student's progress on their study plan, targeting completion in the nominal duration of four years. Until recently, publication of three articles in internationally recognized journals (or a monograph) was necessary before the thesis could be examined (W https://taltech.ee/en/PhD/regulations §6), but now exceptions (allowing only two Q1 or Q2 articles where the candidate is lead author of at least one, or a significant monograph) can be approved by the vice-rector for research. This allows for the fact that different candidates work under different constraints and on different timescales, so screening them out by the same arbitrary yardstick risks being unfair to them. It is the University that awards the PhD, and TalTech already brings an external expert into the PhD assessment committee.

Feedback on the outcome of attestation is given to students. The SER says fewer students are now exceeding the nominal period of studies, which it attributes to the changes to admission and organization of doctoral studies. On the other hand, SER Table 34 shows the average duration of studies increasing from 5.9 years in 2017/18 and 2018/19 to 6.2 years in 2019/20, although the SER says that in 2020 "the average length of doctoral studies decreased to less than six years".

The requirement to amass three publications before submission lengthens the time required for completion (especially once the candidate's stipend ends and they need to take external employment to support themselves), and depends on the decisions of editors and usually anonymous referees for the targeted journals. Even when candidates have produced three publications, the Panel has some concerns that there is no incentive for supervisors to encourage them to submit their thesis, as long as they are still contributing to the group's research. Nevertheless, overall, the arrangements for doctoral work support reliable, independent and objective assessment.

There are clear rules (W https://taltech.ee/en/vota) for recognizing and accrediting what TalTech calls Prior and Experiential Learning, i.e. accreditation of prior learning (APEL). The process is overseen within each school by dedicated advisers (including a feedback loop to students to help screen out applications that are not likely to succeed) and carried out by regularly trained assessors [M 25] in relation to the programme ILOs. A University committee ensures uniformity. The number of applications dropped by 43% between 2015/16 and 2018/19 when programmes changed. Applications for APEL include professional experience (SER Table 33) and are very largely successful; more than 7000 credit points were granted in the autumn semester of 2019/20 (over 16,000 for the full year) and over 11,000 in the autumn semester of 2020/21. In recent years, about 10% of the student body have applied for APEL each year and on average they have been awarded about 20 credits each. The rejection rate consistently remains below 1%, which is very low compared with rates encountered elsewhere by the Panel, but the interactive screening process may help to account for this. Overall, APEL appears to be handled effectively.

Conclusions

Student assessment at TalTech conforms to the respective standard. In particular, policies are easily accessible on the web and clearly formulated, though students have criticized differences between the actual and the published criteria and changes in the criteria during the semester. Lecturer training on assessment, and also on recognition of prior learning is given a high priority, which results in an overall high student satisfaction. From an accreditor's point of view, however, alignment of assessment methods with ILOs should be done more systematically. Assessment of PhD students is structured and supportive for their career, although maybe overly stringent. TalTech has already identified this problem, as is reflected in recent easing of procedures.

Strengths

- Academic policies and guidelines for recognition of prior learning are clearly documented on each department's homepage.
- External faculty are involved in PhD committees.

Areas of concern and recommendations

- The University should require teaching staff to show explicitly how the assessments they use measure achievement of their course ILOs.
- The University should require all programmes to show clearly (for example, by means of a mapping) that achievement of course ILOs delivers all the programme ILOs for any possible study plan.
- The University should ensure that published assessment criteria do not normally change and are those used in practice. If – exceptionally and for good cause – the criteria are changed, then the University should ensure that students are fully aware of the changes and accept them.
- The University should make arrangements to ensure that students consistently receive feedback on their performance in assessments, with advice on how to improve in future.

Opportunities for further improvement

- The publication requirements to submit a PhD thesis are high, and could prolong completion times unfairly. The University may wish to explore whether a more predictable assessment system for PhD programmes could be agreed, perhaps based solely on internal review but with external expert input on whether the research is publishable.

1.10 Learning support systems

Standard:

The higher education institution ensures that all students have access to academic, career and psychological counselling.

Students' individual development and academic progress are monitored and supported.

Guidelines:

The HEI assists the student in developing an individual study programme based on the student's special needs as well as educational abilities and preferences.

The HEI advises its students (including students with special needs and international students) on finding internship places as well as jobs. Students are aware of where to get support in the case of psychological problems.

The HEI has a functioning system to support and advise international students (including psychological and career counselling) which, inter alia, helps them integrate smoothly into the membership of the HEI and Estonian society. The HEI analyses the reasons students withdraw from studies or drop out, and takes steps to increase the effectiveness of the studies.

In order to carry out studies and research, development and creative activities, the availability of up-to-date study and research literature, other study materials and tools (including those for independent work) and access to research databases is ensured. Study literature, materials and other teaching aids are of equally high quality.

To support study activities, timely and relevant information and communication technology solutions have been planned, including the study information system, document management, and e-learning environment.

The HEI supports student participation in extra-curricular activities and civil society initiatives.

The HEI monitors student satisfaction with the counselling services provided and makes changes as needed.

Indicators:

- The average duration of the study by levels of study
- Dropout/withdrawal rate (during the first year and the whole study period)
- Students` satisfaction with the support services
- Other indicators depending on the HEI

Evidence and analysis

TalTech's Strategic Plan 2021–2025 tries to provide "seamless and cost-effective support services with an aim to support and better combine high-quality studies, research and innovation". Advice, information and support are available to students on academic, career and personal matters from various sources, notably a student counselling office (SCO). Establishing the SCO is a clear improvement since the last international assessment of TalTech.

Overall, TalTech takes study support, as a system, seriously. An example of the value of student counselling can be seen in the study portal that the students use, where the third most important selection (student.taltech.ee) is 'counselling'. It is a frequently visible reminder for the students that there are counselling services easily accessible.

TalTech uses an evidence-based approach and tracks key indicators closely. Feedback on counselling services, described in the SER, record very high marks from students. In addition, there seems to be a remarkably low number of students who do not know about the counselling services. This is shown in the data but was also emphasized in interviews [SER, interviews 16A, 21]. Data show improvement in key indicators. Faculty and staff are aware that the aim is that students know that counselling services exist, not necessarily that the students use the services (unless they need or wish to).

An orientation week introduces international students to the services available, which also include courses on personal effectiveness. The SCO website is organized so that it shows clearly academic counselling, psychological counselling, career counselling and counselling for special needs. The SCO website lists several counsellors (5 listed on the TalTech website). International students are catered for by dedicated counsellors, as one third of the queries are from international students.

The SCO is very small. Fortunately, there seem to be very few students with, for example, special needs [Interview 16A]. It is unclear if counselling for special needs can scale up, in its current format, should there be a sudden increase within new intakes of students (e.g. instead of one blind student starting, there are two). The change to online counselling during the pandemic was smooth and well-received by the students. This was as expected, as the students were already used to operating with online tools.

About half of the students have said that they have not used counselling services, which is a sign that studying is successful. Those who do not proceed with their studies, or who proceed slowly, appear largely to know the reason for dropping out or slow progress, and would not to be helped by more counselling services.

The Academic Policies require students to have support in devising an individual study plan (including for doctoral studies) and securing an internship. Advice is provided by student counsellors from the Dean's office. TalTech organizes seminars for programme directors and study counsellors, to guarantee helpful counselling for the students.

The SCO, together with various student organizations, communicates job offers and internships. But otherwise only the school of IT provides a systematic approach to internship support, via an 'Internship café'. Internship placement in itself is not a concern, as TalTech has solid connections to industry.

As an example of a good practice, when the School of IT realized that maths and physics are considered by students to be tough subjects, they organized specific support for the subjects (ReaalAbi). That support was then adopted to the university.

TalTech monitors and sets targets for graduation efficiency and average period of study on all programmes. It analyses reasons for failure and drop-out but does not have a systematic process to capture dropouts with an 'exit interview'. There was evidence that some programmes have used exit interview, but not all [interview 7].

TalTech's Open University is one mechanism to support students in continuing their studies if they drop out from their degree, for whatever reason. However, TalTech Open University serves wider society, not just alumni and students who drop out.

TalTech is working to improve monitoring of progress during the programme, and not just at the end of the year or semester. One of the initiatives mentioned was an in-house learning analytics tool for ongoing monitoring of students' progress, and then intervening, if needed. For this to be possible and effective, it is necessary "for the teaching staff to use more interim assessments (especially in the study programmes with a high drop-out rate)" [SER p. 66]; this also has the benefit of spreading students' workload. There is no university-wide adoption of the tool yet, and no formal approach to using the tool as a part of the management of the study programmes, to support students. However, there is a potential benefit in using the tool, not least because it encourages a natural improvement to the feedback loop for the students' study process, by making assessment more frequent. Wider adoption of the tool is encouraged.

Graduation efficiency has increased 10 percentage points (from 40% to 50% in the last 5 years, and the University is aiming for 60%). Dropout from PhD programmes has decreased noticeably but remains significant for Professional Higher Education programmers [SER p66]. These study programs also take significantly longer (approximately 50% longer than others). The university seems to recognize the problem. The chosen approach, with stricter rules and increased thresholds for student admission, might help to improve the indicators but does not seem to be a student-centred approach. This is not a criticism per se, but it is beneficial that all the stakeholders are aware of the choices made and the rationale behind the choices.

TalTech seems to be well-equipped for hybrid learning, with a large number of auditoriums with the Echo360 video platform. In addition, there is a Teaching and Learning Lab, a space for teachers to experiment and develop further advances in teaching arrangements. The Educational Technology Centre lists 8 staff members on its website. Virtual tours of the campus areas, including many of the buildings, are offered online. Easy access to facilities by virtual tours is good practice. The impact of virtual tours for student application numbers remains unclear.

The library serves the students well, with an online portal and a relatively high number of textbooks per student (approximately one textbook for 5-7 students). There is also a digital thesis collection. The library has been steadily developing; no complaints were made in the interviews concerning the library facilities.

In addition, TalTech provides every student with a portal and a mobile app that ties the student information system and other sources of information together. The mobile app is relatively new and usage is still at an early stage; older students tend to use the portal more, and newer students are more active with the mobile app [Interview 21].

There are various student organizations, which involve about 20% of TalTech students. TalTech sees this as a metric that shows engagement with the learning environment. It is a good to see this metric increase, even if it is not necessarily comparable to other universities, even within Estonia. The Student Union is active and plays a significant, formal role in study quality groups. The Student Union is funded by the university, and has facilities and operation on a par with similar technical universities outside Estonia.

The University offers a number of scholarships from its development fund to support a selection of students. The development fund also acts as a way to connect employers and organizations to the students [website]. Students are represented in all TalTech's formal decision-making and advisory bodies, giving evidence of organization-level student centeredness.

Students keep track of the workload of courses and point out perceived departures from ECTS equivalence via feedback channels [interviews 21, 8B]. The Student Union has study quality workgroups. They process all the mandatory feedback and summarize it for the programme directors, although programme directors sometimes process the data themselves, as well [Interview 21]. Students who carry out the processing are contracted by TalTech to prevent possible wrongdoings with the raw feedback. The practice of students summarizing feedback tightens the connection between the students and the direction of the study programmes [Interview 21].

It is worth noting that there is a focus on first-year dropout, as first-year experience is important for dropout and future study success. A PhD thesis (from Tartu University), stating that social integration is seen as an important aspect of study success, was cited in several interviews.

TalTech has some outreach activities in its portfolio: preparing school students to study by offering summer camps and other activities, as well as open courses for students outside TalTech degree programmes [SER; interview 23B]. However, TalTech students could be more involved in a wider range of societal activities. Students are already involved in business start-ups, and other full-time work, as TalTech students appear to be in high demand in Estonian society.

Conclusions

TalTech offers a wide variety of support to students: up-to-date IT systems, some financial support in a form of scholarships, improving library facilities, a range of clubs and societies, and a well-functioning centralized counselling service. Students are satisfied with the services and only a small proportion of students are unaware of them. Study times tend to be longer than desired, but the challenge has been identified and tackled, using various methods.

When students are successful in advancing their studies as planned (in other words, studying *works*), there is seldom need for separate counselling. That is why a good way to support student success might be Industrial Master's degrees, where one can flexibly combine work in industry with studying towards a degree. There are components of this approach in many TalTech degree programmes already, and some in planning. Successful Industrial Master's programmes require careful coordination and involve training people in industry to fulfil their roles appropriately in the programmes.

Strengths

- Taltech has a coherent approach to offering a comprehensive set of counselling services with a clear strategic aim and clear metrics. There is a very small, but efficiently organized student counselling service, well-communicated using various channels. The central student counselling office links well with the academic counselling in study programmes.
- Feedback is gathered and processed in a deliberate way (e.g. parts are mandatory). Giving and processing feedback have had demonstrable effects on teaching.

Areas of concern and recommendations

- The attitude among teaching staff concerning high dropout numbers, and low numbers in international exchange for outgoing students, seems to be passive; if TalTech wants to reduce dropout rates and increase international exchanges, these should explicitly be made priorities.

Opportunities for further improvement

- The in-house learning analytics tool that is in limited use can be disseminated further in TalTech. During the interviews, the main reason behind not using it more widely was stated as “the lack of interim assessment in courses”. Since lack of feedback to students was also found to be a problem, the learning analytics tools could help motivate an improvement to the pedagogical arrangements, to include more feedback to students by increasing the number of interim assessment points in courses.
- The TalTech App is not used as a system for developing the learning environment as a whole. It is more like a “nice thing” offered to students because many universities nowadays have their own app. By tying the app in a systemic way to other activities, starting in the pre-sessional week and thereafter, a sense of community could be increased.

1.11 Research, development and/or other creative activity

Standard:

The higher education institution has defined its objectives and focus in the fields of RDC based on its mission, as well as on the expectations and future needs of society, and assesses their implementation and the societal impact of its RDC activities. RDC supports the process of teaching and learning at the higher education institution. Support services for RDC are purposeful and support implementation of the objectives of the core process.

Guidelines:

The HEI places a high value on the role and responsibilities of the field of RDC in society and evaluates the results of its RDC activities, their international visibility and societal impact.

The HEI responds flexibly to the current needs of society and the labour market in terms of its research and plans its research in collaboration with enterprises, public sector institutions and organizations of the third sector.

Members of teaching staff introduce students to their research results as well as the latest scientific achievements in their areas of specialization, and involve students in their R&D projects where possible.

The organization and management of RDC take into account the profile and the mission of the HEI.

Indicators depend on the specificities of the HEI:

- Numerical data:
  - (1) scientific publications by classifiers;
  - (2) public presentations of creative work; recognition from international competitions; reviews in professional publications, etc.;
  - (3) patent applications, patents;
  - (4) textbooks, study aids of various formats, etc.;
  - (5) system development solutions; product development solutions; environmental applications solutions;
  - (6) contracts concluded with enterprises;
  - (7) spin-off companies, etc., in line with the profile and priorities of the HEI; etc.
- Number of scientific publications / creative works per member of academic staff and per employee with the requirement to do research (FTE, by areas)
- Number and volume of externally funded projects of RDC activities
- Proportion of projects with a positive financing decision out of the submitted project applications.
- Other indicators depending on the HEI

Evidence and analysis

TalTech is an Estonian leader in research, development and other creative activities (RDC). This mission is highly considered in TalTech's strategic positioning, and this is reflected in the daily life of the university. RDC is taken seriously by management bodies at multiple levels – including the University Council, the Rectoral team (including Vice-Rectors for Research and for Entrepreneurship) and the Deans – who recognize, encourage, and envision TalTech´s RDC activity as an engine for Estonia´s economic and societal progress [SER; Strategic Plan; 2021-2025; E; M].

Evidence from the SER [Table 35] illustrates TalTech´s overall RDC performance during 2015-2020, and reveals positive progress on most indicators. Most of them exceed the targets set for 2020. Research output, as measured by scientific publications per academic position, increased overall; and this took place for every school of TalTech [Additional Materials], notwithstanding internal policies encouraging quality over quantity [M]. Revenues from contract research agreements (e.g. with companies and public entities) doubled over the period, while the income from R&D project agreements increased 170%. The balance between contract research and scientific research grants varies across schools, but every school is involved in RDC activities [Additional Materials]. Evidence also shows that TalTech has strengthened (and keeps monitoring) its international position, as assessed by the share of articles in Q1 journals, article citations, co-authored publications with leading technical universities and success rates in H2020 applications. TalTech coordinates almost one in four of its H2020-funded consortia [SER].

Research activity is strongly institutionalized at TalTech and organized around 124 research groups [SER]. The recent structural merger of Schools and Departments at TalTech (2016-17) is considered by interviewees to have stimulated better research by increasing collaborations and putting in place more capable research leaders [M; T]. Quite naturally, research groups' levels of internationalization and research pre-eminence vary; each research group´s performance is transparently monitored and assessed through updated 'Power-BI' reports and a detailed 'Research Group Atlas', which are compiled and available at University level, in articulation with central IT systems. At a higher level, research activities and strategies are overseen by the Vice-Rector for Research, and several sensible research-focused measures have been set for implementation for 2021-2025. These include, for example: new internal funding vehicles to encourage and stabilize research activity (beyond externally funded grants); measures to develop support services further; and a best practice sharing programme. The Panel found these measures timely and adequate, and encourages TalTech to closely monitor and follow-up on their implementation.

While the forthcoming measures are still moving towards implementation, research is already strongly encouraged at TalTech through multiple incentive schemes. Funding allocation is carried out at the school level, and despite variation across schools, the Panel found examples in which the provision of budgets for early career and tenured professors is considered, as well as funds to support new ideas and reward schemes linked to research productivity [M]. A balanced and detailed career-progression scheme is in place [Academic evaluation matrix] and PhD students are hired full-time as early career researchers. Other research-favourable institutional arrangements include possibilities to top-up baseline salaries through research funding; low contract research overheads; and flexibility to trade-off and negotiate teaching and research time allocation as major research projects are acquired [T; M]. While these incentives are powerful, it would be important to ensure that their application is fully

clear to staff members. Additionally, as research budgets increase [SER], it must be ensured that successful principal investigators keep an appropriate foothold in teaching activity.

In 2019, TalTech mapped and formalized strategic research areas at the university level, seeking to guide and consolidate its profile around five spearhead domains [SER]. The Panel found this initiative promising in countering eventual fragmentation between research groups and as an important vehicle to communicate TalTech´s expertise to society, and position research around broader societal missions. Evidence collected during the interviews suggests that awareness of these research areas as guidelines is starting to be embedded, both for funding allocation in schools and for external promotion [M]. Also, the Panel found that not every research group feels 'represented' by these major research areas [M]. This can be interpreted as a positive signal of selectivity but also of eventual need for fine-tuning and internal communication. The concrete materialization of these 'umbrella' research areas, domains or platforms is still a relatively recent endeavour. The Panel agrees with the SER assessment that these areas will need more concrete operationalization, namely around specific daily governance mechanisms, coordination of joint activities, internal and external communication, ways of monitoring progress, and eventual corrective measures along the way.

TalTech can be considered a societally engaged university with active contributions to several professional groups, societal discussions and policy agendas in Estonia and beyond [SER; E]. There is ample evidence of collaborative research and research contracts with enterprises, public sector and not-for-profit institutions. These contracts reached revenues of 11 million euro in 2020 – corresponding to an increase of over 95% since 2015, including relations with international business partners [SER]. According to the SER, TalTech also has 17 institutional cooperation agreements in RDC domains with companies and governmental organizations, and more are under preparation. The Panel sees the forging of multi-annual, longer-term research agreements as an important step to stabilize research budgets and move beyond ad-hoc research contracts to more strategic collaboration agendas. An important development in this field has also been the establishment of joint industrial master's and PhD Programmes [E], which will likely leverage other modes of strategic collaborations.

Beyond contract research, the recent appointment of a Vice-Rector for Entrepreneurship signals the strong ambitions of TalTech in spin-off promotion, technology transfer and intellectual property strategy. Notwithstanding the presence of a Technology Transfer Office, the pre-eminence of the Mektory Centre in pre-incubation stages, and TalTech´s average yearly granted patents and spin-offs during 2015-20 [SER], the Panel sensed that TalTech was still punching below its weight in these domains, and that the institutional setting could be developed further. Current strategic plans are ambitious and well aligned with TalTech´s positioning; they envision measures to further encourage research spin-offs and facilitate patent submissions by TalTech´s staff members [M]. There is special expertise in intellectual property strategy in particular fields [SER, M], with the Vice-Rector being an experienced entrepreneur himself. The Panel found evidence that governance mechanisms are in place for deciding on IP licensing strategy and participation in spin-off equity [M]. TalTech is well-aware that a challenge ahead is to find ways to better monitor the extent to which TalTech´s research is having societal impact, namely in the field of start-ups and spin-off creation that draw on TalTech´s research. Moreover, although the focus on strengthening the commercialization of knowledge assets is clear, the Panel considers that there is still ample room to develop other possible forms of societal engagement in this respect, namely concerning open science and open patents. Also, collaborations with governmental bodies, other non-governmental organizations and citizens could be better

explored. This could move the current well-established multidisciplinary and interdisciplinary research into a timely transdisciplinary mode.

Concerning the articulation between research and teaching activities, 58% of the staff who are involved in research groups participated in teaching in the 2019-20 academic year (SER). During the interviews [S, A, T], the Panel found evidence that this connection is occurring in multiple instances, and that the institutional setting is favourable to making it happen: incentivizing teachers to be involved in research, and the other way around. In some of the bachelor's and master's level programmes under analysis, the Panel found evidence that students are introduced to their teachers' research early on, notably through engaging in lab-related activities and, as their studies progress, they get ample opportunities to participate in on-going research projects more actively [SER, T]. This practice is routine at the doctoral level, during which PhD students participate in their research group´s projects [SER]. PhD students also engage in teaching activities, forming yet another important channel to link research and teaching [S]. Although links between research and teaching exist, and incentives are in place, not all the analysed study programmes reveal a strong research-based input [T]. Also, concerns were expressed that, in some instances, research leaders should become more closely involved in study programmes, to feel engaged in education and to be involved more often in updating the programmes that they feel connected to.

During the visit, the Panel confirmed that TalTech has very good and well-equipped research facilities and laboratories, which are actively used for research, education and other sorts of entrepreneurial and contract-based activity. These facilities are run in a professional way and their functioning reveals a university that is a vibrant part of society, while playing a key role in the education of young professionals [R]. While research is largely funded through European projects, TalTech is aware of maintenance needs and requirements [R]; also in this respect, the 2021-25 Strategic Plan envisions the development of a funding model to allow for the cross-use of research laboratories and improve access to different types of activities. In fact, interviewees suggested that some signs of pressure and competition have recently emerged [S, T, M]. The Panel foresees that this will probably increase in the future, notably as the volume of research contracts rises and TalTech has the ambition to render more external services and support the creation of new businesses (e.g. through spin-offs and early incubation) while keeping laboratories accessible to students.

Besides laboratory facilities, several services are in place to further support TalTech's RDC activities, including the Research Administration Office, the Technology Transfer Centre and the Innovation Centre Mektory. The Research Administration Office is linked with a dedicated project accounting division at the financial office and is staffed with proposal writing specialists who help researchers with proposal writing, development and project acquisition, and project officers who help with project management, consultations and opportunity scanning. These functions are increasingly institutionalized (e.g. through formal rules for project administration), and the research staff interviewed showed satisfaction with the service provided (T). Implementation of a new data management system is planned, to focus on streamlining the process and facilitating data management for projects. Also, the Technology Transfer Office is staffed with business coordination and development specialists, who work in a decentralized way with different research groups [M]. All in all, well-developed procedures are in place to reduce researchers' administrative and legal burdens (e.g. proposal writing and contractual procedures with companies). TalTech reflects on these processes and tries to close remaining gaps and continuously improve. The professional science-communication team must also be mentioned; its role is likely to increase in line with TalTech's

ambition to keep actively engaged in societal debates. They improve dissemination of research to wider audiences, which is increasingly a fundamental part of RDC activity.

Conclusions

TalTech is a leading Estonian institution in these domains; it has a wide societal impact and is increasingly well embedded in international research networks. RDC is nowadays a core activity at TalTech, and there is evidence that RDC also supports the process of teaching and learning, notwithstanding room for improvement. Bold objectives and targets for RDC are defined at multiple governance levels, underpinned by well-designed monitoring systems, organizational procedures and professional support services. Appropriate measures to improve RDC activity and societal impact have been recently formulated; the Panel encourages TalTech to keep steadily implementing them.

Strengths

- There is strong focus and commitment to place RDC at the centre of TalTech's mission at different administration levels (University Council, Rector, Vice-Rectors for Research and Entrepreneurship, School´s Deans).
- A wide package of formal and informal incentives encourages RDC.
- A Strategic Plan links well-formulated goals with concrete and timely measures to govern, steer and support RDC activity across TalTech, with a focus on research development and knowledge commercialization, and with concrete ownership.
- Power BI reports and the Research Group Atlas provide up-to-date and transparent information on TalTech's RDC profile and progress.
- TalTech demonstrates societal engagement, including active contributions to several professional groups and policy agendas in Estonia and beyond, and a rising volume of contract research with multiple types of organizations.
- PhD students also teach; there is frequently a close connection between teaching and research at lower levels.
- There are well-established and purposeful RDC support services, staffed with committed and specialized professionals.

Areas of concern and recommendations

- TalTech's five key strategic research areas are not yet fully operationalized, and the University should develop mechanisms to govern, coordinate and monitor them.

Opportunities for further improvement

- Ensure that successful principal investigators keep an appropriate foothold in teaching activities and so contribute to keeping study programmes up to date.
- Strive to continue forging multi-annual, longer-term research agreements with companies and other organizations, as a means of stabilizing research budgets and moving beyond ad hoc research contracts towards strategic collaboration agendas.

- Find ways to better monitor the extent to which TalTech´s research is having societal impact, and consider additional forms of societal engagement beyond knowledge commercialization.
- Develop new management models to ensure that laboratory facilities can cope with the fast rise of fundamental and contract-based R&D activity.

1.12 Service to society

Standard:

The higher education institution initiates and implements development activities, which enhance prosperity in the community and disseminate recent know-how in the areas of the institution's competence.

The higher education institution, as a learning-oriented organization, promotes lifelong learning in society and creates high-quality opportunities for that.

Guidelines:

The HEI contributes to the development of the community's well-being by sharing its resources (library, museums, sports facilities, etc.), by providing consulting and advisory services, participating in the development of non-profit sector and charitable activities, and by organising concerts, exhibitions, shows, conferences, fairs and other events.

The HEI involves alumni in activities aimed at the development of the HEI and the knowledge society.

Employees of the HEI participate in the work of professional associations and in other community councils and decision-making bodies as experts, directing society's development processes as opinion leaders. The impact academic employees have on society is taken into account when evaluating their work.

The HEI has clearly defined the objectives for in-service training, measures their implementation and plans improvement activities. The HEI plans in-service training based on the present and future needs of the labour market target groups. Evidence-based learning supports the learning and self-development of adult learners.

Indicators:

- Number of people in continuing training and other privately financed open forms of study (by responsibility areas or structural units)
- Other indicators depending on the HEI

Evidence and analysis

TalTech recognizes its role as the main centre for engineering and science knowledge and education in Estonia, and makes it a priority to disseminate this knowledge in the society through media, events and continuing education. It fulfils its role, taking into account the ways in which the Estonian economy is structured.

Significant demand for advances in science and engineering in Estonia comes from mid-sized firms that did not exist ten or twenty years ago. TalTech recognizes the significance of that and has launched several efforts to support the nascent technology start-up sector. In cooperation between the university and companies, the Innovation and Business Centre MEKTORY was established in 2013. Its activities help to develop business-oriented partnerships, and provide the necessary support for this.

The SER provides evidence of up to 1,000 training events, seminars and conferences for companies, and more than 1,000 events for students, organized by the centre annually.

Furthermore, hackathons and similar events make use of TalTech's premises and resources. Among them, Robotex, the biggest robotics festival in the Nordic countries and Estonia was launched as a classroom event at TalTech [SER].

Estonia has produced many fast-growing technology companies (e.g. Skype, Transferwise) and this has kept demand high for IT engineers. TalTech engages regularly with employers' associations in this sector to tailor its programmes to provide best quality engineering staff.

For example, during consultation with employers, the director of the Business Information Technology programme established that the programme was too theoretical, and that the technical and social skills of IT engineers need to be improved; this led to changes in the programme. The programme also invites employers regularly to provide classes for students [Interviews, 4C].

TalTech staff are elected to high-profile public roles (for example, President of the National Academy of Sciences, members of the council of the Central Bank, AS Eesti Energia, members of the State`s Council of Science and Development). The SER also provides evidence of TalTech participating in assessments of several key national economic development initiatives.

The SER does not provide much numerical evidence of sharing TalTech's resources, besides very impressive outside visitor numbers at its Library (58% from outside of TalTech, according to the SER). However, its campus has been a magnet for many of the most successful technology companies in Estonia – several have, at various periods, established their offices next to it (e.g. Skype, Transferwise, Starship Technologies). While it is hard to pin down the co-location to any particular factor, the Panel finds that this provides sufficient evidence that TalTech is making its resources available to the wider business community.

Although TalTech provides services to business and education, with a natural emphasis on science and technology, and takes part in some external cultural and sporting activities, it is not clear that it contributes to society more widely, for example, through staff and student volunteering. Its Strategic Plan mentions encouraging the academic university community to interact with the general public, but only in the context of explaining TalTech's achievements and raising interest in research and engineering education, thus serving mainly to further its own reputation and interests.

Almost 50% of TalTech's students work full time during their studies and have started studying later in their careers. TalTech has to adjust its full-time study programmes according to these factors; therefore it is hard to separate the impact of its formal lifelong learning programmes from the impact of its regular teaching.

TalTech provides a significant number of lifelong education courses. As additional information to the SER, the Panel was shown evidence from TalTech`s Continuing Education Report 2020, showing that in 2020 TalTech provided:

- 221 courses – length 0-8 academic hours
- 214 courses – length 9-26 academic hours (up to 1 ECTS)
- 203 courses – length 27-80 academic hours (up to 3 ECTS)

- 63 courses – length 81-240 academic hours (up to 9 ECTS)
- 13 courses – longer than 240 academic hours.

These courses were taken, in total, by 15,628 learners, showing wide reach as well as significant time commitment by the participants.

Through its ' Open University', TalTech provides courses for school students at various levels, including primary. While this can be viewed as a feeding activity for TalTech's study programmes, it is very relevant, as it attracts local students to much-needed science and technology degree studies. On average, 22% of the programme participants come eventually to study at TalTech. The Panel was also provided with an example of a gymnasium in Pärnu where 50% of the total class regularly comes to study at TalTech.

Conclusions

TalTech fulfils its role as the main provider of science and technology education and research in Estonia. By engaging the business community and alumni, it adjusts its programmes to society`s needs. It also shares its resources with technology companies, and its campus has become an important physical centre of technology scene.

Strength

- The business centre Mektory is an important initiative launched by TalTech that provides facilities and know-how for the Estonian technology start-up scene.

Areas of concern and recommendations

- TalTech's Council has set a priority to support society in Green and Digital transformation, and several initiatives in research and teaching support this priority, but it should feature more clearly in the University's new strategic plan and KPIs.

Opportunities for further improvement

- The University's service to society currently serves mainly to further its own reputation and interests. It could also seek opportunities to contribute to the community through charitable activities, volunteering and social action, some of it related to Green issues.

2. Assessment findings of the sample of the study programmes

2.1. Telematics and Smart Systems (PHE)

General information: This School of Engineering programme is run at both Virumaa College and Tartu College, with a programme director at each site. It is the merger of 'Applied Information Technology' and 'Cyber-Physical Systems Engineering' that were previously offered at the respective colleges. The new programme was formed after the major restructuring of TalTech in 2016, and has now been in existence for 3½ years as a professional higher education (PHE) programme. When the SER was written, 254 students were enrolled but none had yet graduated. It offers two specializations: 'Telematics Software' (based at Virumaa) and 'Cyber-Physical Systems' (based at Tartu). A third specialization 'Processes Automation' has been dropped, because of overlaps and too few applicants. At Virumaa, 80% of the students are Russian speaking.

2.1.1 Planning and management of studies

- The design and development of study programme(s) take into account the expectations of students and other stakeholders, national strategies, legislation and trends in the particular area as well as labour market needs. The level and volume of RDC activities is sufficient and supports the launching of the study programme(s).
- The objectives of study programme(s), modules (including courses) and their learning outcomes are concrete and coherent. The teaching content and methods and assessment criteria and methods support students in achieving their learning outcomes and developing their key competencies. The study programmes support the development of creativity and entrepreneurship and other general competencies.
- The administration of material and financial resources that ensure the design and implementation of the study programme(s) is purposeful, systematic and sustainable. The learning environment, including materials, tools and technology support the students in achieving their learning outcomes.

Evidence and analysis

The SER offers cogent reasons for the development of the programme, considering technological developments and national needs, as highlighted in the OSKA report on ICT by the Estonian Qualification Authority: https://oska.kutsekoda.ee/wp-content/uploads/2016/05/Key_messages_ICT.pdf.

The two contributing programmes shared goals and intended learning outcomes. The programme's current two specializations remain at the two colleges, where at Virumaa local needs are well met;

their block-study approach (see later) allows the combination of employment and study. Progression is possible to a master's degree

The programme's two specializations show significant overlap superficially, with less than 84 ECTS of difference in the 'special studies' (SER Annex 32). Also, between the specializations, lectures are doubled or just given similar names for the same content (e.g. 'Process Control' and 'Automatic Systems Design' (Telematics Software) versus 'Automatic Control' (Cyberphysical Systems). This doubling of contents is also reflected in corresponding working groups in the two colleges ('Smart Systems Development' versus 'Smart Systems Modelling'; and 'VR/AR Modelling' versus '3D Modelling, Drones and VR'). It is difficult to avoid the impression that the merger of the programs was decided at management level but never taken to its logical conclusion at the operational level.

At the same time, subjects of the same name diverge significantly from a content point of view. This is even for the respective introductory modules, both called 'Introduction to Studies, Telematics and Systems Basics' [SER Annex 32]. This pattern continues in the subsequent modules, which again share titles but differ in content. Also, why the course 'Robot Systems' is part of Telematics Software specialization is unclear, as one would rather expect such a course in the Cyberphysical Systems specialization [SER Annex 32].

However, each specialization's objectives are clearly set out and appear appropriate. A common approach to teaching and learning stresses group and project work, and this requires strong engagement of students with outside companies, and an environment of exploration and development. This is supported by courses that include teamwork and entrepreneurship.

The programme has given significant attention to building up its laboratory resources in pursuit of its practical orientation, with support from the University; it also makes use of facilities provided by companies. The learning environment now appears to be sound, though the SER acknowledges that improvement is still required. The Panel learned during the interviews (especially Interview 10D) that TalTech significantly invested in lab equipment which supports both teaching and R&D.

Although the two specialities are considered as a single programme, in practice they are run separately at the two colleges. The programme management is reasonably well integrated among the heads of the two colleges and the two programme managers, but at the operational level there is little cross-over. Even when the two specialities share courses, these are delivered by different lecturers at the two colleges rather than being shared online, including during the pandemic, and they do not use the same assessments.

The college offerings differ also with respect to their regional outreach. Virumaa College is able to support its local population of students from Russian-speaking backgrounds. It offers its speciality in block mode, with intensive weekend study, which helps access for those in employment or living at a distance; but Tartu College does not offer this possibility. There is little evidence of students transferring between the two specialities or the two colleges (only one case was mentioned; Interview 11D). The thrust of research and development that supports the specialities also differs between the two colleges.

Strengths

- Both colleges with their specialities are strongly linked to their surrounding enterprises and companies, and support technological development in these regions.

- The programme pays much attention to the practical aspects of technology, and this is highly welcomed by potential employers.
- The programme gives a broad topical overview which is appreciated by the students.

Areas of concern and recommendations

- The programme should capitalize on synergies between the two colleges, for example not offering the same class by two different lecturers.
- The programme should synchronize teaching between the colleges, including (but not limited to) module contents, and names and contents of similar courses.

Opportunities for further improvement

- *Either* the parallel structures established by the colleges to run the two specialities could be split up into 2 separate programmes; *or* processes should be harmonized, and the profile of specialities strengthened, resulting in stronger differentiation and specialization.

2.1.2 Learning, teaching and assessment

- Conditions and organization of admission ensure fair access to education and motivated student body. Students' choice of specialization is supported.
- A student-centred approach is used in the studies, aiming at the students to assume responsibility for planning their studies and career and supporting the development of key competencies and achieving the learning outcomes of the study programme.
- Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes. Objective and reliable assessment is ensured.
- The organization of studies including practical work and training is based on the specificities of students and forms of study and supports the student in achieving the learning outcomes. Opportunities have been established for mobility within Estonia and internationally.
- Support services for students are in place and available for students. Individual development and progress of students are monitored and supported.
- Graduates of the study programme are competitive in terms of their knowledge and social skills both nationally and internationally.

Evidence and analysis

Admission of students to the program seems to be satisfactory for the university and the two organizing colleges, even though one specialization was discontinued because of a lack of applicants [SER p. 125]. The admission procedure is based on interviews by the faculty in four categories and subsequent enrolment ranking of candidates. At Virumaa College a personal mentor is assigned in the first year to support students; this is planned to be made a standard procedure for the entire programme [SER p. 132 'Areas for Improvement']. Students can follow a standard study plan but also have the possibility to develop an individual study plan. The choice of specialization seems to be mainly motivated by geographic proximity, further underlining the finding that content-wise the specializations differ little [Interview 8D].

Groups at both colleges are claimed to be small and teaching is, to a large degree, project based. Several courses are listed where this is indeed the case. Also, teaching via team work strengthens the experience of students of working in teams and on projects. Further, personal development is emphasized in a number of subjects in the General Studies module. Learning outcomes are formulated in a very generic way and therefore difficult to measure. For example, they are the same for both specialities. However, the course selection is adequate for the development of key competencies. This is reflected in about 50 ECTS of modules which are specific to each specialization.

Students commented that, although both specializations provide a good overview of the area (which is highly appreciated), they provide little opportunity to go deeper into the topics [Interview 8D]. The question arises whether improved depth would be possible if the specializations developed clearer and more diverging profiles.

APEL is considered, as defined in the relevant guidelines [W https://taltech.ee/en/vota]. However, no common policy on transparency of assessment seems to be in place. Assessment is carried out per course, meaning several assessments contribute to the final grade. Taking into account the applied nature of the programme, this seems appropriate.

Many courses are assessed as pass/fail rather than grades. While this makes sense for internships and training, and may be considered appropriate for non-technical subjects, it is less evident why 'Data Science and Machine Learning', 'Engineering Informatics' and 'Introduction to Telematics and Smart Systems' belong to that category. No clear link to the number of ECTS points or teaching approach could be found in the documentation the Panel saw.

The programme has built up a considerable number of international collaborations resulting in student exchange [SER p. 131]. Still, the actual number of exchange students is very small, because most students study in parallel with one or more jobs [Interview 8D]. Occasionally, visiting faculty teach in the programme but exchange of lecturers between the colleges is rare.

Practical training is an integral part of the programme, in the frameworks of the subjects as well as in the form of internship (both in companies and in research labs). This underlies the applied aspect of the programme.

Support services exist in the form of student mentors (Virumaa), an Office of Academic Affairs (Virumaa) and a Study Manager (Tartu). Monitoring of students is expected to be done by the lecturers; no formal process is established. On-site psychological counselling is available only at Virumaa College in Russian; otherwise students must visit the Tallinn campus.

The considerable drop-out rate was explained as mainly due to students' wrong choice of specialization, even though a dedicated course at the beginning of the studies (Introduction to Telematics and Smart Systems) introduces and explains the specializations. It is planned to combat this perceived problem by improving communication in the initial stage of the studies [SER p. 132 'Areas for Improvement']. During the interviews, however, the Panel learned that most students study either part-time or as session-based students (who are enrolled in an intensive full-time programme but have fewer contact hours) and incompatibility of study load with professional and family commitments is a major cause of dropout.

The graduates seem to be in high demand on the labour market, although no evidence is given except for the reference to the OSKA report (see above). Since graduates are only beginning to exit from the programme, the necessary data is not available, but feedback from potential employers is positive [Interview 9D].

Strengths

- Teaching is done in small groups, and subjects generally are very applied;
- The programme has an interview for admission, and provides a personal mentor for students.

Areas of concern and recommendations

- The programme should introduce the best practices of one college to the other one (student mentors, admission interviews) to improve service quality and harmonize processes at the same time.

Opportunities for further improvement

- Structures and approaches between and within the two sites/colleges could be homogenized.
- Further electives could be offered, enabling students to specialize in their field of interest.

2.1.3 Development, cooperation and internationalization of teaching staff

- Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.
- Teaching staff follows the principles of academic ethics and the codes of conduct in case of non-compliance.
- Members of the teaching staff participate in international mobility programs which encourage the development of their teaching and RDC activities and the cultural openness of the HEI and the Estonian society.
- The effectiveness of both studies and RDC activities, students' feedback, the effectiveness of supervision, development of teaching and supervision skills, international mobility and entrepreneurial or work experience in the specific field

outside the HEI is taken into consideration in evaluating the work of the member of the staff.

Evidence and analysis

The staff of the 'Telematics and Smart Systems' programme are employed by the two different colleges. Twenty-three lecturers work full-time for the programme and ten work part-time [SER Annex 35]. The programme also strongly relies on thirteen guest lecturers, mostly with professional experience rather than a higher degree and research expertise. Only 14 of these 46 lecturers have a PhD (and 22 a MSc, 3 a BSc and 6 another kind of degree). The lecturers' CVs present little evidence to support the statement from the SER: "The instructors of several courses are outstanding specialists in their field ...". The SER also states that several staff members are working on their PhDs. Although this is a PHE programme, higher academic qualifications and research experience by the lecturers would be likely to improve the quality of the taught courses in the programme.

The annual professional development goals set by the lecturers include writing popular articles and research papers, and participating in research and international mobility projects [SER page 133]. Only a few lecturers meet these goals. Most lecturers do not publish or engage in collaborative projects, as evidenced by their CVs [SER Appendix 35].

The lecturers follow the principles of academic ethics and the codes of conduct in case of non-compliance. For example, student essays and theses are checked for plagiarism.

The topics taught in the programme are very timely, and adequate knowledge and experience on innovative telematics and smart systems is urgently needed in society. This new programme and its staff should be informed by state-of-the-art research developments. This can be partly achieved through (inter)national collaborations and links with companies. Some of those collaborations are listed in the SER but their impact on the programme is not evident. The staff and students are also informed by additional public lectures. However, it is unclear whether these lectures are organized systematically, or only incidentally or opportunistically.

It is unclear whether the colleges have a dedicated PhD or research programme relevant to this education programme and its courses. Little exchange or inspiration seems to emerge from any such research to improve and update the programme. The programme has strong links with industry, but research is not well developed.

Students' feedback is systematically collected and seriously considered, and this helps to improve both the programme and its staff. Students gave evidence that feedback time on assessment is as short as two days [Interview 8D]; this is very good.

Strengths

- This is a new and timely programme that educates engineers who should be able to develop and implement emerging telematics and smart systems.
- Links to society and companies are well elaborated.
- The programme teaches appropriate academic attitudes.

- Student feedback is collected, valued and considered.

Areas of concern and recommendations

- The Colleges could further incentivize the achievement/completion of a PhD thesis by the faculty or encourage publication for the ones who have already done so.

Opportunities for further improvement

- None noted

2.2. Business Information Technology (MA)

General information: This graduate programme was launched in 2002 and is intended to educate leading and senior specialists in the fields of (a) business analysis and enterprise architecture (b) information systems analysis and architecture and (c) data analysis and business intelligence. The number of students on the programme has been relatively stable between 2017/18 (171) and 2020/21 (172), fluctuating slightly in between. However, this belies a more complex reality, whereby only a small proportion of those students graduate each year, with substantial numbers of students either deferring their studies or dropping out. This situation reflects national challenges in relation to funding, family commitments and the need for postgraduate students to work alongside their studies.

2.2.1 Planning and management of studies

- The design and development of study programme(s) take into account the expectations of students and other stakeholders, national strategies, legislation and trends in the particular area as well as labour market needs. The level and volume of RDC activities is sufficient and supports the launching of the study programme(s).
- The objectives of study programme(s), modules (including courses) and their learning outcomes are concrete and coherent. The teaching content and methods and assessment criteria and methods support students in achieving their learning outcomes and developing their key competencies. The study programmes support the development of creativity and entrepreneurship and other general competencies.
- The administration of material and financial resources that ensure the design and implementation of the study programme(s) is purposeful, systematic and sustainable. The learning environment, including materials, tools and technology support the students in achieving their learning outcomes.

Evidence and analysis

The School of Information Technologies at TalTech aims to educate high-qualified IT professionals for the Estonian economy in all computing sub-disciplines. The Business Information Technology programme was launched in 2002 and subject to a new curriculum proposed by the Advisory Board in 2010. Since then, the curriculum has been subject to minor amendments following annual reviews, most recently in 2020. The Panel found that this process appeared largely informal and would benefit from a more formalized and systematic approach [SER p. 85, M].

The design and development of the study programme takes the expectations of students, industry, alumni and other stakeholders into account, through their participation in the Advisory Board. The Board meets at least once a semester. Members informed the Panel that the Programme Director is responsive to their feedback, and has sought to address concerns that the programme was historically too theoretical, by introducing practical focussed content. The most recent changes have also sought to introduce greater flexibility across the three specialisms [M, 6C]. When asked to consider the

strength of this programme in the national context, there was a sense among employers that TalTech is the university of choice if you are looking to recruit engineers [E, A].

The programme director reported that a key learning outcome of the programme is a successful thesis defence [M]. There was no evidence that learning outcomes at the programme level were mapped to outcomes and assessment at the course level. In relation to the assessment of learning outcomes, the Panel was provided with the syllabi of master's seminars where the examination criteria appeared to be drawn directly from central guidelines. The programme would benefit from a more considered, coherent articulation and exposition of learning outcomes at the various levels and how they relate to one another and are assessed [Annex 10].

The programme management have identified that, apart from funds for salaries and the recognized shortage of learning space for students and groups for out-of-classroom studies, the programme has enough resources for high-quality teaching. This includes an annual fund of between 40,000 and 60,000 euros for capital expenditure [SER p. 87, M]. However, this view appeared counterintuitive to the Panel, given that some of these factors, especially the staff resource, are critical to the successful delivery of the programme. Ultimately, the programme team stated they were content with the student-staff ratio of approximately 25:1, which they consider comparable with other universities. While the overall volume of staff teaching on the programme may be sufficient, the Panel recognized that lower salaries may limit the programme's ability to attract high calibre international academics. The Panel therefore concluded that further resource may be required in order for the programme to advance to its next phase of development and progression. At the same time, the Panel recognized that other barriers to achieving this persist, such as the delivery of the programme in Estonian, which limits the pool of potential applicants [SER pg. 87].

Strengths

- The reputation of the programme in producing high quality, sought-after software engineers.
- The responsiveness of the programme director to stakeholder feedback, and the overall 'hands-on' approach with the business community.

Areas of concern and recommendations

- Formalise the process of programme design and review.
- Ensure that programme-level learning outcomes are mapped to course learning outcomes.

Opportunities for further improvement

- Increase resource for the programme to ensure its continued development and success.

2.2.2 Learning, teaching and assessment

- Conditions and organization of admission ensure fair access to education and motivated student body. Students' choice of specialization is supported.
- A student-centred approach is used in the studies, aiming at the students to assume responsibility for planning their studies and career and supporting the development of key competencies and achieving the learning outcomes of the study programme.
- Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes. Objective and reliable assessment is ensured.
- The organization of studies including practical work and training is based on the specificities of students and forms of study and supports the student in achieving the learning outcomes. Opportunities have been established for mobility within Estonia and internationally.
- Support services for students are in place and available for students. Individual development and progress of students are monitored and supported.
- Graduates of the study programme are competitive in terms of their knowledge and social skills both nationally and internationally.

Evidence and analysis

The programme is open to a wide pool of applicants and does not institute entry criteria beyond those which are set nationally: namely, that a candidate must have a bachelor's degree in ICT or a comparable field at the required threshold of achievement. To pass the minimum threshold (6.0 points), a candidate must have a weighted average grade of at least 3.0 at the bachelor's level and the candidate's bachelor's thesis grade must not be lower than 3 (good). The number of admitted students depends on how many candidates pass the threshold. If an applicant fails to meet these requirements, he or she can be accepted based on a motivation letter and professional resume, if the applicant's working experience is in the required field, for instance software development and IT operation [SER p. 88]. The Panel reflected that the absence of more stringent entry criteria, such as an admissions examination, may be contributing to the high dropout rate, as students' real desire to study is not being as robustly scrutinized as possible.

In terms of the programme's student-centred approach, it faces similar challenges to many IT programmes around the world, including slow progression and high drop-out rates, due to plentiful, and often lucrative, market opportunities for students. TalTech tries to address this by integrating professional-focused topics and methods into the programme, together with flexibility. Students have the possibility to freely design their study programme (they can pick their courses from four modules). The rationale behind this is that students can shape their programme of study around their interests,

development needs and the needs of their master's thesis topic. The Panel identified some challenges with this approach; for example, some students reported only choosing the topic at the end of the programme. Employers also play an active part in selecting thesis topics, in particular where employees undertaking study can support the needs of the company [E, S, T, M].

In addition to flexibility in student choice, the programme team have also adopted innovative approaches to delivery. For instance, the study group in Kohtla-Järve (Virumaa College) (8+14 students) are all employed professionals (compared to approximately 70% at the university's main location in Tallinn) and the programme therefore operates on a different basis at Kothla-Järve, with students attending campus twice a month. However, as yet, these innovations in student choice, flexibility and delivery are not having the desired impact on retention and progression [SER, page 85, T].

The programme has set a goal for the next 3–5 years to search for fair and flexible assessment criteria, both for the work-based-learning students and for 'ordinary' learners. To achieve this, teachers have been asked to experiment with different assessment criteria as well as different methods. The programme team state that this is partly in recognition of the need for the University to make sure students are studying 26 hours per 1 ECTS, as stated in the regulations [SER, M]. The Panel found that there is an inherent tension here where students, who are often working full-time, will struggle to dedicate all the learning hours necessary to fulfil their study commitments in addition to their work commitments. This has an impact on the retention and deferral challenges mentioned above. Linked to this, some students informed the Panel that, in their view, the programme was not demanding enough, and it was possible to pass examinations by attending lectures, with little additional work [S]. This led the Panel to reflect on whether the ECTS requirements are wholly implemented on this programme, an issue that was also recognized by teaching staff.

The programme team recognises that the majority of their students are in employment, and takes this into account when organising practical work, training and professional practice within the curriculum. For example, professional practice was removed from the programme and replaced by workplace-based learning and four 6-ECTS courses titled 'Work-Based Project' [SER page 87, T, M].

In practice, there is almost no international mobility by students on the programme. Opportunities for outgoing mobility exist in theory, for instance through the EuroTeQ Universities Alliance and the possibility to select 30 ECTS of 'free choice' electives. However, there are no incoming exchange students, and only two outgoing students used the exchange opportunity in 2020/2021. This is due to a series of challenges, including that the programme is run in Estonian, postgraduate students are typically employed in Estonia and they have family and other personal commitments. While some of these challenges are more intractable than others, the Panel encourages the programme team to reflect on what more can be done, including the use of short-term and online mobility opportunities, to enhance this element of students' studies [SER, page 88, M, T, S, A].

Support services are largely provided at the TalTech level, including career and psychological support, study counselling and tutoring [SER, p. 89]. Students are encouraged to ask for help from teachers, assistants, and the programme director. Students are aware that this support is available and that up-to-date information is contained on the virtual learning environment, as well being cascaded in the first class of each course [S3C]. The programme is also working on several initiatives designed to 'bring together' students and teachers (e.g. get-together events and joint publications based on MA theses). Despite the availability of support services and attempts to build a supportive learning culture, the

Panel is unconvinced that this will significantly help to overcome the more entrenched structural challenges affecting attrition on the programme [M, T].

Employers report that TalTech graduates are competitive at a national level in terms of their knowledge and social skills, especially in engineering. [E]. This is consistent with the University's role as the only university of technology in Estonia.

Strengths

- The range of student support services available and the extent to which students find these accessible and valuable.
- The flexible nature of the programme, which enables students to develop personalized learning paths.

Areas of concern and recommendations

- The high dropout and deferral rates on the programme, for which there currently do not appear to be effective solutions in place.
- The need to ensure that ECTS are being implemented in full on the study programme.
- Strengthen the academic coherence and rigour of the programme by developing programme learning outcomes and ensuring that elective courses, selected by students, enable them to demonstrate that they meet these outcomes.

Opportunities for further improvement

- The programme could reflect on the possible introduction of more stringent and/or involved admission requirements to ensure students admitted to the programme are committed to completing their studies.
- There is potential to further exploit opportunities with the business community to identify business problems that can be analysed in theses, so that preparing theses is more closely tied to students' work.

2.2.3 Development, cooperation and internationalization of teaching staff

- Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.
- Teaching staff follows the principles of academic ethics and the codes of conduct in case of non-compliance.
- Members of the teaching staff participate in international mobility programs which encourage the development of their teaching and RDC activities and the cultural openness of the HEI and the Estonian society.
- The effectiveness of both studies and RDC activities, students' feedback, the effectiveness of supervision, development of teaching and supervision skills, international mobility and entrepreneurial or work experience in the specific field outside the HEI is taken into consideration in evaluating the work of the member of the staff.

Evidence and analysis

The programme employs 28 lecturers to deliver its 76 courses. This includes 28 staff who hold PhDs; the University informed the Panel that the remaining staff are either PhD students themselves or possess strong industrial backgrounds [Annex 11]. In total, 10 staff are professors, 5 are international and 35% are female. All staff are associated with a scientific research group or are actively involved with industry. The Panel found that staff CVs demonstrate active engagement in projects and a demonstrable track record of publication in international, peer-reviewed journals [SER p. 87]. The University employs a considerable number of lecturers from business, which enriches the programme. However, the Panel considers that it would enhance provision if these lecturers were encouraged to participate in pedagogical seminars and training.

The responsibility for conveying information to students about academic ethics is vested in programme staff at the start of each course [M, T]. Staff informed the Panel that there is an expectation that students entering a master's programme should already be aware of ethical issues [T]. Students reported to the Panel that these issues are not always discussed at the beginning of each course, possibly due to the assumption that, as most students come from the TalTech BA programme, they do not require detailed information on the subject [S]. Staff also confirmed that there have been very few examples of plagiarism on the programme and that the bespoke nature of assessment, often tailored to a student's workplace, renders this difficult or impossible [SER p. 90, M, T]. Nevertheless, the Panel concluded that the programme team would benefit from maintaining a broad perspective on the range of potential forms of academic misconduct, and that students are routinely advised about good and acceptable practice.

The University's employment contract guarantees staff a free semester once every five years. The School also provides a Lecturers Grant of up to 10,000 euros to support mobility; 10 grants have been issued, across all staff in the School, in the past 2 years [SER p. 91, T]. Unfortunately, plans formed under the Grant had to be suspended due to the Covid-19 pandemic. The programme team recognise the need to do more in terms of mobility, and informed the Panel that it has a plan in place to cover the next 3–5 years. This includes cooperation with the EuroTech Universities Alliance in the EuroTeQ Engineering University project to advance virtual Erasmus mobility and a virtual EuroTeQ Campus [M, T]. Initial visits as part of the project have already taken place, focussing on teaching quality and student projects. The project has, so far, stimulated cooperation with education researchers at Tallinn University to develop a learning website.

The programme director conducts evaluation meetings with every lecturer on an annual basis. These meetings address student feedback, successes and challenges, and the programme director's expectations for the upcoming year. In practice, the Panel found that these meetings are relatively informal and that the performance of staff is more formally reviewed on a five-year cycle [M, T].

Strengths

- Research-active staff are attached to research groups, and bring their research into the classroom effectively.

Areas of concern and recommendations

- Ensure all students are provided with baseline information about sound academic conduct, irrespective of whether they have progressed from within the university.
- International mobility is weak for staff (as well as for students). The programme team should instigate additional measures to increase mobility rates.

Opportunities for further improvement

- There is potential to recruit a higher proportion of female lecturers and staff with PhDs.
- Encourage lecturers from business and industry to participate in pedagogical training seminars.

2.3 Applied Chemistry, Food and Gene Technology (BA)

General information: This programme started in its present form under the School of Science in 2017, as a result of merging programmes in Applied Chemistry, Biotechnology, Gene Technology and Food Technology. It is run by the Department of Chemistry and Biotechnology, which supplies the programme director. It can admit up to 80 students a year; after four years of operation, in 2020/21 the total enrolment was 155, with an intake of 72 that the programme now aims to sustain.

2.3.1 Planning and management of studies

- The design and development of study programme(s) take into account the expectations of students and other stakeholders, national strategies, legislation and trends in the particular area as well as labour market needs. The level and volume of RDC activities is sufficient and supports the launching of the study programme(s).
- The objectives of study programme(s), modules (including courses) and their learning outcomes are concrete and coherent. The teaching content and methods and assessment criteria and methods support students in achieving their learning outcomes and developing their key competencies. The study programmes support the development of creativity and entrepreneurship and other general competencies.
- The administration of material and financial resources that ensure the design and implementation of the study programme(s) is purposeful, systematic and sustainable. The learning environment, including materials, tools and technology support the students in achieving their learning outcomes.

Evidence and analysis

The proposal for the merged programme was prepared by a committee consisting of representatives of lecturers, students, employers and alumni of the precursor programmes, aiming to address the challenges of a declining age cohort while meeting the needs of the labour market. The programme itself was drawn up by lecturing staff with input from stakeholders, including the members of the programme advisory board.

The programme was designed in order to cover adequately the main specialities present in the precursor programmes (which at TalTech's comparator universities, in larger Nordic countries, are viable separately). It introduces the three specialities of applied chemistry, gene technology and food technology at an early stage, while ensuring adequate coverage of the underlying disciplines by core courses.

This allows students to start specializing early, and helps to maintain their interest and to reduce drop-out, which indeed fell from 27 students to 15 between 2017 and 2019. To allow students flexibility, each speciality also offers a large set of elective courses, while still providing enough basic material to allow graduates to proceed to master's programmes at universities in Estonia and abroad. From

Interview 3A, the Panel concluded that students were very satisfied with this flexibility. The course descriptions are presented in the online catalogue for courses, and students can make their own choices, provided that they take the mandatory courses. Students also appreciate being guided by staff, after they have explained their own scientific and professional interests.

After feedback from staff and students, the programme was revised for the 2021–22 entry to better reflect the importance of organic chemistry in the Food Technology and Gene Technology specialities, with other changes to improve the sequence of courses and rebalance workloads. The choice of specialities is now made in the third rather than the fourth semester. The minimum student enrolment per speciality is set at 15, and to help maintain adequate student numbers, the department has increased publicity. While the programme clearly receives feedback from students, those interviewed were not fully aware of the function of this advisory board for the program, and perceived it as working "more with outside stakeholders than with the students".

From Annex 8 attached to the SER, it is clear that all lecturing staff cover the programme syllabus and are also active researchers, notably from the department of chemistry and biotechnology at TalTech. They are at various ranks, and many have very valuable academic records. For graduation thesis work and internships there are collaborations with other TalTech departments, external research organizations, and companies. Some theses have won national prizes, and many are connected to ongoing projects in research groups, in what is described as a very competitive environment. Lecturers are invested in gaining interest from the students in their own research topics, and students appreciate their involvement.

The SPSER addresses the relevance of the programme to employment, where food technology graduates, in particular, are in short supply, but the interest of students in the applied chemistry speciality is currently rather low. Furthermore, the SPSER says that employers in the areas of applied chemistry and gene technology prefer master's degree holders, and so do not engage readily with the programme. This trend, which is general in Estonia, was confirmed in the different interviews. Hence the programme has to focus more on training excellent undergraduate students, and encouraging them to continue into the master's programme. The programme management is said to be active in frequently tracking and fostering content coherence across courses, and monitoring workloads. The SPSER also argues that the coherence of the programme is fostered by recent changes following feedback, including that from a working group of the Students' Union on education quality. This also showed a need to keep students better informed about how they will benefit from the feedback they provide. Apart from the changes in the curriculum already mentioned, coherence is fostered by the lecturers in the department allowing their colleagues access to their study materials in Moodle, and it is intended that all lecturers should now do this.

Central to the European Standards and Guidelines (ESG) are Intended Learning Outcomes (ILOs), which underpin the expected approach to much of teaching, learning and assessment; but the SPSER does not refer to the ILOs of the courses. The programme specification [SER Annex 5] adequately describes the broad programme ILOs, and gives information about the ILOs for the modules that make up the programme. However, many of the ILOs (especially in the more applied areas) are expressed as what the student knows, rather than what the student can do (and hence can be examined on) as modern practice expects; the graduation thesis is an exception. The same tends to be true of the key courses in the specialities, but the assessment criteria confirm that what students can do is tested [SER Annex 6].

Apart from the more specialized outcomes, the programme also provides courses for personal development, including 'value-based' competences (e.g. bioethics), general competencies and lifelong learning skills. This is supported by group work, presentations and written work.

The programme receives a block grant of funding from the University each year to cover staff and consumable costs, including for research. It has the use of laboratories to support all the specialities, while research laboratories host graduation thesis work and some specialized classes. As the laboratories receive significant funding for their research activities and equipment, this nicely benefits the programme, enabling the students to have very good infrastructure for their practical work and research internships. This was confirmed during the site visit. Practical work is generally integrated into theoretical courses and is developed during the internship, as discussed below.

All compulsory courses are supported in the Moodle environment (as University policy requires), as are some electives; two core courses have received the e-course quality label. The provision of e-support for distance learning was accelerated in response to the Covid-19 restrictions, and continues to be expanded. Interviewed students reported that they have been individually affected at different levels by the Covid-19 crisis; but unanimously explained that it had been very well handled by the programme, and that, overall, it catalysed the online transformation of courses and resources.

As for all bachelor's degrees, the programme is taught in Estonian, and to support this, chemistry and biochemistry textbooks have been produced in Estonian translations, some available online. Students can access research databases online, particularly for graduation thesis work, but these are in English. Instruction in Estonian is a barrier for international students, though their enrolment in the master's courses taught previously in English was small anyway. Few students attend the present BA programme from other Estonian universities because of timetabling and funding problems, though a few have transferred into the programme with recognition of prior learning.

In summary: the programme necessarily has a complicated structure. Overall, this has been carefully developed with appropriate external input and attention to the external environment, and has been modified later as necessary. The programme, module and course specifications contain useful detail, but would be improved by using a common format. Although it is possible to gain information from the specifications about the ILOs, these are not expressed consistently in terms of what students should be able to do, and hence will be assessed on. The choices of speciality and of electives lead to a diverse set of individual student study plans that nevertheless all have to deliver the programme ILOs. This could be verified by showing how the programme ILOs are delivered by the course ILOs for all pathways through the programme.

Strengths

- There is good involvement of employers at the programme-level advisory board.
- Students are satisfied with the organization of the programme, which is clear and also gives them freedom of choice.
- There are strong connections with research: many lecturers are also active researchers in their fields of expertise, and bachelor theses are connected to ongoing projects in research groups.
- There are good levels of research, infrastructure and equipment.

Areas of concern and recommendations

- The specifications for the programme, modules and courses would be improved by writing them all in a common format.
- The added value provided by the merging of the previous programmes is not fully clear at present.

Opportunities for further improvement

- Given the diversity of the programme, with its three specialities and numerous electives, its coherence could be better assured by showing that the courses together achieve the programme ILOs, whatever a student's speciality and detailed study plan.

2.3.2 Learning, teaching and assessment

- Conditions and organization of admission ensure fair access to education and motivated student body. Students' choice of specialization is supported.
- A student-centred approach is used in the studies, aiming at the students to assume responsibility for planning their studies and career and supporting the development of key competencies and achieving the learning outcomes of the study programme.
- Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes. Objective and reliable assessment is ensured.
- The organization of studies including practical work and training is based on the specificities of students and forms of study and supports the student in achieving the learning outcomes. Opportunities have been established for mobility within Estonia and internationally.
- Support services for students are in place and available for students. Individual development and progress of students are monitored and supported.
- Graduates of the study programme are competitive in terms of their knowledge and social skills both nationally and internationally.

Evidence and analysis

To support recruitment, the programme is well publicized to schools, and familiarity with it is actively fostered by engagement with pupils and teachers by TalTech's staff and students. This includes TalTech open days and support for school research activities and Olympiad entrants. Plans to provide continuing education courses for secondary teachers, postponed because of Covid-19, are now well in hand in the form of video lectures.

Admission to the programme follows a standard procedure whereby students must attain threshold scores in state examinations in maths and Estonian. The maths score is used as a surrogate for ability in science generally, allowing students who have studied science subjects to different levels to be admitted; pre-sessional courses are offered for further support in maths and physics. It is planned to raise the thresholds to make entry more selective, with the aim of further reducing drop-out. To help students to reach suitable levels of performance on the programme, and to choose the speciality that best suits them, the initial pace of teaching after enrolment is moderated and support is available, aided by introductory material in the curriculum. Admission of students, and easing them into the programme, appears to follow sound practice.

Students plan their own study, and in the third semester choose their speciality and corresponding electives; they may also (if for good reasons) take electives from a wider range. Lecturers introduce students to the specialities, and many lecturers offer insights into the activities of their research laboratories. Detailed information on the choice of courses is available in the student information system; other information is available through social media. Interviewed students [3A] indicated that the teaching and research staff let students state their interests first, and then help them to find matching courses and projects. The SPSER cites this freedom of choice as an element of student-centred learning. Though it originates from having three specialities in the one programme, it is not fully clear how the situation is different from the previous three separate programmes. Students choose their internships and their graduation thesis supervisor, who may be outside the department, but supported by a co-supervisor inside. The SPSER argues that using research-active lecturers, and including experimental research projects, contributes to evidence-based learning. There still appears to be scope for the programme to adopt further student-centred approaches in methods of teaching and learning.

Published assessment criteria are intended to foster consistent assessment that is objective and reliable, though different elements of assessment carry different weights in different courses. Lecturers provide revision questions and help if requested. The department recognizes that it needs to develop further the security of its digital assessment, particularly for distance learning. Graduation theses are reviewed by two people, with grades agreed by a defence committee of five to six members, usually with one from a partner University; this supports reliable, independent and objective assessment. Prior learning inside and outside TalTech has been recognized for several students; the SPSER says students are content with the amount of credit awarded for prior learning, and those who met the Panel had no negative comments about this process.

Lecturers use a variety of teaching methods, from traditional through electronically-supported to predominantly online; the SPSER mentions using the flipped classroom for one basic course. The SPSER acknowledges that challenges remain in checking knowledge and competencies developed through online learning, and in engaging students in face-to-face teaching including practical work. Student feedback is obtained from compulsory surveys in the student information system, supplemented by surveys the lecturers themselves conduct through Moodle. The independent students' quality action group has grown significantly in participation, supplying lecturers with an analysis of the free-text feedback in surveys. The programme director discusses any negative feedback from students with the lecturer concerned, which in the past has led to changes in the organization of teaching or professional development for the lecturer, as students who met the Panel confirmed.

Internships can be completed in a range of public and private external organizations, where skills useful in employment are developed. Skills in using specific techniques are developed according to the research laboratories students work in. The teaching staff are very active in attracting students to research projects, either by promoting their research during the courses, or by proposing internships to the students with the best marks (for example, in chemical engineering). Students and staff also indicate that the equipment for practical work and for research internship is modern and of high quality. This was confirmed during the Panel's campus tour. Despite opportunities for student mobility in Estonia and abroad, uptake is low, which the SPSER says reflects insufficient support; students who met the Panel also said that the appetite for mobility among students was not high.

The SPSER says dropout is higher than the University's goal of 40% maximum, most commonly because the programme did not meet the students' expectations; the students who drop out have usually had difficulties with their courses but have not taken up the offer of support from the programme. The data provided show dropout falling as the programme has become established, reaching 15 in 2019-20 (which is approximately 12% of the total enrolment). Finance may also be a problem, as may the change to more independent learning at university, and there is significant dropout in the first year when students are able to change their minds about their programme relatively freely (in particular, without financial penalty).

Student progress on key courses is monitored, and where it is poor the student counsellor in the Dean's office can refer them for more counselling. As a result, retention and progression rates in subsequent years are reasonably good. In general, the Department is well aware of dropout and seeks to reduce it by ensuring that applicants are suitably motivated and qualified and that, once enrolled, they are properly supported.

Significant numbers of students work with companies on their bachelor's theses. The Panel did not find any detailed evidence in the SPSER about how competitive graduates from the programme are, nationally or internationally, except the statement [SER p. 80] that three students got 1st or 2nd prizes in the Estonian National Students Contest (2020, 2019, 2018); no substantial information is given on the level of the graduates globally. Alumni and employers who met the Panel explained that employment patterns differ for the three specialities, and that the merger of programmes is adversely affecting the supply of food technology graduates, who are in high demand; also the private sector is attracting the best chemists (though many students find chemistry too hard). Staff thought food technology may be suffering because it is more practical, while the other specialities are more academic. It appears that, while applied chemistry and gene technology are basically *applicable*, their applications are strongly oriented towards academic research. In contrast, food technology is essentially *applied* and strongly oriented towards practical techniques and development in the food industry, as reflected in the syllabus. These differences suggest that food technology might be better if run as a separate degree programme that continued to have strong links and interoperability with the other two specialities, particularly for common core courses.

Overall, admission to the programme is well regulated to afford fair access. A student-centred approach allows students to choose their own study plan, while support is offered to students with problems, who are identified by systematic monitoring. Teaching varies mainly in the mode of study, with little detailed evidence offered that novel approaches are explored; but practical work, including the graduation project, fosters evidence-based learning. Assessment is governed by published criteria, but it varies noticeably between courses. In general, it appears that the

programme is still in the process of developing a coherent approach to teaching, learning and assessment informed by the concept of constructive alignment and structured around intended learning outcomes. Dropout is a concern, internationalization is weak, and employment opportunities vary across the specialities. Nevertheless, the programme is well aware of these issues and is taking suitable steps to address them, within an overall approach to teaching, learning and assessment that is generally sound.

Strengths

- The programme staff actively engage with school students.
- The high quality of research actively supports students' motivation for learning, and provides excellent conditions for their internships.

Areas of concern and recommendations

- The programme should develop a more coherent approach to teaching, learning and assessment, firmly based on intended learning outcomes.
- The programme should develop a more active strategy for students' internationalization.

Opportunities for further improvement

- The Department of Chemistry and Biotechnology may wish to develop the food technology speciality as a separate programme, that for efficiency still shares content with the applied chemistry and gene technology specialities, and for flexibility allows easy transfer in or out.

2.3.3 Development, cooperation and internationalization of teaching staff

- Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.
- Teaching staff follows the principles of academic ethics and the codes of conduct in case of non-compliance.
- Members of the teaching staff participate in international mobility programs which encourage the development of their teaching and RDC activities and the cultural openness of the HEI and the Estonian society.
- The effectiveness of both studies and RDC activities, students' feedback, the effectiveness of supervision, development of teaching and supervision skills, international mobility and entrepreneurial or work experience in the specific field outside the HEI is taken into consideration in evaluating the work of the member of the staff.

Evidence and analysis

The programme is taught by over 50 professionally competent staff, most of them research active, and a number of them specialists from other institutions. The teaching staff's research is mainly carried out at TalTech Department of Chemistry and Biotechnology, which hosts excellent facilities that also support students' practical work. The SPSER cites several staff members teaching in this program who received recent national research awards (2019, 2016, 2015). Annex 8, which gives detailed information on staff members teaching in the programme, confirms the SPSER statement that the staff are well qualified for the programme, active in research and mainly have a full teaching workload. Staff at all levels have numerous opportunities to develop their teaching skills, and there is increasing pressure to undertake training. Staff who met the Panel also reported that various mechanisms help them to manage their workload of teaching and research [M: 5A].

The SPSER says that "No formal study programme specific goals have been set in terms of quality, as the feedback from students is good." The positive feedback was confirmed during the Panel interviews, where the students were very appreciative of the staff. They were extremely satisfied with the research orientation of the courses and with the student-teacher interactions. Good student feedback is in itself a quality goal, but the programme's approach seemed largely reactive.

The SPSER acknowledges that international mobility related to "study" – from the context presumably meaning teaching and learning – is low among lecturers in speciality courses. However, they do gain international experience and exposure through mobility as researchers, and in areas related to their research, such as networks, collaborations and publications. The SPSER also stresses that the research environment is very competitive and does not yield enough time for teaching mobility. Staff may also encounter some international doctoral students. Although the whole University is very proactive at involvement in international alliances, there is no mention of these in the present programme, which does not seem to benefit from them, perhaps because these alliances are more focused on engineering and IT.

Staff teaching and research are evaluated against the Academic Evaluation Matrix of the institution, which assigns roughly equal weight for research and teaching. At higher levels of seniority (e.g. full professor), the SPSER (p. 84) confirms that greater weight is given to research and development and success in applying for grants and contracts. Only for the higher grades is international experience expected [W: Academic Career Management (In force from: 01.06.2021) - Legislation (taltech.ee) and Tables in its Annex 3].

Strengths

- The programme is taught by very high-level academic staff in the field with good research records.

Areas of concern and recommendations

- International mobility of staff is too low, possibly owing to significant involvement of the staff in running day-to-day research at a high level. The programme should set increasing annual targets for staff mobility, supported by specific action.

Opportunities for further improvement

- The programme could perform better on international mobility if it proactively seeks to take part in the international alliances to which TalTech belongs.

2.4 Product Development and Robotics (BA)

General information: This programme provides students with the opportunity to start their studies with the basics of product development and robotics in the first year, leading into two pathways, one concentrating on product development, and the other on robotics. The programme is supported by industry and provides the opportunity to work in industry. Many students take the opportunity to start using their skills in the workplace while they work towards completing the study programme. The total number of students on the programme has risen from 60 in 17/18 to 175 in 20/21. So far only one cohort has graduated (19/20 - 23 graduates).

2.4.1 Planning and management of studies

- The design and development of study programme(s) take into account the expectations of students and other stakeholders, national strategies, legislation and trends in the particular area as well as labour market needs. The level and volume of RDC activities is sufficient and supports the launching of the study programme(s).
- The objectives of study programme(s), modules (including courses) and their learning outcomes are concrete and coherent. The teaching content and methods and assessment criteria and methods support students in achieving their learning outcomes and developing their key competencies. The study programmes support the development of creativity and entrepreneurship and other general competencies.
- The administration of material and financial resources that ensure the design and implementation of the study programme(s) is purposeful, systematic and sustainable. The learning environment, including materials, tools and technology support the students in achieving their learning outcomes.

Evidence and analysis

The design and development of the study programme involved employers, through a series of meetings during the development phase. Subsequently a Programme Advisory Board was established to maintain an industry input into the operation of the study programme. Major companies such as ABB Eesti and Starship Technologies have been represented. The Programme Advisory Board also has representation from students and from a professional body, the Federation of Estonian Engineering Industry. The representation by industry was confirmed at the interview [4D] with industry partners and alumni. The study programme was designed against the occupational qualification standard for Mechanical Engineering (level 6), matching the main mandatory competencies and learning outcomes. Consideration was also made of the OSKA study on the modernization of technical higher education, when designing the study programme. While in operation, the study programme has had changes as a result of input from students, advisory board, and employers. Examples of changes were discussed and confirmed at the interviews with students [3D], alumni and industry partners [4D]. Four

main changes in the last three years are noted in the SER, providing evidence of activity undertaken to meet the expectations of all key stakeholders.

At the programme management interview [11C] the team described the study programme as designed to be highly practical with a large focus on practical assessment of learning outcomes. The inclusion of an industrial project had its sceptics, but this has proved successful and is a strong point of the study programme.

The overall structure of the programme with the two pathways is available on SIS (TalTech ÕIS (ttu.ee), clearly indicating study programme learning outcomes, course level learning outcomes, and timetables. A structure diagram is provided [SER Fig 26] with further information in annexes 28-30. It is not clear in the SER, SIS or through evidence gathered at the interviews [3D, 4D, 5D, and 11C] whether there is clear monitoring, and responsibility for monitoring, that course learning outcomes are mapped to programme learning outcomes and then to industry competencies.

Robotics, as a complete subject, requires knowledge of mechanical, electrical, electronic, and software engineering. Given the 'Robotics' title of one pathway of the programme, it is not clear that students are prepared in all aspects of robotics. During the interview with students [3D] they indicated that some subject areas were taught to the level they expected, whereas other areas, such as electronics, were not so well covered. It may be that 'Robotic Mechanics' would be a more accurate title.

The two pathways are built up of 12 modules, 7 of which are common to both pathways. Each module is made up of a subset of courses. Some modules have courses in more than one year of the study programme. Courses within modules range in size from 3-12 ECTS. Each course has clear course learning outcomes, making the course objectives clear. However, there is no explicit alignment of course-level learning outcomes to programme-level outcomes, at least none that is available to students in SIS.

The assessment methods are provided for each course in Annex 28 and for some courses in Annex 29. Assessment information, mainly generic in nature, is provided to students and the public in SIS. Specific details of assessments are provided in Moodle, mainly in Estonian, with some examples in English. A review of one example was found to be appropriate to the course content but no constructive alignment to the course learning outcomes was signposted to students. In another example (from course TMJ0130) the learning outcomes of the course were clearly stated on the assessment information sheet, making the link between course learning outcomes and assessment much clearer, and demonstrating constructive alignment. At the interview with students [3D] assessment and practical work was discussed. Students were positive about most of their assessments and practical work. They stated that the limited negative comments were mainly 'nit picking'. The students felt that any problems they raised with the programme director were dealt with swiftly.

The programme provides a course on Entrepreneurship in the first year, and there are statements made in Annex 28 that study results include being 'familiar with creative problem-solving methods'. Through the interviews [3D, 4D, 5D, 11C], the tour of facilities, and review of SIS and Moodle, it is clear that students are exposed to a great deal of creativity in their learning and assessment, but it is not clear that they have opportunities to demonstrate their own creativity.

Limited information is provided on the resources available for the study programme, although it is noted that basic funding is provided from the budget of the Dean's office; and other funding opportunities, such as HITSA and Erasmus, have been utilised. There is no inventory of: laboratories

available; the resources within those laboratories; and what ratios of access are provided for research and education. During the interviews [3D, 4D, 5D] and through the tours, strong support for the quality of the resources available to students was voiced, and observed in action.

Some resources have been used to market the study programme to schools, including payments to existing students on the study programme to help run schools-based workshops.

Strengths

- The study programme is well structured with a strong practical focus through the learning outcomes, the facilities provided for practical work, and the practical assessments.

Areas of concern and recommendations

- The study programme needs clear mapping between course learning outcomes and programme learning outcomes, after appropriate pedagogical training.
- The programme learning outcomes should have documented mapping to the industry standard competencies, after appropriate training of identified responsible staff.
- All course assessments should show constructive alignment to the course learning outcomes.

Opportunities for further improvement

- None were noted

2.4.2 Learning, teaching and assessment

- Conditions and organization of admission ensure fair access to education and motivated student body. Students' choice of specialization is supported.
- A student-centred approach is used in the studies, aiming at the students to assume responsibility for planning their studies and career and supporting the development of key competencies and achieving the learning outcomes of the study programme.
- Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes. Objective and reliable assessment is ensured.
- The organization of studies including practical work and training is based on the specificities of students and forms of study and supports the student in achieving the learning outcomes. Opportunities have been established for mobility within Estonia and internationally.
- Support services for students are in place and available for students. Individual development and progress of students are monitored and supported.

- Graduates of the study programme are competitive in terms of their knowledge and social skills both nationally and internationally.

Evidence and analysis

The grade criteria for admission to the study programme are clearly stated, but it is not possible to ascertain how the criteria compare to the grade distribution of engineering students in Estonia generally. At interview 11C the Panel learned that applicants are admitted based on a certain threshold. The required grade is low (for example, compared to that for the IT Systems Administration programme), although considerable effort is made to recruit highly motivated students.

Recruitment appears to be healthy, with the number recruited each year increasing, even though in Estonia there is a decline in overall admissions to higher education. Potential students are well informed through workshops held in schools, as well as through involvement by TalTech researchers, lecturers and graduate students in the Young Engineer Programme. This programme consists of 7 study days, held on Saturdays, to provide access to a wider community of grade 9-12 students.

The SPSER refers to student-centred teaching, rather than student-centred learning, on page 122. The content of that section is concerned with support provided for students as an addition to the normal teaching, considering the complex nature of some courses. Information is also provided on what support is provided to students in the first year for them to better understand the specialisms of this study programme with its two pathways. Finally in this section of the SPSER, some information is provided regarding the innovative nature of the practical projects undertaken in the two pathways in the final year.

Overall, very little information is provided about how the study programme was designed and operates in a student-centred learning mode. During the interview with the programme management [11C] the Panel learned that new teaching methods were being promoted to the teaching staff. This might be exemplified by the information provided to support students in their self-study; using flipped classroom methodology; the methodology used for assessments; the assessment documentation; and grading criteria. At the meeting with students [3D] the discussion of their understanding of a student-centred learning approach was focussed on the speed of response to problems raised, which they felt was appropriate. The students felt that Moodle and recorded lectures were good steps forward and assisted them in pacing their learning. At the meeting with alumni and industry representatives [11C] alumni expressed their enthusiastic support for the learning approach and how it had made them ready for industry or to set up their own company.

The SER states that assessment criteria are defined in the extended syllabus for each course. The Panel found information on assessments in SIS, mainly of a generic nature; in some cases the assessment was linked to the course learning outcomes. Further, more specific assessment information was available in Moodle. As assessments are undertaken to ensure students meet course-level learning outcomes and (through a mapping) study programme-level learning outcomes, it is essential that assessments provide this information to students. Then all concerned can be confident that assessments determine whether learning outcomes have been met.

The programme director supports and encourages teachers to adopt continuous assessment throughout the semester for each course. This is an excellent approach. There is some evidence that

this does occur using midterm examinations or other assessment combinations (as opposed to reliance only on final exams). It would further strengthen the evidence that this encouragement is put into practice if a full coursework and examination timetable were made available to students at the start of each semester, alongside their study programme timetable. This could be done without hindering too much the flexibility the teachers currently have to make rapid alterations to their course arrangements.

Students can complete the study programme partly through the use of APEL. The SER states that APEL assessment is based on learning outcomes, and undertaken by the programme director, supported by the student counsellor and the APEL advisor. It is not clear if APEL is undertaken course-by-course, using course-level learning outcomes, or for the programme as a whole, using programme-level learning outcomes. All submitted APEL applications have been approved to date. Based on the material provided and the interviews, it seems that there is limited demand for APEL in the program. Therefore, all applications can be negotiated and agreed flexibly.

The study programme includes an internship course of 6 ECTS credits taken over the summer, although at which point in the study programme this is taken is not specified. Students are encouraged to find an internship, which is subsequently approved by the internship coordinator. The internship must be of at least 5 weeks. An internship log and report are written by the student, and a presentation is given, attended by all first-year students of the study programme. This is a good example of providing the students with real engineering experience and the opportunity to present their work to an audience of students and staff. A report by the internship supervisor is also provided. It is not clear how the student and supervisor submissions are assessed to determine if the learning outcomes of the internship have been met. Internship supervisors are not trained but regular dialogue is maintained with long-term internship providers to ensure the expectations of all parties are met. At the interviews with students [3D] there were only positive remarks regarding the internship. They felt that internships were easy to find, gave a great experience, and helped in finding employment.

The study programme involves considerable practical experience within courses, either for individuals or teams. Both pathways within the study programme have a speciality project course in the final year. An example of one is given in the SER in the form of a video of a small production line manufacturing reflectors to mark power lines to warn birds of the hazard. At the meeting with students [3D] they noted their overall satisfaction with their practical training. Some concerns were voiced regarding outdated equipment and variability in the support provided by the teaching staff, but, overall, the students were positive.

Home-study labs were created to allow students to gain practical experience from home. This was found useful in the Covid-19 pandemic when the University campus was closed. Combined with access to simulation software, students were given opportunities to learn and meet the learning outcomes of each course.

The SER records a dropout rate of 44.9% and a completion rate of 26.53% from the 2017 intake. The initial reaction, without comparison data, is that this completion rate is very low. The topic of completion rates was discussed at the interviews [3D,4D,5D,11C] but no clear picture emerged regarding any actionable reason for the high dropout rates. The University sets the use of e-learning, and improving teaching quality, as the current foci to deal with the high dropout rate [7].

Student support systems linked to the low completion rate have been established, such as a senior student support group to support new students, and integration parties for new students. As well as these support systems, a system has been established to monitor students in the first two years. The monitoring system provides performance data from mid-term assessments to the programme director and student counsellor, as well as to students. The data is used to identify students in need of support, and to contact them to discuss the causes and to seek solutions to their underperformance. Actively contacting at-risk students is good practice even if it leads to only some improvement in the dropout rate. During meeting 16A it was noted that some Schools were operating exit interviews with students who dropped out, but analysis of any data gathered was not available.

Student feedback on courses is provided in SIS but, for this study programme, the programme director conducts an additional survey with students. The survey is designed to allow students to evaluate, on a scale of 1–5, the whole set of courses within a semester, as well as each course separately. The evaluation of the semester set of courses usually remains between 4 and 5. The programme director uses this information to facilitate discussions with lecturers and to make changes to the study programme if necessary.

Graduates of the study programme are reported to have an average salary 1.3 times a comparable average graduate salary. Students are encouraged to participate in international engineering projects to provide them with additional skills to enhance their employability. During the interviews [3D,4D,5D, 11C] the common view among all interviewees was that the competitiveness of graduates from this study programme is strong.

Strengths

- The study programme has a very good balance of theoretical and practical training, with a strong emphasis on practical training.
- The internship course is well developed and provides both practical training and employment opportunities for students.

Areas of concern and recommendations

- There seems to be little data or analysis to explain the high dropout rate. The programme should consider structured exit interviews to establish data to inform preventative actions.

Opportunities for further improvement

- There are very good responses to requests by students for feedback, and issues raised by students. However, the programme director could establish a more consistent feedback methodology. This would ensure students understand whether they have met the learning outcomes, and what they need to do to improve.

2.4.3 Development, cooperation and internationalization of teaching staff

- Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.
- Teaching staff follows the principles of academic ethics and the codes of conduct in case of non-compliance.
- Members of the teaching staff participate in international mobility programs which encourage the development of their teaching and RDC activities and the cultural openness of the HEI and the Estonian society.
- The effectiveness of both studies and RDC activities, students' feedback, the effectiveness of supervision, development of teaching and supervision skills, international mobility and entrepreneurial or work experience in the specific field outside the HEI is taken into consideration in evaluating the work of the member of the staff.

Evidence and analysis

There are 20 full time lecturers listed in Annex 31 who are associated with the study programme, but two of them do not teach any courses. Of the 20 lecturers, 13 have a PhD, and all the others have a master's qualification; some of them are pursuing a PhD. Practical classes are supported by PhD students.

Teaching staff are encouraged to utilise student-centred learning, with a range of meetings being held to discuss and disseminate good practice regarding student-centred learning. Teaching staff [Interview 5D] confirmed the availability of training opportunities, and their use of these opportunities.

Teaching staff are also encouraged to participate in continuing education courses and in programmes offered by the Estonia Centre of Engineering Pedagogy. To date, the programme director has completed one of their programmes, resulting in the director being awarded the title 'International Engineering Educator'. The aim is for all teaching staff on the study programme to undertake pedagogical training and for key staff to be awarded this title.

Teaching staff are given the opportunity to engage in staff mobility through the Erasmus+ scheme and, in some cases, this has led to the joint development of study materials.

Staff performance evaluation considers their involvement in research projects and business ventures; this is an appropriate assessment of their commitment to scholarly activity, and to maintaining an expert viewpoint when designing and delivering the study programme. A major part of staff performance evaluation is based on student feedback, from both the university-wide survey and from the survey managed by the programme director. The programme director uses the results of the surveys to guide developments, and in some cases areas of improvement are discussed with individual

lecturers. Although PhD students are involved in conducting practical classes and teaching single courses within modules, it is not clear what pedagogical training they undertake or if they are always supervised by members of the teaching staff. Based on Interview 5D, PhD students frequently take pedagogical training during their studies.

Strengths

- The teaching staff work as a team, assisting each other with personal development, and developing a strong practical study programme.

Areas of concern and recommendations

- None

Opportunities for further improvement

- The programme director is encouraged to work with the Head of Department to ensure that staff evaluation has a strong focus on teaching and pedagogical training, particularly in the areas of learning outcomes, constructive alignment, and student feedback on assessments.

2.5. International Business Administration (BA)

General information: The International Business Administration programme is a programme for which students must pay the full tuition costs, run entirely in English. 90% of the students are international students coming from a large number of countries. The number of students has been decreasing in the last two years, and in 2020/2021 only 41 students were enrolled, compared to 92 in 2019/2020 and 127 in 2017/2018. However, the progression and completion rate have slightly improved. The Programme Director and teaching staff attribute both trends to tougher admission requirements [T, M].

Within the core field, the programme offers four different streams in which students can specialize. The programme was accredited by EFMD in 2021 for the duration of three years. This accreditation, based on the leading international system of business programme quality assessment, signifies the commitment of the programme management to achieving international recognition, and a level of programme quality comparable to international benchmarks.

2.5.1 Planning and management of studies

- The design and development of study programme(s) take into account the expectations of students and other stakeholders, national strategies, legislation and trends in the particular area as well as labour market needs. The level and volume of RDC activities is sufficient and supports the launching of the study programme(s).
- The objectives of study programme(s), modules (including courses) and their learning outcomes are concrete and coherent. The teaching content and methods and assessment criteria and methods support students in achieving their learning outcomes and developing their key competencies. The study programmes support the development of creativity and entrepreneurship and other general competencies.
- The administration of material and financial resources that ensure the design and implementation of the study programme(s) is purposeful, systematic and sustainable. The learning environment, including materials, tools and technology support the students in achieving their learning outcomes.

Evidence and analysis

A number of relevant procedures are in place to monitor the programme design and implementation, and contribute to its improvements on an annual basis. They include consultation on multiple levels (with lecturers, other programme directors, Dean and Vice-dean), student surveys and analysis of reports and programme KPIs. The programme advisory board includes students, lecturers and employers (Finnish-Estonian Chamber of Commerce, PwC Estonia, a newspaper and the Tourism Association) [SER Section 4.5]. Based on these inputs, some important modifications to the programme were implemented in recent years to better cater to labour market needs and ensure more flexibility for students:

- redesigning course credits to multiples of three ECTS;

- expanding the number of specializations from two to four (Marketing, Entrepreneurship and Management, Accounting and Business intelligence, and Finance);
- almost doubling the amount of ECTS in special studies/specializations;
- introducing a new preparatory course for the graduation thesis;
- introducing an internship (as elective content).

These changes align the programme with similar offers nationally and in the Baltic region. The interviewed alumni reported that some of these aspects were recognized as shortcomings when they were students in the programme (a few years ago); they expressed satisfaction that their proposed changes have been implemented [A]. The fact that the programme touches upon many different subjects is ambiguously assessed by students: while some appreciate the programme's wide character, others suggest that some courses are too general and not very analytical [S]. Overall, the programme has enough flexibility, and provides students with considerable choice in their specialization. The elective courses provide room for student exchange and mobility periods.

Some lecturers are respected researchers in their fields, with active participation in scientific communities. Yet, as recognized in the SER, the links between R&D and teaching could be improved. Currently research-based knowledge transfer seems to occur on a rather ad hoc basis, e.g. illustrating course content with some findings and examples from the literature, or during thesis writing seminars [T]. Teachers' proficiency in English language is not formally assessed, and the programme director believes this is under the purview of departments to which teaching staff belong [M]. Students reported that language proficiency of teaching staff is adequate [S].

The objectives and learning outcomes are well-framed and coherent overall, balancing between 'knowing' and 'doing', both at the programme and course level [SER Annex 20 and 21]. This is consistent with TalTech's motto *Menti et manu*. The structure of the programme is also coherent and flows logically, with most ECTS concentrated in the core studies (transverse knowledge and skills), and specializations [SER Annex 22]. The learning outcomes and assessment methods in the course samples which were provided are expressed in a clear and detailed way [SER, Annex 21]. Students also appreciate that some lecturers provide a detailed syllabus early in the courses, making it easy to know what is expected of them [S].

Due to the nature of the programme, a number of courses focus on entrepreneurship and creativity; some are compulsory (required for all specializations), and the others are specialization-specific or elective. TalTech offers a staff training programme "Deed of success" in which some teachers participate, focusing on how to promote entrepreneurial skills. Also, the connection to business practice (e.g. managers, entrepreneurs) and the close engagement with real-life business issues is appreciated by students [S]. Employees and alumni see potential in increasing these connections further, namely in relation to the Estonian start-up ecosystem [S].

Attention has been paid to ensuring the provision of online textbooks and other database resources. Lecture rooms and basic presentation facilities are in place, but not all rooms are equipped with modern digital technology (e.g. allowing for hybrid formats). Despite investments in physical infrastructure, there is still a lack of flexible rooms for working groups and other sorts of learning activities [SER 4.5, S], although students declare an overall satisfaction with the physical conditions provided [S].

Strengths

- The programme was redesigned based on inputs of various stakeholders. The quality feedback-loop is in place.
- The programme provides students with opportunities to engage with practitioners, and close connections to real-life business issues.

Areas of concern and recommendations

- The link between research and teaching is tenuous and occurs on an ad hoc basis. This link could be strengthened by stimulating teachers to include students in applied research projects whenever possible, and/or introducing relevant research findings as structured business cases in course syllabi.

Opportunities for further improvement

- None noted

2.5.2 Learning, teaching and assessment

- Conditions and organization of admission ensure fair access to education and motivated student body. Students' choice of specialization is supported.
- A student-centred approach is used in the studies, aiming at the students to assume responsibility for planning their studies and career and supporting the development of key competencies and achieving the learning outcomes of the study programme.
- Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes. Objective and reliable assessment is ensured.
- The organization of studies including practical work and training is based on the specificities of students and forms of study and supports the student in achieving the learning outcomes. Opportunities have been established for mobility within Estonia and internationally.
- Support services for students are in place and available for students. Individual development and progress of students are monitored and supported.
- Graduates of the study programme are competitive in terms of their knowledge and social skills both nationally and internationally.

Evidence and analysis

The sustainability of the programme, as recognized in the SPSER, relies on keeping a strong base of applicants. The target market is high-potential high school graduates, particularly from countries around the Baltic, including domestic students. The application process is fair and sufficiently rigorous. Teaching staff have reported that the quality of students is increasing, which is also a reflection of more demanding entry requirements. Requirements for applicants from different countries are explained in detail, and take into account inherent differences between various national baccalaureate and grading systems. The application process includes personal interviews, conducted by the programme director.

Currently 90% of the students are international. This may prove to be detrimental to programme success, as foreign students may feel 'isolated' from the local environment. This issue has been addressed to some degree by the programme director: for project work in one of the courses, student teams from this programme have been merged with students from the equivalent programme run in the Estonian language.

Students' choice of specialization is supported and, following TalTech's principle that students should have free study choices, there is no quota for enrolment into any of specializations. This may in future impose a strain on resources (for more popular specializations) and create cost imbalances, triggering the need for cross-subsidising. In addition, if enrolment remains at the current level (about 40 students), four specializations might prove economically unsustainable.

In order for the study programme to provide sufficient challenges for students with different levels of knowledge and skills, pre-semester courses in mathematics are offered, and foreign language courses are provided. Flexibility is provided in selecting the main speciality, elective and optional courses, and in compiling an individual study plan [SER 4.5].

Students have reasonable flexibility in designing their study programme (they can choose in total 36 ECTS), and they do not demonstrate difficulties in gathering information to choose their education path. They can influence the development of the programme via surveys, and participate in the programme advisory board [S].

The assessment methods and criteria are related to the learning outcomes they measure. In course syllabi each type of assessment is linked with learning outcomes [SER, Annex 21]. Based on student feedback and the description/extended syllabus of the course, the programme director monitors whether the teaching and assessment methods applied are consistent with the goals and requirements of the study programme and the course.

In courses where several instructors participate, several teaching staff members are involved in assessment. Practitioners from outside the university are also involved in assessment: as mentors and/or jury evaluators for projects and in competitions, as supervisors of graduation theses, and as members of thesis defence committees.

The student counsellor is also the APEL (Accreditation of Prior Experiential Learning) adviser; the programme director has the role of APEL assessor, and can involve the lecturers of the corresponding courses in making a decision [SER 4.5].

Internship has been included in the study programme since 2019 (as an elective course); it allows application of knowledge acquired in the course of studies to performance of specific work tasks. Securing internship is the responsibility of the student; this poses a major obstacle for many foreign students, who also recognise this as an important challenge [S].

Although mobility opportunities exist, only about 3-5% of students in the programme use these opportunities. Some measures have been adopted to improve outgoing mobility, e.g. increasing study programme flexibility by adding elective courses similar to those on programmes at partner universities so that students can fit in better there.

Student support is provided in terms of refresher courses and counselling; TalTech recognises a need for developing the student–tutor system. Student progression is monitored (via learning analytics) and acted upon (by outlining the requirements and providing some help). Each programme has a student counsellor.

The entrepreneurial and business consultancy experience of lecturers is valuable for developing student competencies and preparing them better for entering the labour market.

Strengths

- Students have flexibility in designing their study programme, and access to enough resources to make informed choices.

Areas of concern and recommendations

- The student body is almost exclusively international, and lack of interaction with Estonian students may lead international students to feel disconnected with the local environment (which should constitute an important part of their study experience). At the same time, domestic students are losing the opportunity for 'internationalization at home'. Providing additional incentives (e.g. via tuition waivers) for Estonian students to enrol in the programme, with its international accreditation, would increase interest among local students in this programme (rather than its Estonian parallel).
- Support infrastructure for foreign students has been established, but their relative isolation from other TalTech programmes creates some challenges for them. TalTech should find ways to provide more support for foreign students (including pastoral care), for example by introducing a tutor system to accompany the 'buddy' system which is already in place.

Opportunities for further improvement

- To reduce challenges with securing internships, an internship portal was established. Further efforts should be put into making the portal work effectively for the students.

2.5.3 Development, cooperation and internationalization of teaching staff

- Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.
- Teaching staff follows the principles of academic ethics and the codes of conduct in case of non-compliance.
- Members of the teaching staff participate in international mobility programs which encourage the development of their teaching and RDC activities and the cultural openness of the HEI and the Estonian society.
- The effectiveness of both studies and RDC activities, students' feedback, the effectiveness of supervision, development of teaching and supervision skills, international mobility and entrepreneurial or work experience in the specific field outside the HEI is taken into consideration in evaluating the work of the member of the staff.

Evidence and analysis

In total, 61 teaching staff participate in programme delivery. 35 of them (57%) hold a PhD degree [SER Annex 23], which roughly corresponds to the average at TalTech, but is low by international standards. As this is a BA programme, the staff sufficiency criterion is met.

About 50% of the teaching staff of the programme were active in R&D activities from 2017-2020, which roughly equals the share of teaching staff with a PhD degree [SER Section 4.5]. The teaching staff encompass different ranks of professors and lecturers (including visiting lecturers and early stage researchers), with a moderate degree of internationalization. About 25% of the teaching staff with a PhD obtained their doctoral degrees in other European countries, or beyond. The majority of staff obtained their degrees in Estonia, many at TalTech. Staff mobility is moderate: 13 out of 61 staff have participated during last three years in Erasmus+ programme activities. External practitioners are regularly included in the programme delivery (in all courses at least once a year).

Academic staff assessment follows TalTech rules: it is done once every five years. However, all elements of programme delivery, including teachers, are assessed once a year, also based on student feedback. If a teacher’s performance does not meet the expected standard, the programme director can discuss with the head of the relevant department possible replacement of the teacher with another qualified colleague. However, it is not clear where the power for decision-making lies and who takes the final decision.

Pedagogical training is not specific to the programme, as it is run at university level. Three lecturers in the programme have participated in international pedagogical conferences/training. As in other TalTech programmes, teaching staff members with unsatisfactory student feedback can improve their

teaching skills and abilities by participating in the Good Lecturer Development Programme, which has been recently established with the aim of supporting pedagogical development of teachers.

Interviews with staff showed high levels of satisfaction with programme development over the years, and with the way it is run and managed. TVTB is a successful study programme with a well-developed quality monitoring system. Feedback is regularly collected from various stakeholders, and measures for programme improvement are implemented.

Strengths

- Teaching staff are enthusiastic and committed to the programme's success. The programme is led by a dedicated programme director, who is committed to continuous improvement of the programme.

Areas of concern and recommendations

- As in other programmes, the programme director has the responsibility for successful programme design and delivery; however, the power to enact the changes is limited, and depends on cooperation with heads of departments and vice-deans/deans. Clearer delineation of managerial roles at school/department/programme level should be considered, to establish an appropriate and sustainable balance between responsibilities and power to implement necessary measures.
- Only about 50% of academic staff engaged in research in 2017-2020. Becoming a research-led university is one of the strategic goals of TalTech; hence placing more emphasis on reinforcing the link between research and teaching should also be one of the goals for the TVTB study programme.

Opportunities for further improvement

- None

2.6. IT Systems Administration (BA)

General information: The IT Systems Administration bachelor programme aims to "train IT systems administrators and architects" [SER p.113]. As the word "train" in the SER suggests, the composition of the study programme is very much hands-on. A recent re-structuring of the study programme, and active marketing, have led to an increase in student intake [SER].

2.6.1 Planning and management of studies

- The design and development of study programme(s) take into account the expectations of students and other stakeholders, national strategies, legislation and trends in the particular area as well as labour market needs. The level and volume of RDC activities is sufficient and supports the launching of the study programme(s).
- The objectives of study programme(s), modules (including courses) and their learning outcomes are concrete and coherent. The teaching content and methods and assessment criteria and methods support students in achieving their learning outcomes and developing their key competencies. The study programmes support the development of creativity and entrepreneurship and other general competencies.
- The administration of material and financial resources that ensure the design and implementation of the study programme(s) is purposeful, systematic and sustainable. The learning environment, including materials, tools and technology support the students in achieving their learning outcomes.

Evidence and analysis

In the SER, it is stated that the programme was in a very poor state after a merger of the IT College and Tallinn University of Technology. Today It is clear that the programme is in a solid state [Interviews 8B, 9B, 10B]. The best evidence of this is the increasing number of student applications - students who want to be a part of this particular study programme - in the last three years.

The study programme uses various means to inform potential students of its existence. This is grounded by the fact that there is a need for professionals in the area. The connection to societal need is clearly stated in the SER and was explicitly pointed out in interview 9B.

The design and development of the IAAB study programme involved benchmarking with other universities in 2018 to make the study programme up to date [SER]. It is laudable that the study programme is constantly updated, as stated in the SER. The study programme has a Programme Advisory Board with students and representatives from large companies. The curriculum was considered to be up to date [Interview 9B].

A major re-structuring of the study programme involved removing seven courses and adding eleven new courses. This type of a re-structuring is not an easy task. It seems that the result is a well-balanced curriculum with a solid base; a number of electives ensure that the students can build up their study

paths to suit their personal preferences. Half of the speciality courses are elective, thus making personally tailored study paths possible.

The need for IT system administrators nationwide is obvious. The shift to re-focus some of the priorities towards software development has been successful. In the SER, there is a reference to alignment with ACM/IEEE curriculum work. The alignment is cursory, as there are no directly comparable curricula in ACM/IEEE standards [Interview 11B]. However, it is sufficient that the ACM/IEEE curricula is considered in the development of the study programme.

The design and development of the study programme considers the expectations of students and stakeholders in the area [SER]. An identified need for better practical skills is accommodated in the design of the study programme [Interviews 8B, 9B, 11B].

It is clear that the study programme is closely tied with industry and aligns well with the state of the art in the field, helped by the involvement of a significant number of visiting staff who bring experience of industrial practice. [SER Annex 24, 25]. The staff have a wide range of research experience, but their publication records vary significantly in volume, and some have published little in recent years. A specialist area of development is projects that help modernize teaching methods, such as a proctoring solution and a process to facilitate distance learning. [Annex 27]

The objectives of the study programme, modules and courses are clearly stated. The learning outcomes are concrete and coherent in the study programme, modules and courses. There is no direct mapping of the outcomes between programme, modules and courses. It is not easy to validate if the course-level outcomes result in programme-level outcomes [Interview 11B].

Studies are organized in various ways: written and oral tests, individual and group work, presentations of group work. Independent project work is typical of the programme [Interviews 8B, 11B]. There is also an emphasis on general competencies. Social, ethical, and entrepreneurial viewpoints are covered in courses as well as in internships. Practical work (e.g. on topics such as horizontally scalable data storage service) is catered for well in the study programme.

Internship is an exceptionally large part of the IAAB programme with 24 ECTS. Internship is well-organized from the study programme's perspective, including an internship blog and a confidential learning portfolio with interaction between the student and the supervisor. Internship supervisors are trusted but not trained, per se [SER]. Supervisors are monitored by feedback, and this feedback shows that the supervisors receive high marks [Interview 11B]. A public guideline or a checklist could further augment the role of the supervisors outside TalTech.

IAAB has a simplified internship procedure for those already working in the field in suitable positions [SER]. This practise is formulated well, and functions as expected. There is room for a "grey area" but according to the interviews, guidelines are clear for all stakeholders [interviews 9B, 10B, 11B].

Student feedback is gathered, and significant actions taken based on the feedback received. Examples include courses removed or added, and timetables changed [SER]. According to the interviews, even teacher changes have taken place [Interview 8B].

Constructive alignment is not explicitly stated as a guiding principle for the teaching arrangements, but the teaching content, methods, and assessment support students in achieving their learning outcomes and developing their key competencies [Interviews 8B, 10B].

In summary, the study programme supports the development of entrepreneurship and other general competencies.

Implementing and developing the study programme is the responsibility of the programme director. According to the SER, 40 000 € per year is deemed sufficient for the operating development budget for the programme.

Students' access to research and other databases is not measured but relies on TalTech centralized services on offer. Usage of research databases is not measured but there were no reported problems in the interviews. Conditions for students are deemed suitable [Interviews 10B, 11B]. Studying is increasingly online, regardless of the pandemic. An increase in e-learning is evident [SER, Interviews 8B, 10B].

Overall, the conclusion is that the administration of material and financial resources ensures that the design and implementation of the study programme is purposeful, systematic, and sustainable. The learning environment, including materials, tools and technology, supports the students in achieving the learning outcomes.

Strengths

- Internship is a large part of the IAAB programme with 24 ECTS. It is well-organized, including an internship blog and a confidential learning portfolio between the student and the supervisor.
- The development of the programme involved benchmarking against other universities to ensure currency of the programme; the programme is also constantly updated.

Areas of concern and recommendations

- None noted

Opportunities for further improvement

- The programme could encourage and support staff to develop and sustain their publication record.

2.6.2 Learning, teaching and assessment

- Conditions and organization of admission ensure fair access to education and motivated student body. Students' choice of specialization is supported.
- A student-centred approach is used in the studies, aiming at the students to assume responsibility for planning their studies and career and supporting the development of key competencies and achieving the learning outcomes of the study programme.
- Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes. Objective and reliable assessment is ensured.

- The organization of studies including practical work and training is based on the specificities of students and forms of study and supports the student in achieving the learning outcomes. Opportunities have been established for mobility within Estonia and internationally.
- Support services for students are in place and available for students. Individual development and progress of students are monitored and supported.
- Graduates of the study programme are competitive in terms of their knowledge and social skills both nationally and internationally.

Evidence and analysis

The IAAB has made an effort to adjust the conditions and organization of admission to ensure access to the study programme for a fitting and motivated student body [SER]. Several channels are used to advertise the programme to potential students. The study programme uses year-round admission even though the start of studies is only once per year [Interview 11B]. State examinations are used with a relatively low threshold. The admission system is transparent, and the results are auditable. A large portion of the admitted students are already in employment [SER]. This is well-suited to the study programme, even though it makes the dynamics different from many other study programmes in TalTech.

In the interviews, the concept of student-centred learning was not completely clear [Interviews 8B, 10B]. It seems that the approximation of student-centredness points to non-lecture-based courses. In order to share a common view, it is necessary to explicitly state the meaning of the student-centred approach used in arrangement of the studies.

Students are assumed to take responsibility for planning their studies and career [SER]. There are generic counselling services as well as academic counselling. Support for the development of key competencies and achieving the learning outcomes of the study programme is expected. In the SER, it is stated that the teachers give “thorough feedback”, but this is not in evidence based on the interviews [Interviews 8B, 10B]. There is no barrier between the students and the teachers, so students can have feedback, if they specifically request it [Interview 8B].

Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes.

The organization of studies, including practical work and training, is based on the specifics of students and forms of study, and supports the students in achieving the learning outcomes. Opportunities have been established for mobility, even though those opportunities are used less than they should be, per TalTech’s ambition in mobility [Additional material provided to the Panel]. Opportunities for increasing the enthusiasm for student exchange should be utilized fully.

Support services for students are in place and available. Individual development and progress of students are monitored and supported.

Graduates of the study programme are in high demand nationally. The SER identified the need to involve alumni more formally in the development of the study programme.

Strengths

- The connection between the teachers and the students (as well as the programme director) is frictionless.

Areas of concern and recommendations

- The rapid increase in admitted students makes it difficult to arrange teaching, even though the study programme has coped well. Change in admission thresholds (mathematics from 55 to 65, Estonian language from 45 to 55) is a straightforward way to adjust the intake but yields unpredictable numbers of incoming students. It should be explored whether more predictable student admission processes could be employed.

Opportunities for further improvement

- As IT system administration is a universally relevant programme, international cooperation via increased student mobility would be beneficial. Opportunities should be taken to increase enthusiasm for international student exchanges.

2.6.3 Development, cooperation and internationalization of teaching staff

- Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.
- Teaching staff follows the principles of academic ethics and the codes of conduct in case of non-compliance.
- Members of the teaching staff participate in international mobility programs which encourage the development of their teaching and RDC activities and the cultural openness of the HEI and the Estonian society.
- The effectiveness of both studies and RDC activities, students' feedback, the effectiveness of supervision, development of teaching and supervision skills, international mobility and entrepreneurial or work experience in the specific field outside the HEI is taken into consideration in evaluating the work of the member of the staff.

Evidence and analysis

The list of teachers in the SER Annex 27 for the study programme reveals that the programme relies heavily on visiting faculty. Of the 32 teachers listed, only one is a full professor, three are associate professors, nine are lecturers or senior lecturers. For a study programme such as this, there is a clear need for visiting faculty, to connect the programme solidly to industry. Based on the interviews, a high

number of visiting faculty is not a problem for the study programme: the students, the study programme management and the alumni value the visiting faculty [Interviews 8B, 9B, 11B]. We conclude that the teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.

Given the rapid rise in the number of students, there is an increasing burden of workload for the teachers. In the interviews, it was stated that the increase in the student intake is dealt with by the permanent faculty, and the visiting faculty are needed only for the additional courses [Interviews 10B, 11B]. However, careful consideration is needed to balance the teaching loads of the permanent and the visiting faculty. Based on the interviews, there is no risk to the sustainability of education because of the high number of visiting faculty [Interviews 10B, 11B].

External partners are selected according to the goals of the study programme, and based on their professional competence [SER]. The issue that some of the partners have no academic credentials was not raised in the interviews.

Information about teacher training is available via an internal portal with a schedule [Interview 10B]. There are training courses sponsored by European funds. Teachers can also participate in external training. There is a budget, e.g. for summer schools. In the interviews, teachers stated that they receive a list of training opportunities, and that they participate in didactic and practical training [Interview 10B]. New teachers are mentored via an informal process, and are encouraged to take part in internal training [SER]. Teachers are well aware of the training opportunities that are offered [Interview 10B]. Serving as a teaching assistant is seen as training for the teaching profession [SER]; this is laudable.

A process for dealing with ethical violations exists and is used [Interview 10B]. Information is handed out to students during the pre-week and in other appropriate situations [Interview 8B]. Teaching staff are well informed of the processes. Overall, there are very few cases of ethical violation [Interviews 10B, 11B]. We can conclude that the teaching staff follow the principles of academic ethics and the codes of conduct in case of non-compliance.

Alumni are involved in many projects, making boundaries porous for the students to understand real-world project requirements [SER, Interviews 8B, 9B].

Compared to other study programmes, the members of the teaching staff participate less in international mobility programs [Additional material provided to the Panel]. As IT system administration is widely offered in other countries, it would be beneficial for all faculty members to use opportunities for mobility.

It remains unclear what is the metric for teaching effectiveness, and what impact teaching success has on career development. Apparently, there are clear feedback mechanisms, and the programme director has the power to remove and/or rotate teachers if needed. But success in teaching needs to be valued in career progress. Clear metrics would help the teachers to align their own efforts, to help the students to learn effectively.

Strengths

- The study programme has a strong practice orientation that is well utilised in the arrangements of the studies.

- External stakeholders are involved in ways that benefit the students.
- Revamping of the programme has been successful, given the increase in student numbers

Areas of concern and recommendations

- Having very few professors and associate professors, the programme risks overloading them, and it relies heavily on visiting faculty. It would be strengthened by recruiting more staff into professorial grades.

Opportunities for further improvement

- Compared to other study programmes, the members of the teaching staff participate less in international mobility programs. As IT system administration is widely offered in other countries, it would be beneficial for all staff to use opportunities for mobility.

2.7. Industrial Ecology (MA)

General information: The Industrial Ecology MSc programme aims to educate specialists who have extensive knowledge and practical skills in understanding the basic principles and implementing various methods of industrial ecology in enterprises, including the principles of circular economy. The number of students recruited each year increased from 14 in 2017–18 to 32 in 2020–21, with aggregate enrolments each year from 42 to 54. In this period 31 students graduated and 16 dropped out. The graduation rate is affected by parental leave and the high dropout rate is attributed to family and employment commitments (as most students work at least part time).

2.7.1 Planning and management of studies

- The design and development of study programme(s) take into account the expectations of students and other stakeholders, national strategies, legislation and trends in the particular area as well as labour market needs. The level and volume of RDC activities is sufficient and supports the launching of the study programme(s).
- The objectives of study programme(s), modules (including courses) and their learning outcomes are concrete and coherent. The teaching content and methods and assessment criteria and methods support students in achieving their learning outcomes and developing their key competencies. The study programmes support the development of creativity and entrepreneurship and other general competencies.
- The administration of material and financial resources that ensure the design and implementation of the study programme(s) is purposeful, systematic and sustainable. The learning environment, including materials, tools and technology support the students in achieving their learning outcomes.

Evidence and analysis

In the Industrial Ecology MSc programme students are educated to become specialists in industrial ecology. The programme is organized by and taught at TalTech's Tartu College. Students of the programme should master knowledge, practical skills and competences in relation to industrial ecology's methods, such as the principles of life-cycle analysis and the circular economy, and should be able to apply these methods in enterprises. The study programme covers modern industrial ecology approaches, and is promoted at different events and in publications to attract prospective students [SER, Section 4.3]. Learning outcomes are specified and the programme's teaching and learning is in line with the Academic Policies of TalTech. Students have ample opportunities to participate in research projects for their internships and MSc theses, and many do their research and development thesis in enterprises or other institutes (Interview 3B).

The study programme is essential for Estonia, as its government is committed to publishing a strategic plan on circular economy by the end of this year. But the programme is broader than that. The need to transition to a circular economy and more sustainability is also expressed in several European documents (e.g. the Circular Economy Action Plans from 2015 and 2020, and the European Green Deal

from 2019). These plans illustrate the need for qualified circular-economy and sustainability specialists, who can apply industrial ecology's principles and methods to redesign products and production processes in enterprises. This will help to implement a circular ecology. These kinds of specialists are in increasing demand (evidenced also by the Estonian OSKA study). The programme's most important development directions are improved resource efficiency, eco-innovation, eco-design and creating industrial ecosystems.

The SER's notion that industrial ecology experts are urgently needed, and indispensable to society gives the programme an atmosphere of pride and self-awareness. The number of students is rising, and graduates find their way to different positions in industry and governance. The staff team evidently demonstrates an entrepreneurial attitude. For example, Tartu College has close relationships with enterprises, and this increases the opportunities for internships and thesis research by students.

Although some contacts with other closely related study programmes in TalTech are established, the link between Tartu College and the School of Engineering could be strengthened [Interview 19]. The curriculum is strongly based on natural science and engineering science. However, the circular economy and sustainability also require social science (e.g. economics and law), which was taught in the now discontinued BSc programme (Interview 6B). Although the curriculum is constantly developed – with a role for staff, students and advisory board – staff who met the Panel saw broadening of the programme as problematic [Interview 6B], although in fact some aspects are found in current courses. The development mainly focuses on avoiding overlapping subjects and fine-tuning the programme.

Students are invited to comment on and suggest course improvements. The guidelines and procedures of TalTech are followed for the official evaluations; but Tartu College is also small enough to allow for many contacts between lecturers and students, and this creates an inspiring learning environment.

The programme regularly invites guest lecturers and professors from TalTech and the Estonian University of Life Sciences. Many contacts with international universities with comparable programmes exist (e.g. the Norwegian University of Science and Technology, the Technical University of Denmark and the Swedish Chalmers University of Technology).

Internal project-based funding has been used to develop student projects and study materials, and create the material and technical base of the study programme. The university has also invested in this programme. In the last two years the teaching infrastructure at Tartu College was updated. This included the establishment of a dedicated Industrial Ecology laboratory and additional student workspaces with the necessary facilities. Students' development projects further develop this infrastructure to be as comfortable, circular, sustainable and energy efficient as possible. For example, paper handouts are used only sparingly, and most study materials are available electronically in the e-environment. Tartu College also sorts and recycles its waste.

Strengths

- The study programme stands out for its societal relevance.
- The programme has a distinct engineering approach to industrial ecology, and focuses on commercialising ideas in line with companies' strategic goals.

- This is a young programme in a developing field of wide relevance and interest where it has shown the ability to respond to rapid changes.
- The college has relatively small numbers of students and they are known by the staff. This creates an inspiring learning environment.

Areas of concern and recommendations

- Several of the research areas of individual lecturers are not strongly linked to industrial ecology topics. This jeopardizes the desired connections between education and research and development.
- Dropout rates are still high. Reducing them needs to be addressed by assessing their causes and strengthening solutions such as student support and monitoring systems and individual counselling.

Opportunities for further improvement

- Industrial Ecology and circular or green economy topics internationally are developing rapidly towards a more interdisciplinary and integrated approach. The current programme director and her team will have to overcome several challenges to follow these developments.
- Alumni and stakeholders (governments and enterprises) should be encouraged to give better advice on programme developments. This is likely to increase employability.

2.7.2 Learning, teaching and assessment

- Conditions and organization of admission ensure fair access to education and motivated student body. Students' choice of specialization is supported.
- A student-centred approach is used in the studies, aiming at the students to assume responsibility for planning their studies and career and supporting the development of key competencies and achieving the learning outcomes of the study programme.
- Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes. Objective and reliable assessment is ensured.
- The organization of studies including practical work and training is based on the specificities of students and forms of study and supports the student in achieving the learning outcomes. Opportunities have been established for mobility within Estonia and internationally.
- Support services for students are in place and available for students. Individual development and progress of students are monitored and supported.

- Graduates of the study programme are competitive in terms of their knowledge and social skills both nationally and internationally.

Evidence and analysis

The MSc programme 'Industrial Ecology' is a small programme with currently fifty students. Students are informed at specific information days and the Programme Director answers individual requests for information. Admission is based on a dedicated professional proficiency test, which is compiled and evaluated by several faculty members. The five best students from the admission test are awarded a scholarship to study on the programme. A student-centred approach is used in the programme. The aim is for students to assume responsibility for planning their studies and career, supporting the development of key competencies and achieving the learning outcomes of the study programme. The individualization of studies is supported in terms of internship, national/international student exchange and elective courses, including those given at TalTech campus or Tartu College (i.e. 18 out of 36 ECTS and free electives of 6 ECTS). However, the possibility of an individual study plan could usefully be formally set out and recorded.

The programme is comprehensive, well-structured and transparent (as illustrated in Appendix 14 of the SER). Course topics are well motivated and cover a wide range of subjects. The study is concluded with a master's thesis. Appendix 13 of the SER describes some key courses together with aims, learning outcomes and study literature, some of it much broader than the programme itself. Some of the courses use well-established textbooks, others dedicated papers and reports, but they are listed in a variety of formats. The Panel learned that the Life-Cycle Analysis course uses the software and database *SimaPro*, which is still the current industrial standard, but could helpfully mention this specifically in the course documentation. Students are content that they are well informed of the course schedule, deadlines, learning outcomes and exams, and that feedback or results are provided by the lecturers in a few working days [Interview 3B].

Support material for the students is provided and lectures are recorded for asynchronous learning. Also, feedback concerning homework is emphasized and this contributes to the excellent lecturers' evaluations by students. Assessments, including accreditation of prior and experiential learning, support the students and correspond to the learning outcomes. Objective and reliable assessment is ensured by following the guidelines of TalTech's School of Engineering. Although the assessment of most courses is based on multiple components, 80% of the core subjects [Appendix 13 SER] were graded entirely by just a final exam. Teaching does not seem to be as strongly project-based as in other programmes reviewed. As many students already have work experience or are in work, the final MSc thesis (30 ECTS) is often based on the student's employer's needs, and guided by supervisors from both the enterprise and the College. Students' prior learning and work experience can be added to their completion of the programme. However, this APEL has been applied only to the Entrepreneurship and Practical Environmental Economics course.

The organization of studies, which includes courses, practical work and training, is based on the specifics of students and different forms of study, and supports students in achieving the learning outcomes. Individual development and progress of students are supported; support is provided by the programme director, the study coordinator and Tartu College's Rector. A new tutoring plan will

probably be implemented in the near future. Although all dropouts and delayed students are interviewed, some formal systematic monitoring system at the College is desirable.

Opportunities have been established for mobility within Estonia and internationally. Student exchange can take place internationally with many universities and in Erasmus programmes. A plan for studying abroad must be approved beforehand by the programme director. However, due to the Covid-19 restrictions, (inter)national mobility has recently been difficult and restricted to, for example, e-courses provided by the EuroTech network of six engineering universities.

Graduates of the study programme are competitive in terms of their knowledge and social skills, both nationally and internationally. Alumni from the programme are in high demand but stakeholders pointed out that graduates lack knowledge in legislation. Although the programme management strongly emphasises employability in industries and enterprises, many students do their internship, or are employed, in the public sector. The programme does not appear to cater well for this [Interview 4B].

Strengths

- The five best students from the admission test are awarded a scholarship to study on the programme.
- Students can accomplish their internship and thesis in the enterprises and industry that employ them.

Areas of concern and recommendations

- A systematic monitoring system for students' progress should be introduced.

Opportunities for further improvement

- Employability in enterprises and industry is emphasized, but the need for industrial ecologists in other sectors, such as governments and NGOs, should also be made clear.

2.7.3 Development, cooperation and internationalization of teaching staff

- Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.
- Teaching staff follows the principles of academic ethics and the codes of conduct in case of non-compliance.
- Members of the teaching staff participate in international mobility programs which encourage the development of their teaching and RDC activities and the cultural openness of the HEI and the Estonian society.
- The effectiveness of both studies and RDC activities, students' feedback, the effectiveness of supervision, development of teaching and supervision skills, international mobility and entrepreneurial or work experience in the specific field outside the HEI is taken into consideration in evaluating the work of the member of the staff.

Evidence and analysis

The ten lecturers in the programme are all linked to Tartu college. Seven of them have a PhD and several have a good internationally visible research record [Appendix 15 of the SER]. The others have only an MSc degree and only a few international publications. Many of the publications focus on environmental or ecological issues (i.e. waste water, pollution, the fate of pharmaceuticals in the environment, and soil issues) and only a few address specific industrial ecological issues, such as circular ecology, sustainability, life-cycle analysis, methodology development or assessment (e.g. uncertainty or risk assessment). Most of the lecturers' publications are strongly focussed on Estonian issues and include several laudable popular publications and reports, but only a few publications demonstrate a strong international collaboration in, for example, EU's H2020 projects. The links provided [Appendix 15 of the SER] to Google Scholar or ORCID accounts also show few citations and thus modest academic impact.

Although most of the thesis research projects are done in close collaboration with enterprises, several are part of lecturers' research projects at Tartu College [Interview 5B], which mainly focus on natural science based environmental issues and topics [Appendix 15 of the SER]. The international field 'Industrial Ecology', however, is quickly moving towards circular economies and sustainability. Such development requires more interdisciplinary research that combines natural, engineering and social sciences (including economics). Master's thesis projects should ideally represent these international developments, while also being anchored in Tartu College's research projects. However, as the College's projects generally do not address the currently advanced Industrial Ecology topics and

approaches, this could jeopardize the quality and timeliness of thesis supervision, and consequently the programme and the programme's graduates. The Panel therefore questions whether lecturers will still be suited to supervise students' final MSc thesis research in the near future.

The lecturers' CVs do not indicate a clear link between them and the industrial ecology practice community. Only one (part-time) lecturer provides evidence of regular participation in the international SETAC conferences on industrial ecology, though the programme says other full-time staffs are so involved. The programme could also be better linked to other courses in TalTech's School of Engineering and beyond.

Interviews 5B and 6B showed that the lecturers are pragmatic and agile in teaching and inspiring the students, who are generally mature students, and have ample work experience in the field. The programme's curriculum is very comparable with other industrial ecology curricula in Europe. The teachers can also follow specific training programmes and pedagogical courses to improve their teaching competences and skills. All new assistant professors are now expected to obtain 20 ETCS of such courses, but few current staff have done this, preferring to take technical courses about e-learning and Moodle. Lecturers are evaluated annually by the programme director, who, in turn, is evaluated by Tartu College's Director. Discussing and planning for educational development is part of these evaluations. Tartu College has recently entered the peer tutoring programme and lecturers will soon complete the necessary training. Lecturers also follow academic ethics principles and the codes of conduct in case of non-compliance.

Over the last few years, several younger lecturers have been inspired to do more research, and obtained their PhDs. They are also more actively engaged in research than most older lecturers [Appendix 15 of SER]. For example, one gained a PhD in 2017, has since published many influential papers, and often published thesis research together with students. This lecturer provides an excellent example of how students can mature academically.

Strengths

- Well-qualified lecturers inspire students, and are available, agile and pragmatic.

Areas of concern and recommendations

- The research projects of the lecturers do not link well with up-to-date industrial ecology, circular economy or sustainability topics. The programme should encourage existing staff to move into these research areas and make this a condition of appointing any new staff.

Opportunities for further improvement:

- It would be beneficial to stimulate those lecturers who have only an MSc degree to advance to PhD level.

2.8. Industrial Engineering and Management (MA)

General information: The master's programme Industrial Engineering and Management has been developed in cooperation with the University Consortium for Science and Technology BALTECH, initiated in 1997 by the Rectors of seven universities of the Baltic States and Sweden. Currently, the study programme is running simultaneously in four universities in Sweden, Latvia, Lithuania and Estonia, which means that it is easy for students to move between partner universities. At TalTech, the study programme is run in cooperation between the School of Engineering and the School of Business and Governance. The student numbers on the programme have witnessed a modest increase between 2017 (44) and 2021 (57). The programme has proven attractive to international students, with just over 20 foreign students taking the programme from 2017, until the Covid-19 pandemic resulted in a smaller cohort for the 2020/21 academic year.

2.8.1 Planning and management of studies

- The design and development of study programme(s) take into account the expectations of students and other stakeholders, national strategies, legislation and trends in the particular area as well as labour market needs. The level and volume of RDC activities is sufficient and supports the launching of the study programme(s).
- The objectives of study programme(s), modules (including courses) and their learning outcomes are concrete and coherent. The teaching content and methods and assessment criteria and methods support students in achieving their learning outcomes and developing their key competencies. The study programmes support the development of creativity and entrepreneurship and other general competencies.
- The administration of material and financial resources that ensure the design and implementation of the study programme(s) is purposeful, systematic and sustainable. The learning environment, including materials, tools and technology support the students in achieving their learning outcomes.

Evidence and analysis

The study programme aims to prepare internationally competitive managers for industry (roles such as head of factory, production manager, production engineer, etc). The programme has a good spread of stakeholders that have been involved in the development and design of the programme, in order to fulfil their expectations as well as the general expectations of society and business. These stakeholders include the programme advisory board which represents students, faculty, potential employers and business organizations [Interviews 9C and 10C]. The programme was developed in cooperation with several other universities, which improves its chances of relevance. The specific field of the programme is in rapid development, in accordance with the different stakeholders' needs.

In general, the programme focuses on all the relevant topics and trends in industrial engineering production worldwide, with emphasis on globalization, international and local cooperation, and dynamic markets. Technical courses are combined with economic and social courses. The main

characteristics of the programme – business management topics, industrial orientation, innovative technology, flexible programming, a combination of teaching and research and an international orientation – are easily recognizable in the structure and learning outcomes of the programme.

The study programme prepares engineers who will be experts in a particular field of engineering but who also possess the more general skills required for company management. Graduates of the programme are able to work in any field, from manufacturing to retail. The development of the curriculum and the programme's graduates are considered valuable by employers [Interview 9C]. Most of the students are working in the field in parallel with their studies, which helps to bring real world challenges into the classroom. This is considered beneficial to the quality of the education and also shows the relevance of the programme to market needs [Interviews 8C, 9C, 11C]. The SER states that a right balance has been found between student workload and credit points; but students think otherwise. In their opinion the high workload they face is probably part of the explanation as to why the programme faces such high drop-out rates [Interviews 8C, 9C].

The programme is coordinated by the programme director, together with the programme advisory board, consisting of representatives from the field of work (enterprises, manufacturing companies, professional associations), professors/lecturers and students.

There are regular internal evaluations that draw on feedback from the outside world and from visiting specialists and lecturers, often resulting in changes to the programme. In general, students are positive in their feedback on the programme (average score above 4.0) [Interview 10C].

The programme is flexible enough to adapt in structure and in content to new trends and technologies and to the needs of companies. Specialists from several enterprises (e.g. Ericsson Eesti AS, ABB, IMECC, etc.) are regularly involved in delivering lectures and conducting practice classes/training sessions in courses.

There is close cooperation with MEKTORY, using MEKTORY's infrastructure and equipment (the mechanical engineering lab). The courses in the study programme are closely linked to the research and development carried out by the teaching staff [Interview 10C].

The study programme has been built on new technologies (IoT, Industry 4.0, Production Digitalization, etc.). A wide range of elective courses help students design their own study path in accordance with their interests and needs.

Of the students, 5-15% take the opportunity to study abroad for a semester or a year; the credit points received abroad are eligible for the student's study programme. Since the study programme is developed in cooperation with the BALTECH universities, it is easier for students to go on exchange to the partner universities; there the students can take exactly the same courses as at TalTech. The language of instruction is English; that fits the global orientation of the programme and opens the programme to international students. Since May 2019 it has been possible for students to acquire an international double master's degree from TalTech and Vilnius Gediminas Technical University (VGTU).

As the study programme is run in cooperation between the School of Engineering and the School of Business and Governance, good communication, coordination and participation by teaching staff from both schools is important. As the SER states, this needs to be enhanced, and there is a plan to start regular meetings and workshops. The teaching staff are well aware of the challenge to bring the

diverse student groups (from the two schools and also a large share of international students) to the same level. The teachers work in a commendable way, arranging group work to ensure that the students benefit by learning from their peers [interviews 8C, 10C].

Because the study programme was developed in cooperation with BALTECH, it has close cooperation with the participating universities KTH, VGTU, Lund and Riga Technical University. Many students from the study programme have studied in those universities for one or two semesters and there is close cooperation with the different universities, as there is with manufacturing companies in the supervision of master's theses.

The physical and financial resources for the development and implementation of the study programme are allocated from the budgets of the dean's office and the department. Study facilities are up to standard, as evidenced from the visits by the Panel and from Interview 10C. For example, the TalTech library has good conditions for individual work, and small seminar rooms for working in teams of 4–12 people; the programme's students report satisfaction with the library [Interview 8C]. There are enough study places for students in the halls of every building. There is a computer classroom equipped with up-to-date software. Students can use a variety of equipment for their assignments in the Protolab (3D scanners, 3D printers and laser sintering units) and the Flexible Manufacturing systems and Robotics Demo Centre (Virtual and Augmented Reality technologies, robot on- and offline programming with Yaskawa, ABB, Omron and Festo robots and AGV units), etc.

Strengths

- The programme is embedded in the cooperation between the BALTECH universities, opening up opportunities for students and staff, and giving it a strong international profile with a high proportion of international students.
- The programme has strong relations with employers and manufacturing companies, and uses specialists from those companies to enrich the programme content.
- The programme is continuously developing; following trends, and listening to manufacturing companies and enterprises, gives it the flexibility and open-mindedness that is needed to move with the times.

Areas of concern and recommendations

- The quality of the communication and coordination between the two organising schools needs to be improved, especially the involvement of teaching staff. The programme management is aware of this issue, and should ensure that it is remedied following the planned workshops and meetings . The high workload for students on the programme is one of the aspects that explains the high dropout rate. It needs explicit attention.

Opportunities for further improvement

- Relations with other universities could be intensified, in order to arrange possibilities for more double degrees.
- Focused coaching could help students to choose their own learning path.

2.8.2 Learning, teaching and assessment

- Conditions and organization of admission ensure fair access to education and motivated student body. Students' choice of specialization is supported.
- A student-centred approach is used in the studies, aiming at the students to assume responsibility for planning their studies and career and supporting the development of key competencies and achieving the learning outcomes of the study programme.
- Student assessment, including taking accreditation of prior and experiential learning into account, supports the students and corresponds to the learning outcomes. Objective and reliable assessment is ensured.
- The organization of studies including practical work and training is based on the specificities of students and forms of study and supports the student in achieving the learning outcomes. Opportunities have been established for mobility within Estonia and internationally.
- Support services for students are in place and available for students. Individual development and progress of students are monitored and supported.
- Graduates of the study programme are competitive in terms of their knowledge and social skills both nationally and internationally.

Evidence and analysis

Admission takes place all year round in person, or online, and a following an interview [Interviews 11C, 15A]. The online admission is important, considering the programme's international focus and dependence on international students. The programme is one of the smaller programmes at TalTech, with about 60 students. The annual number of applicants is around 165, from many parts of the world. However, considering that only about a third of those are eligible, this raises the question of whether the information about the programme, and the admission requirements, are clear enough. The conclusion by the programme in the SER that "the admission requirements allow selecting the best student candidates" seems slightly stretched since the number of eligible applicants is just marginally greater than the number of accepted students. Nevertheless, the admitted students are well motivated [Interviews 8C, 9C, 10C].

The programme offers a wide range of elective courses and tracks, allowing students considerable freedom in choice of specialization; it also offers international mobility with the cooperating universities. From the first lecture, the programme director presents the flexible study path and the overview and interconnection between courses; these can be further investigated by the students through a course coherence tool. The students can attend 'taster' sessions of classes and then decide which to include in their study path (Interview 8C). The strong interaction and peer-to-peer learning among the diverse student body is considered as positive by students and staff alike [Interviews 8C, 10C]. Still, there are indications that not all teaching staff are up to date on student-centred learning,

or have sufficient English language skills; this leads to student dissatisfaction with one-way lectures where only the teacher speaks (Interview 8). The Panel noted that the interviewed teaching staff had strong interests in the different learning approaches of the students [Interview 10C]. The Panel also noted the teachers', programme management's, and partners' commitment to further improving the learning methods of the programme [Interviews 9C, 10C, 11C].

The learning outcomes and assessment methods and criteria are clearly specified in the study programme specification, including the modules, as well as in the different course plans. The courses include several projects with real life problems; these projects provide opportunities for the students' development of key competences [Interviews 8C-11C]. The Master's thesis topics typically offer opportunities for involvement in research and development projects. The assessments for each course are often based on a combination of methods, such as project reporting, individual analysis of projects, group work and written exams.

The programme is based on strong international collaboration as well as broad cooperation with business. This offers the students, under normal circumstances, excellent opportunities for international mobility and practical studies on real-world problems. For the international students it is, however, sometimes harder to find practical use cases in industry [Interview 10C]. The Covid-19 pandemic has had a negative impact on the opportunities for practical work and international exchange, and the programme therefore needed to become more theoretical. Although the students feel that TalTech handled the situation well and that the Moodle e-learning system works well, it is important to now facilitate networking and interaction with partners [Interview 8C]. A general reflection from the Panel is that the international set-up of the programme is probably a valuable model for other programmes at TalTech.

The programme's students report that the lecturers are helpful when the students need support related to studies or other challenges [Interview 8C]. The programme director is very active. Still, drop-out rates are very high, which is acknowledged as a serious problem, and counter measures, such as additional monitoring, are employed [Interviews 8C, 9C, 10C, 11C]. As mentioned, most students work professionally in combination with their studies at TalTech. To accommodate this situation, the lectures in the programme typically start at 4 pm, and are also given during weekends, which in the long run could become problematic for both students and lecturers.

The individual development and monitoring of students are at a high level. However, students would like to be notified more effectively of the outcomes of their feedback on the courses [Interview 8C]. The reporting of above-average salaries for graduates from the programme indicates that the graduates are competitive, due to their knowledge of the national work market. It is harder to evidence the graduates' international competitiveness or their social skills, but students and teaching staff say that the programme is modern and of a high international standard [Interviews 8C, 9C, 10C]. The large share of group work, with interactions between business students, engineering students, international students and international institutes, as well as national/international business, provides the students with great opportunities to develop their social skills.

Strengths

- The international set-up of the programme is a valuable model for other programmes at TalTech. The programme offers a strong international environment, collaboration between two schools, and interaction with business and three other Baltic universities.

- The flexibility of the programme.

Areas of concern and recommendations

- As with the other TalTech programmes, the drop-out rate and graduation rate are troubling. A stronger analysis and action plan is needed. Part of the reason is that students take on employment before finishing their studies. It could be beneficial to collaborate with business partners to help students finish and graduate, for the long term good of all.

Opportunities for further improvement

- The programme has a fairly small number of students. It is likely, with wider marketing, that this attractive programme (and school) could secure even more applications from highly qualified international students.
- The large number of elective courses possibly gives too much flexibility, too early, and could benefit from a clearer link to the general study program goals, following the principles of constructive alignment.

2.8.3 Development, cooperation and internationalization of teaching staff

- Teaching is conducted by a sufficient number of professionally competent members of the teaching staff who support the development of the students.
- Teaching staff follows the principles of academic ethics and the codes of conduct in case of non-compliance.
- Members of the teaching staff participate in international mobility programs which encourage the development of their teaching and RDC activities and the cultural openness of the HEI and the Estonian society.
- The effectiveness of both studies and RDC activities, students' feedback, the effectiveness of supervision, development of teaching and supervision skills, international mobility and entrepreneurial or work experience in the specific field outside the HEI is taken into consideration in evaluating the work of the member of the staff.

Evidence and analysis

Currently, the programme has 21 members of staff involved in teaching and learning. This includes a mixture of professors, associate and adjunct professors and researchers, together with senior and visiting lecturers. Twenty of these 21 staff have a PhD or a doctoral degree, meaning that the educational level of the teaching staff is above the TalTech average, and also meets the goals for

TalTech. Most of the staff have their training and PhDs from TalTech; those with international qualifications amount to only 2.9 FTE, with one being well over retirement age. The Panel recommends that the programme works on a development plan to strengthen both the long-term internationalization of staff, through key staff recruitment, and staff training, through international mobility programmes.

The University provided the Panel with comprehensive details on programme teaching staff, including qualifications, publications and supervision responsibilities. Staff CVs demonstrate that significant research activity is being conducted by a wide range of staff, leading to successful publication in international, peer-reviewed journals [Annex 19]. Some staff seem, however, to lack publications with co-authors outside Estonia, indicating a lack of an international network.

The language of instruction is English and the University views English language proficiency among programme staff to be high or excellent. The students and teaching staff, however, point out that the English language proficiency of some staff is weak [Interviews 8C, 10C]. Additional language support is provided in the form of continuing education courses, delivered by the Estonian Centre of Engineering Pedagogy, to support further development in language acquisition and application.

Staff are typically appointed without a pedagogical education. Occasional courses are delivered to enhance pedagogical skills among lecturers; however, principally these skills are acquired through collaboration between new staff and senior lecturers and professors. Teaching staff and programme management point out that pedagogical training is important, recommended and available; however, in practice, the time required by teaching and other commitments is an obstacle to undertaking this training. It was also suggested that some lecturers who would need this training are not interested in pursuing it [interviews 10C & 11C]. The programme management is working to improve motivation in different ways [Interview 11C].

The University's principles of academic ethics guide the staff teaching on the programme (see Standard 1.4). Ethics was, however, not discussed in any of the interviews with the programme stakeholders. Where problems arise, the programme director and the Vice-Dean Academic Affairs provide assistance in following the guidelines.

Staff are actively engaged in research activity, including collaborations with other universities. This is typically, though not always, aligned to the programme's research priorities and the content of courses taught by staff. Consequently, research and scholarship directly inform courses and student development.

The teaching skills of staff are one of the performance indicators considered in expert evaluation prior to their re-election. As part of the re-election process student representatives act as a conduit for providing the Student Board's opinion about lecturers. The University informed the Panel that there is an issue in terms of a lack of competition for staff vacancies on re-election. Lecturers are also able to access students' feedback on their course, upon its conclusion, through SIS.

Strengths

- The high level of qualifications and research activity of the teaching staff.

Areas of concern and recommendations

- Action is needed to increase the motivation and uptake for pedagogical training among some staff.
- Action is needed to strengthen the long-term internationalization of staff through key staff recruitment and training, including international mobility programmes.

Opportunities for further improvement

- The range and quality of teaching staff could be enhanced if means are found to increase the competition for teaching vacancies upon re-election.

ANNEX

Institutional Accreditation
Tallinn University of Technology

SCHEDULE OF THE VISIT
4 - 8 October 2021

Members of the assessment committee

Bob Munn	Chair, Emeritus Professor of Chemical Physics, University of Manchester, UK
Karen Kear	Secretary, Senior Lecturer, Faculty of STEM, Open University, UK
Matthew Kitching	Student representative, Edinburgh Business School, Heriot-Watt University, Edinburgh, UK
Anthony John Vickers	Professor, School of Computer Science and Electronic Engineering, Head of School, University of Essex, UK
Jaakko Kurhila	Dr., Chief digital officer, University of Helsinki, Finland
Laurent Counillon	Director of the University Côte d'Azur Graduate School in LIFE and Health Sciences, France
Luis Carvalho	Professor, School of Economics and Business, University of Porto, Portugal
Paul Rullmann	Former Vice-president of Education and Operations, Delft University of Technology, the Netherlands
Rik Leemans	Professor, Department of Environmental Sciences, Wageningen University, The Netherlands
Tanja Dmitrović	Professor, Vice-rector for Knowledge Transfer, University of Ljubljana, Slovenia
Tõnu Pekk	Employer representative, Founder and a Member of the Management Board of Tuleva, Estonia
Martin Tunér	Professor, Vice-dean, Faculty of Engineering, LTH, Lund University, Sweden
Andreas Mehrle	Director of studies & head of department mechatronics, Management Center Innsbruck, Austria

Jekaterina Trofimov
Quality Agency for Higher and Vocational Education (EKKA)

Liia Lauri
Quality Agency for Higher and Vocational Education (EKKA)

Observers: **Anneli Kritšmann-Lekštedt** (EKKA); **Marge Unt** (Estonian Quality Assessment Council for HE)

Monday, October 4 *All times in the schedule are in Estonian (EET/UTC+3)		
Time	Activity	Representatives of TalTech *Names of the interviewees and their positions*
10.15 - 10.45	*Panel meeting*	
10.45 - 11.15	1. Introductory meeting with the TalTech representatives (SER team)	1. **Tiit Land**, Professor, Rector 2. **Maarja Kruusmaa**, Tenured Full Professor, Head of Centre Vice-Rector for Research, Member of Estonian Academy of Sciences, Member of the Group of Chief Scientific Advisors of the European Commission 3. **Hendrik Voll**, Tenured Associate Professor, Vice-Rector for Academic Affairs 4. **Helen Sooväli-Sepping,** Vice-Rector for Green Transition 5. **Sven Illing,** Vice-Rector for Entrepreneurship 6. **Kaja Kuivjõgi**, Quality Manager-Strategy Manager, Rectorate Strategy Office (coordinated the self-evaluation process) 7. **Hanna Haavapuu**, Chief Academic Quality Officer, Office of Academic Affairs (coordinated the self-evaluation process) 8. **Martin Malm**, Business Architect, Rectorate Strategy Office
11.15-11.30	*11.15-11.25 panel discussion* *11.25-11.30 break*	
11.30 – 12.20	2. Meeting with the Rector	**Tiit Land**, Professor, Rector
12.20-13.00	*Panel discussion*	
13.00-14.00	*Lunch*	

Assessment of the sample study programmes ***4 study programmes: parallel interviews***		
14.00 – 14.45	Meeting with students	*Diverse representation of students from all study years, international students, etc. max 8 persons*
	3A. Applied Chemistry, Food and Gene Technology (LAAB)	1. **Mihkel Külm**, 3rd year (food techology) 2. **Evelyn Pil**, 3rd year (gene tehnology) 3. **Mia Peterson** 4th year (chemistry) 4. **Anne-Maria Jazõkov**, 2nd year 5. **Katariina Kinnunen,** 2nd year (chemistry) 6. **Saara Suurkivi** 2nd year (food technology) 7. **Arina Laanemets** 3rd year (gene technology)
	3B. Industrial Ecology (NAEM)	1. **Andres Salu,** 2nd year (*via Teams*) 2. **Kätlin Roose**, 2nd year 3. **Karl-Joosep Pärtel**, 2nd year (*via Teams*) 4. **Justin Hein**, 2nd year (*via Teams*) 5. **Karme Petrutis**, 2nd year (*via Teams*) 6. **Raina Jürgens**, 1st year 7. **Eliisa Lehtme**, 1st year (*via Teams*) 8. **Anet Adamson,** 2nd year
	3C. Business Information Technology (IABM)	1. **Annela Pindis ,** 2nd year 2. **Hanna-Liisa Vilbiks ,** 2nd year 3. **Jelena Kuzmina,** 2nd year (*via Teams*) 4. **Henri Lepik,** 2nd year 5. **Rene Allkivi,** 2nd year 6. **Igor Roos,** 2nd year (*via Teams*) 7. **Vadim Aland,** 2nd year (*via Teams*) 8. **Vladimir Andrianov**, 2nd year **Translator** Kertu Liik
	3D. Product Development and Robotics (EARB)	1. **Karl Läll,** 4th year 2. **Liisa Kõve,** 2nd year 3. **Martin Arus,** 3rd year 4. **Mikk Paju,** 2nd year 5. **Carolin Tõntsu**, 1st year

		6. **Teodor Undrits,** 3rd year
14.45 – 15.00	*Break*	
15.0 – 15.45	Meetings with alumni, employers/ partners	*Representatives of main cooperation partners, someone who has provided work placements and /or employed the graduates of TalTech, also participated in the curriculum development etc. Alumni - from past three years. (max 8 persons).*
	4A. Applied Chemistry, Food and Gene Technology (LAAB)	1. **Olivia Stella Salm**, Master's student of Applied Chemistry and Biotechnology, graduated in 2020 2. **Sigrid Kirss**, 1st year PhD student, graduated Gene Technology in 2018, (responsibile for social media marketing of the study programme and institute, visits) 3. **Kaisa Orgusaar**, CEO, ProProtein OÜ, graduated Food Technology in 2019 4. **Evelin Heiberg**, Product Development Manager, Kalev Factory, Orkla Eesti AS (*via Teams*) 5. **Sirli Rosenvald**, Head of Product Development and Sensorics Department, Center of Food and Fermentation Technologies (TFTAK) 6. **Kaia Palm**, CEO and founder, Protobios 7. **Jekaterina Mazina-Šinkar**, Laser Diagnostic Instruments AS
	4B. Industrial Ecology (NAEM)	*1.* **Andrus Paat** – TalTech, Project Coordinator (*via Teams)* 2. **Heikki Kalle**, Member of the Board, Hendrikson & Ko (*via Teams*) 3. **Rihard Rohtla** – Environmental Health Safety Specialist, Valio Eesti AS (*via Teams*) 4. **Helen Juhkam** – Senior Inspector, Environmental Board

		5. **Dagny Kungus** – Adviser, Environmental Management Department, Ministry of Environment (*via Teams*) 6. **Marily Jaska** – Adviser, Ambient Air and Radiation Department, Ministry of Environment 7. **Paula Nikolajeva** – Environmental Consultant, Alkranel OÜ (*via Teams*) 8. **Reelika Kuusik** – Expert, Estonian Rescue Board (*via Teams*)
	4C. Business Information Technology (IABM)	1. **Külli Raidma**, Competence Manager, Nortal AS (*via Teams*) 2. **Karle Nutonen**, graduated in 2021 3. **Ants Sild**, Member of the Board, Baltic Computer Systems AS 4. **Indrek Hiie**, Process Owner, Luminor Group 5. **Hele Tammenurm**, Head of Quality and Process Management, Telia Estonia AS 6. **Martin Rajur**, graduated in 2021, Platform and Infrastructure Architect at Omniva (Eesti Post AS) 7. **Jaan Susi,** graduated on 2021, Project Architect at Axinom Eesti OÜ **8. Merje Einla**, Team Manager, Swedbank AS (*via Teams*) **Translator** Kertu Liik
	4D. Product Development and Robotics (EARB)	1. **Triin Ploompuu,** Member of the Board, Federation of Estonian Engineering Industry 2. **Leho Kuusk,** Local Division Manager, ABB Estonia 3. **Mikk Leini,** Software and Verification Development Manager, Stoneridge Electronics 4. **Andres Petritšenko**, Project Manager, Teamwork Engineering OÜ 5. **Kristjan Metsis,** Sales Engineer, Demek CNC OÜ 6. **Priit Raid**, Business Development Manager, HOOB OÜ 7. **Georg Seema,** Product Developmemnt Engineer, CoModule, alumnus **Translator** Liina Sudak
15.45 – 16.00	*Break*	

16.00 – 16.45	Meetings with teaching staff	*Diverse representation of teaching staff (permanent and visiting; gender, positions, novice and experienced, local and international, including recently hired international faculty), max 8 persons*
	5A. Applied Chemistry, Food and Gene Technology (LAAB)	1. **Riina Aav**, Tenured Associate Professor, Department of Chemistry and Biotechnology, School of Science 2. **Richard Tamme**, Senior Lecturer, Department of Chemistry and Biotechnology, School of Science. 3. **Ly Villo**, Senior Lecturer, Department of Chemistry and Biotechnology, School of Science 4. **Pirjo Spuul**, Senior Researcher, Department of Chemistry and Biotechnology, School of Science 5. **Agne Velthut-Meikas**, Associate Professor, Department of Chemistry and Biotechnology, School of Science 6. **Katrin Laos**, Associate Professor, Department of Chemistry and Biotechnology, School of Science 7. **Kristel Vene**, Senior Lecturer, Department of Chemistry and Biotechnology, Business Development Specialist, School of Science 8. **Annela Avarlaid**, Early Stage Researcher, PhD student (also supervisor of students, participated in programme development from the beginning)
	5B. Industrial Ecology (NAEM)	1. **Egge Haiba**, Senior Lecturer, Tartu College, School of Engineering 2. **Karin Muoni**, Lecturer, Tartu College, School of Engineering 3. **Tiit Lepasaar**, Councellor, Tartu College, School of Engineering 4. **Mari Ivask**, Councellor, Professor Emeritus, Tartu College, School of Engineering 5. **Aija Kosk**, Lecturer, Tartu College, School of Engineering 6. **Aime Ruus,** Associate Professor, Tartu College, School of Engineering *All participate virtually via Teams.*
	5C. Business Information Technology (IABM)	1. **Innar Liiv**, Associate Professor, Department of Software Science, School of IT 2. **Ants Torim**, Lecturer, Department of Software Science, School of IT

		3. **Erki Eessaar**, Associate Professor, Department of Software Science, School of IT 4. **Jaan Penjam**, Professor Emeritus, Department of Software Science, School of IT 5. **Jaak Tepandi**, Professor Emeritus, Department of Software Science, School of IT 6. **Silvio Capobianco,** Senior Researcher, Department of Software Science, School of IT 7. **Amirouche Moktefi,** Senior Lecturer, Ragnar Nurkse Department of Innovation and Governance, School of Business and Governance 8. **Ahti Lohk,** Lecturer, Department of Software Science, School of IT **Translator** Kertu Liik
	5D. Product Development and Robotics (EARB)	1. **Kaimo Sonk,** Lecturer, Department of Mechanical and Industrial Engineering, School of Engineering 2. **Martinš Sarkans,** Senior Researcher, Department of Mechanical and Industrial Engineering, School of Engineering 3. **Priit Põdra,** Senior Lecturer, Department of Mechanical and Industrial Engineering, School of Engineering 4. **Aigar Hermaste,** Lecturer, Department of Mechanical and Industrial Engineering, School of Engineering 5. **Hans Rämmal,** Associate Professor, Department of Mechanical and Industrial Engineering, School of Engineering 6. **Kati Kõrbe-Kaare,** Senior Researcher, Department of Mechanical and Industrial Engineering, School of Engineering **Translator** Liina Sudak
16.45 – 17.00	*Break*	
17.00 – 17.45	Study programme management	
	6A. Applied Chemistry, Food and Gene Technology (LAAB)	**Vello Tõugu**, Associate Professor, Programme Director of Applied Chemistry, Food and Gene Technology, School of Science **Toomas Tamm**, Vice-Dean for Academic Affairs, Tenured Associate Professor, School of Science

	6B. Industrial Ecology (NAEM)	**Jane Raamets,** Senior Lecturer, Programme Director, Tartu College, School of Engineering **Lembit Nei,** Director of Tartu College, Professor, School of Engineering **Kaie Lehtme,** Academic Director, Tartu College, School of Engineering *All participate virtually via Teams.*
	6C. Business Information Technology (IABM)	**Gunnar Piho,** Associate Professor, Programme Director, School of IT **Ingrid Pappel,** Vice-Dean of Master's Studies, School of IT
17.45 – 18.00	*Break*	
18.00 – 19.00	*Panel meeting for summing up the Monday meetings*	

Tuesday, October 5 *All times in the schedule are in Estonian (EET/UTC+3)		
Time	Activity	Representatives of TalTech *Names of the interviewees and their positions*
10.15 - 10.45	*Panel meeting*	
10.45– 11.35	7. Meeting with Vice-Rector for Academic Affairs	**Hendrik Voll,** Tenured Associate Professor, Vice-Rector for Academic Affairs
11.35-12.15	*11.35-11.50 panel discussion* *11.50-12.15 break*	
Assessment of the sample study programmes		

4 study programmes: parallel interviews		
12.15 -13.00	Meeting with students	*Diverse representation of students from all study years, international students, etc. max 8 persons*
	8A. International Business Administration (TVTB)	1. **Roman Thomas Akiva Cole**, 3rd year, Student Ambassador 2. **Zhanaiym Suleimenova**, 3rd year 3. **Bushra Faroquei**, 3rd year, Student Ambassador 4. **Aizhas Beisembay**, 3rd year 5. **Natia Vardanidze**, 2nd year 6. **Ariel Shriki**, 1st year
	8B. IT Systems Administration (IAAB)	1. **Margus Laanem**, 3rd year 2. **Gen Lee**, 3rd year 3. **Tanel Saar**, 3rd year 4. **Erkki Laagriküll**, 2nd year 5. **Merit Sisas**, 3rd year 6. **Martin Vool**, 3rd year 7. **Martin Erik Pille** 3rd year 8. **Maria Torop**, 3rd year **Translator** Kertu Liik
	8C. Industrial Engineering and Management (MARM)	1. **Kerd Kaarus,** 2nd year 2. **Lars Becker,** graduated in 2021 (*via Teams*) 3. **Rene Lõhmus,** graduated in 2021 4. **Taavi Nõmm**, 2nd year (*via Teams*) 5. **Hans Johan Erikson**, 2nd year (*via Teams*) 6. **Aleksei Tanjuhhin**, 2nd year 7. **Nida Altuğ,** 1st year 8. **Raquel González Martin**, 1st year
	8D. Telematics and Smart Systems (EDTR)	1. **Monika Kiik,** 2nd year 2. **Nikolai Kornõšev,** 2nd year 3. **Evelina Marhel,** 3rd year, Member of Student Council 4. **Karlis Nutonen,** 1st year 5. **Sander Plümberg**, 2nd year 6. **Hendrik Hütt**, 4th year

		7. **Marie-Johanna Janno**, 3rd year 8. **Johan Mattias Juul**, 3rd year *All participate virtually via Teams.* **Translator** Karin Keerdo-Massa
13.00-14.00	*Lunch*	
14.00 – 14.45	Meetings with alumni, employers/ partners	*Representatives of main cooperation partners, someone who has provided work placements and /or employed the graduates of TalTech, also participated in the curriculum development etc. Alumni - from past three years. (max 8 persons).*
	9A. International Business Administration (TVTB)	1. **Mano Asatiani,** graduated in 2021 2. **Aivar Kamal,** graduated in 2021 3. **Polina Bulavko,** graduated in 2021 4. **Folasade Ogunnaike,** graduated in 2021, 5. **Sofia Niemi,** graduated in 2021 6. **Sunmola Peter,** graduated in 2021 (master's student of TalTech TVTM programme) 7. **Kristjan Kolbre,** Visiting Lecturer of TVTB programme (Introduction to Entrepreneurship); Vamp Digital OÜ, Founder and CEO 8. **Joole Kuljus-Triik**, NOC EE People Consultant. Provider of internships/employer
	9B. IT Systems Administration (IAAB)	1. **Lars Asi**, graduated in 2021 2. **Kristjan Karmo**, Testing Area Manager, Coop Pank AS 3. **Mario Pauskar**, Chief Technology Officer, Ridango 4. **Maarit Maremäe**, Head of Baltic Internet Bank IT Development, SEB Bank 5. **Rudolf Purge**, Team Lead at OIXIO 6. **Einar Laagriküll**, Head of Base Services Domain, IT and Development Centre of the Estonian Ministry of Interior (SMIT)

		7. **Kristjan Hinn**, Head of Infrasturcture Engineering Services division, The North Estonia Medical Centre (PERH)
	9C. Industrial Engineering and Management (MARM)	1. **Indrek Kiolein**, Baltics Area Sales Director at IDEAL Group 2. **Aleksei Snatkin**, Strategic Sourcing Manager at Stoneridge 3. **Annemari Sepp**, alumna, Product Owner at Ericsson 4. **Tõnu Lelumees**, Chairman of the Supervisory Board at Federation of Estonian Engineering Industry 5. **Frid Kaljas**, Chair of the Programme Advisory Board, Festo Oy Head of Sales 6. **Marko Paavel**, Member of the Programme Advisory Board, Head of Business Unit - Energy at Harju Elekter Elektrotehnika AS 7. **Jüri Riives**, Adjunct Professor, Member of the Programme Advisory Board, IMECC OÜ
	9D. Telematics and Smart Systems (EDTR)	1. **Maksim Dmitrijev**, Member of the Programme Advisory Board (Virumaa), graduated in 2021, Viru Keemia Grupp, Computer Network Administrator/ IT division 2. **Vladislav Zaitsev**, Chair of the Programme Advisory Board (Virumaa), Eesti Energia AS, Process Automation Lead Engineer 3. **Artjom Hiisku** – graduated in 2021, System Administration Specialist at Forus Security AS 4. **Natalja Horohordina**, Head of Recruitment and Future Staff, Eesti Energia AS 5. **Tiit Vapper**, Member of the Programme Advisory board (Tartu), Reaalsüsteemid AS 6. **Aleksandr Florip**, Member of the Programme Advisory Board (Tartu), Ldiamon AS 7. **Liivika Koobakene**, graduated in 2021 8. **Jaanika Abel**, graduated in 2021

		All participate virtually via Teams.
14.45 – 15.00	*Break*	
15.00 – 15.45	Meetings with teaching staff	*Diverse representation of teaching staff (permanent and visiting; gender, positions, novice and experienced, local and international, including recently hired international faculty), max 8 persons*
	10A. International Business Administration (TVTB)	1. **Wolfgang Dieter Gerstlberger**, Tenured Associate Professor, Department of Business Administration, School of Business and Governance 2. **Simona Ferraro**, Senior Lecturer, Department of Economics and Finance, School of Business and Governance 3. **Maris Zernand-Vilson**, Senior Lecturer, Department of Business Administration, School of Business and Governance 4. **Karin Reinhold**, Associate Professor, Department of Business Administration, School of Business and Governance 5. **Karin Jõeveer**, Associate Professor, Department of Economics and Finance, School of Business and Governance 6. **Oliver Parts**, Associate Professor, Department of Business Administration, School of Business and Governance 7. **Natalie Aleksandra Gurvitš-Suits**, Associate Professor, Department of Business Administration, School of Business and Governance 8. **Liis Ojamäe**, Associate Professor, Department of Business Administration, School of Business and Governance
	10B. IT Systems Administration (IAAB)	1. **Ken Peedimaa**, Visiting Lecturer, IT College, School of IT 2. **Edmund Laugasson**, Lecturer, IT College, School of IT 3. **Mohammad Tariq Meeran**, Senior Lecturer, IT College, School of IT

		4. **Kaido Kikkas**, Associate Professor, IT College, School of IT 5. **Aleksei Talisainen**, Lecturer, IT College, School of IT 6. **Nadežda Furs**, Visiting Lecturer, IT College, School of IT 7. **Roman Kuchin**, Visiting Lecturer, IT College, School of IT **Translator** Kertu Liik
	10C. Industrial Engineering and Management (MARM)	1. **Martin Eerme**, Professor, Department of Mechanical and Industrial Engineering, School of Engineering 2. **Kashif Mahmood**, Researcher, Department of Mechanical and Industrial Engineering, School of Engineering 3. **Jüri Majak**, Professor, Department of Mechanical and Industrial Engineering, School of Engineering 4. **Pavel Tšukrejev**, Site Manager at Swappie 5. **Tauno Otto**, Tenured Full Professor, Department of Mechanical and Industrial Engineering, School of Engineering 6. **Margus Müür**, Lecturer, Department of Mechanical and Industrial Engineering, School of Engineering 7. **Tarvo Niine,** Associate Professor, Department of Business Administration, School of Business and Governance
	10D. Telematics and Smart Systems (EDTR)	1. **Avar Pentel**, Lecturer, Virumaa College, School of Engineering 2. **Olga Dunajeva**, Lecturer, Virumaa College, School of Engineering 3. **Sergei Pavlov**, Lecturer, Virumaa College, School of Engineering 4. **Oleg Shvets**, Lecturer, Virumaa College, School of Engineering 5. **Merik Meriste**, Associate Professor, Tartu College, School of Engineering

		6. **Ago Rootsi**, Lecturer, Tartu College, School of Engineering 7. **Sven Oras**, Senior Lecturer, Tartu Collage, School of Engineering 8. **Rinaldo Rüütli**, Engineer, Tartu College, School of Engineering *All participate virtually via Teams.* **Translator** Karin Keerdo-Massa
15.45 – 16.00	*Break*	
16.00 – 16.45	Study programme management	
	11A. International Business Administration (TVTB)	1. **Merle Küttim**, Researcher, Programme Director, School of Business and Governance 2. **Laivi Laidroo,** Associate Professor, Vice-Dean for Academic Affairs, School of Business and Governance
	11B. IT Systems Administration (IAAB)	1. **Siim Vene**, Lecturer, Programme Director, IT College, School of IT 2. **Kalle Tammemäe,** Associate Professor, Vice-Dean of Bachelor's Studies, Director of IT College, School of IT
	11C. Industrial Engineering and Management (MARM) **and** Product Development and Robotics (EARB)	1. **Kristo Karjust**, Tenured Associate Professor, Programme Director (MARM), School of Engineering 2. **Raivo Sell,** Tenured Associate Professor, Programme Director (EARB), School of Engineering 3. **Ivar Annus,** Tenured Assistant Professor, Vice-Dean for Academic Affairs, School of Engineering
	11D. Telematics and Smart Systems (EDTR)	1. **Helle Hallik**, Senior Researcher, Programme Director, Tartu College, School of Engineering 2. **Žanna Gratšjova**, Lecturer, Programme Director, Virumaa College, School of Engineering 3. **Mare Roosileht**, Director of Virumaa College, School of Engineering 4. **Lembit Nei**, Director of Tartu College, Professor, School of Engineering *All participate virtually via Teams.*
16.45 – 17.00	*Break*	

17.00 – 18.00	*Panel meeting for summing up the Tuesday meetings*	

Wednesday, October 6 *All times in the schedule are in Estonian (EET/UTC+3)		
Time	Activity	Representatives of TalTech *Names of the interviewees and their positions*
8.45-10.00	12. Campus tour – School of Engineering labs - Mäemaja (Construction Hill Building) labs - Short walk and ride with self-driving car to U06-building - Acoustics Laboratory + rooms for student projects (bicycle ja scooter, Wheele, Climbing wall, etc), Student clubs (Formula Student, Robotex, Robotics Club, Solaride; - Energy Technology Laboratory - The Laboratory of Optoelectronic Materials Physics *If there is time (also available at https://virtuaaltuur.taltech.ee/)* - 3D prototyping Centre ProtoLab (3D scanners, 3D printers and laser sintering units, - Self-driving Vehicles and Autonomous Vehicles Lab (ISEAUTO), - Research Centre of Smart Industry and Robotics	1. **Fjodor Sergejev**, Tenured Assistant Professor, Dean of School of Engineering 2. **Jarek Kurnitski**, Tenured Full Professor, Director of Department of Civil Engineering and Architecture, School of Engineering 3. **Eero Tuhkanen**, Lecturer, Business Development Specialist, Department of Civil Engineering and Architecture 4. **Kristjan Lill**, Quality Manager of Laboratory, Department of Civil Engineering and Architecture, School of Engineering 5. **Raivo Sell**, Tenured Associate Professor, Programme Director (Product Development and Robotics) 6. **Jüri Lavrentjev**, Professor, Department of Mechanical and Industrial Engineering, School of Engineering 7. Georg Kõivumägi, Captain of the Student Formula team, master's student of Industrial Engineering 8. **Ave Laas**, CEO, Robotex International 9. **Rauno Kiviberg**, Member of the Board of TalTech Robotics Club 10. **Mart Erik Kermes**, Engineering Project Manager, Solaride (SolarCar Estonia)

		11. **Alar Konist**, Tenured Associate Professor, Head of Research Group, Research Group of Sustainable Energy and Fuels, Department of Energy Technology, School of Engineering 12. **Andres Siirde**, Tenured Full Professor, Director of Department of Energy Technology, School of Engineering 13. **Maarja Grossberg**, Tenured Full Professor, Department of Material and Environmental Technology, School of Engineering 14. **Tauno Otto**, Tenured Full Professor, Department of Mechanical and Industrial Engineering, School of Engineering 15. **Le Liu**, PhD student 16. **Kristo Karjust**, Tenured Associate Professor, Programme Director (MARM), School of Engineering 17. **Tõnis Raamets**, Early Stage Researcher, Department of Mechanical and Industrial Engineering, School of Engineering
10.15 - 10.45	*Panel meeting*	
10.45– 11.35	13. Meeting with Vice-Rector for Entrepreneurship	**Sven Illing**, Vice-Rector for Entrepreneurship
11.35 – 12.15	*11.35-11.50 panel discussion* *11.50-12.15 break*	
12.15– 13.05	14. Meeting with Vice-Rector for Research	**Maarja Kruusmaa**, Professor, Vice-Rector for Research, Member of Estonian Academy of Sciences, Member of the Group of Chief Scientific Advisors of the European Commission
13.05 – 14.30	*13.05 – 13.20 panel discussion* *13.20 – 14.30 lunch*	
14.30 – 15.15	Parallel meetings	
	15A. Theme: Study process Topics:	1. **Betra Leesment**, Study Director, Head of the Office of Academic Affairs

	- Admissions (Estonian and International) - Support of study regulations and Study information system - Support for developing e-courses and using e-tools	2. **Kirsti Naaber,** Student Admission Officer, Admission and Student Counselling Centre, Office of Academic Affairs 3. **Barbara Hein,** Counsellor, Admission and Student Counselling Centre, Office of Academic Affairs 4. **Marilin Kivisto,** Chief International Admissions Officer, Office of Academic Affairs 5. **Liisi Järve**, Head of Eduational Technology Centre, Office of Academic Affairs 6. **Raido Puust**, Tenured Assistant Professor, Department of Civil Engineering and Architecture, School of Engineering 7. **Ülle Laur**, Study Information System Development Manager, Office of Academic Affairs 8. **Ivar Annus**, Tenured Assistant Professor, Vice-Dean for Academic Affairs, School of Engineering **Translator** Kertu Liik
	15B. Theme: Research, Development and Creative activities (RDC) Topics: - Research - Research projects - PhD studies	1. **Maia-Liisa Anton**, Head of the Research Administration Office 2. **Kiira Parre**, Research and Development Analyst, Research Administration Office 3. **Erkki Karo**, Tenured Associate Professor, Director of Ragnar Nurkse Department of Innovation and Governance (*via Teams*) 4. **Maie Bachmann,** Tenured Assistant Professor**,** Vice-Dean for Research, School of IT 5. **Ilona Oja Acik**, Tenured Associate Professor, PhD Programme Director (Chemical and Materials Technology), School of Engineering 6. **Sadok Ben Yahia**, Professor, Head of Data Science Group, Department of Software Science, School of IT 7. **Mihkel Kõrgesaar**, Tenured Assistant Professor, Kuressaare College, School of Engineering

		8. **Tarmo Soomere**, Professor, Department of Cybernetics, School of Science, President of Estonian Academy of Sciences
15.15 – 15.45	*15.15 – 15.30 panel discussion* *15.30 – 15.45 break*	
15.45 – 16.30	Parallel meetings	
	16A. Theme: Student support system Topics: - Academic counselling - Career counselling - Psychological counselling - Support for student with disabilities - Student feedback system - Extracurricular activities (Formula Student etc)	1. **Monika Sutrop**, Career Counsellor, Admission and Student Counselling Centre, Office of Academic Affairs 2. **Pillemari Lilleorg**, Counsellor, Admission and Student Counselling Centre, Office of Academic Affairs; student of Public Administration and Governance 3. **Heili Kangust**, Head of Centre of Academic Affairs, Estonian Maritime Academy 4. **Kersti Matiisen**, Academic Quality Assurance Coordinator, Office of Academic Affairs (student feedback specialist) 5. **Lenne-Liisa Heinoja**, Previous board member of educational affairs at Student Union (until july 2021), student quality work group coordinator (until july 2021), master's student of Building and Infrastructure Engineering 6. **Riina Tallo**, Internship Coordinator, Dean's Office, School of Information Technologies 7. **Georg Kõivumägi**, Captain of the Student Formula team, master's student of Industrial Engineering 8. **Kaisa Hansen,** Start-up Manager, Technology Transfer Office (innovation club) **Translator:** Kertu Liik
	16B. Theme: Academic integrity Topics: - Institutional structure (committees etc.) - Good research practice and research ethics - Academic ethics in teaching and learning	1. **Birgy Lorenz**, Researcher, Department of Software Science, School of IT (Chair of Academic Ethics Committee, Researcher)

	- Equal treatment of members	2. **Tanel Kerikmäe**, Professor, Department of Law, School of Business and Governance (previous head of Academic Ethics Committee) 3. **Kaire Prems**, Head of Internal Audit 4. **Liina Võssotskaja**, Legal Adviser, Human Resources Office 5. **Henri Schasmin**, Coordinator for Protection of Personal Data and State Secrets. Rectorate Strategy Office 6. **Archil Chochia**, Senior Researcher, Department of Law, School of Business and Governance (member of Academic Ethics Committee) 7. **Aive Pevkur**, Senior Lecturer, Department of Business Administration, School of Business and Governance (expert of ethics, member of Academic Ethics Committee) 8. **Jakob Kübarsepp**, Professor Emeritus, Department of Mechanical and Industrial Engineering, School of Engineering (member of Academic Ethics Committee, previous Vice-Rector for Academic Affairs) **Translator** Liina Sudak
16.30 – 17.00	*16.30 – 16.45 panel discussion* *16.45 – 17.00 break*	
17.00 – 17.45	Parallel meetings	
	17A. Theme: Management support Topics: - Management support - Planning and evaluation - Administrative and technical support - Management information systems	1. **Tea Trahov,** Acting Director for Administration (as of Oct 1 Director for Administration) 2. **Kaja Kuivjõgi**, Quality Manager-Strategy Manager, Rectorate Strategy Office 3. **Renno Veinthal**, Professor, Department of Mechanical and Industrial Engineering, Director of the Department of Material and Environmental Technology 4. **Raul Hanson**, Head of Information Technology Services, previous Business Architect 5. **Laura Mere**, Councellor to Vice-Rector for Academic Affairs, Head of Development and Quality Division, Office of Academic Affairs

		6. **Aleksander Vukkert**, Chief Officer of Research and Development Projects, Research Administration Office 7. **Ruth Laos**, Head of Support Unit, Department of Software Science, School of IT 8. **Martin Malm**, Business Architect, Rectorate Strategy Office **Translator** Liina Sudak
	17B. Theme: Marketing and communication Topics: - Internal and external communication - Marketing activities and the university's brand - Student recruitment marketing (national and international) - Research communication	1. **Anne Muldme**, Head of Marketing and Communications Office 2. **Hele-Riin Pihel,** Head of Centre of E-channels, Marketing and Communications Office 3. **Keit Kiissel**, Head of International Marketing, International Marketing and Student Recruitment Division, Office of Academic Affairs 4. **Rutt Hints**, Researcher, Department of Geology, School of Science, Programme Director (Georesources; Earth Sciences and Geotechnology) 5. **Sander Sein,** Programme Director (Road Engineering and Geodesy), Lecturer, School of Engineering (*via Teams*) 6. **Karin Härmat**, Marketing and Communication Officer, School of IT 7. **Heili Sõrmus**, Marketing and Alumni Specialist, School of Business and Governance 8. **Kaire Uusen,** Head of Science Communication, Marketing and Communications Office **Translator** Kertu Liik
17.45 -18.45	*Panel meeting for summing up the Wednesday meetings*	

Thursday, October 7

*All times in the schedule are in Estonian (EET/UTC+3)

Time	Activity	Representatives of TalTech *Names of the interviewees and their positions*
8.45-10.0	18. Campus tour – School of Science research groups/labs: - Supramolecular Chemistry - Structural Biology and Lignin biochemistry - Molecular Neurobiology - - Plant Pathogen Interaction Laboratory of Systems Biology	1. **Pirjo Spuul**, Senior Researcher, Department of Chemistry and Biotechnology, School of Science 2. **Riina Aav**, Tenured Associate Professor, Department of Chemistry and Biotechnology, School of Science 3. **Tiit Lukk**, Senior Researcher, Department of Chemistry and Biotechnology, School of Science 4. **Tõnis Timmusk**, Tenured Full Professor, Department of Chemistry and Biotechnology, School of Science 5. **Maria Cecilia Sarmiento Guerin**, Associate Professor, Senior Researcher, Programme Director, Department of Chemistry and Biotechnology, School of Science 6. **Marko Vendelin**, Senior Researcher, Department of Cybernetics, School of Science
10.15 - 10.45	*Panel meeting*	
10.45– 11.30	19. Meeting with all Deans of the Schools and Director of EMARA	1. **Fjodor Sergejev,** Tenured Assistant Professor, Dean of School of Engineering 2. **Enn Listra,** Professor, Dean of School of Business and Governance 3. **Gert Jervan,** Tenured Full Professor, Dean of School of Information Technologies 4. **Andrus Salupere,** Tenured Full Professor, Dean of School of Science 5. **Roomet Leiger,** Director of Estonian Maritime Academy
11.30 – 12.00	*11.30 -11.45 panel discussion* *11.45 -12.00 break*	
12.0 – 12.45	20. Meeting with representatives of the University Council	1. **Gunnar Okk**, Chairman of the Council, Vice President and Chief Operating Officer of Nordic Investment Bank, Member of the Research and Development Council of Estonia, appointed by the Ministry of

		Education and Research, Member of the Council since 2015 (*via Teams*) 2. **Maive Rute**, Deputy Director-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) of the European Commission, Member of the Research and Development Council of Estonia, appointed by the Ministry of Education and Research, Member of the Council since 2020 (*via Teams*) 3. **Tiina Randma-Liiv**, Tenured Full Professor of Public Policy at TalTech, Member of the Estonian Academy of Sciences, appointed by the Senate, Member of the Council since 2020 4. **Mart Saarma**, Professor of Biotechnology, Research Director at University of Helsinki, Member of the Estonian Academy of Sciences, Member of the Research and Development Council of Estonia, Appointed by the Estonian Academy of Sciences, Member of the Council since 2015 5. **Andres Öpik**, Professor Emeritus at TalTech, Member of the Estonian Academy of Sciences, Appointed by the Senate, Member of the Council since 2015 6. **Tõnis Kanger**, Tenured Full Professor of Organic Synthesis at TalTech, Former Dean of School of Science, Appointed by the Senate, Member of the Council since 2020 7. **Robert Kitt**, Chairman of the Board of AS Utilitas Eesti, Chairman of TalTech Alumni Association and TalTech Develoment Fund, Appointed by the Ministry of Education and Research, Member of the Council since 2015
12.45 -13.15	*12.45 -13.00 panel discussion* *13.00 – 13.15 break*	
13.15-14.00	21. Meeting with representatives of the Student Union	1. **Sten Ärm**, Chairman of the Board of the Student Union, student of Informatics BSc, School of Information Technologies

		2. **Engel-Mari Mölder**, Member of the Board of the Student Union, student of E-Governance Technologies and Services MSc, School of Information Technologies (*via Teams*) 3. **Sven Põder**, Member of the Student Parliament, PhD student, School of Science 4. **Anna Suzdalev**, Member of the Student Union, student of Business BSc, School of Business and Governance 5. **Lisethe Angelika Vähi**, Member of the Student Parliament, student of Ship Navigation BSc, Estonian Maritime Academy 6. **Anett Pook**, Member of the Student Union, student of Architecture MSc, School of Engineering 7. **Johanna Heinonen**, Member of Erasmus Student Network TalTech, international student of Cyber Security Engineering BSc, School of Information Technologies
14.00 -15.00	*14.00 -14.15 panel discussion* *14.15 – 15.00 lunch*	
15.00 – 15.45	Parallel meetings	
	22A. Theme: Human resource management Topics: - Academic career model and evaluation - Recruitment of academic staff - Personnel development - Remuneration of employees	1. **Tea Trahov**, Head of Human Resources Office (as of 1 Oct Director for Administration) 2. **Marju-Triin Pilt**, Personnel Management Specialist, Human Resources Office 3. **Jarek Kurnitski**, Tenured Full Professor, of Department of Civil Engineering and Architecture, School of Engineering 4. **Maria Cecilia Sarmiento Guerin**, Associate Professor, Senior Researcher, Programme Director, Department of Chemistry and Biotechnology, School of Science 5. **Kadri Männasoo**, Tenured Full Professor, Department of Economics and Finance, School of Business and Governance

		6. **Marko Kääramees,** Associate Professor, Director of Department of Software Science, School of IT 7. **Tiia Rüütmann,** Head of Estonian Centre of Engineering Pedagogy, Associate Professor, School of Engineering; President-Elect of International Society for Engineering Pedagogy (*via Teams*)
	22B. Theme: Internationalisation (staff and students) Topics: - International cooperation - International mobility - Internationalisation at home	1. **Reijo Karu,** Head of International Cooperation, Rectorate Strategy Office 2. **Riina Potter,** Head of Mobility Centre, Erasmus+ Institutional Coordinator, Office of Academic Affairs 3. **Marika Lunden**, Deputy Head of Research Administration Office (responsible for internationalisation of research) 4. **Katri Liiv**, Coordinator of International Staff Centre, Human Resources Office 5. **Kevin Ellis Parnell,** Research Professor, Department of Cybernetics, School of Science 6. **Yazeed Haddad,** President of the Erasmus Student Network, TalTech's Student of the Year 2020 7. **Prashanth Konda Gokuldoss,** Tenured Full Professor, Department of Mechanical and Industrial Engineering, School of Engineering 8. **Aet Michelson,** EuroTeQ Project Manager, Office of Academic Affairs
15.45 -16.15	*15.45 -16.00 panel discussion* *16.00 – 16.15 break*	
16.15 -17.00	Parallel meetings	
	23A. Theme: Financial management and resources Topics: - Financial management and position - University's budget - Campus/real estate/infrastructures	1. **Helen Sooväli-Sepping,** Vice-Rector for Green Transition 2. **Margit Pado,** Head of Budget and Analysis Division, Finance Office 3. **Georg Logins,** Chief Real Estate Officer, Real Estate Office

		4. **Ave Tamm**, Chief Accountant, Head of Accounting Division, Finance Office 5. **Ralf-Martin Soe**, Founding Director and Senior Research Fellow of Smart City Centre of Excellence 6. **Marika Lunden**, Deputy Head of Research Administration Office 7. **Mari Avarmaa**, Director of Department of Business Administration, Senior Lecturer, School of Business and Governance 8. **Ivo Palu**, Tenured Associate Professor, Director of Department of Electrical Power Engineering and Mechatronics, School of Engineering **Translator** Liina Sudak
	23B. Theme: Service to Society Topics: - Lifelong learning - Cooperation between researchers and companies and organisations	1. **Hanno Tomberg,** Head of TalTech Open University 2. **Reet Pärgmäe,** Head of Technology Transfer Office 3. **Anu-Mai Levo,** Entrepreneurship Cooperation Coordinator, Technology Transfer Office 4. **Tõnis Liibek,** Director of TalTech Library 5. **Maarja Grossberg,** Tenured Full Professor, Department of Material and Environmental Technology, School of Engineering 6. **Robert Kitt,** Chairman of TalTech Alumni Association, Chairman of TalTech Develoment Fund, Member of the TalTech Council since 2015, Chairman of the Board of AS Utilitas Eesti 7. **Indrek Orav,** Tehnopol, CEO 8. **Jenni Vilhelmiina Partanen,** Research Professor, School of Engineering (*via Teams*) **Translator** Hanna Hiiesalu
17.00 -18.00	*Panel meeting for summing up the Thursday meetings*	

Friday, October 8

*All times in the schedule are in Estonian (EET/UTC+3)		
Time	Activity	Representatives of TalTech *Names of the interviewees and their positions*
8.45–10.00	24. Campus tour – IT College labs - High Performance Computing Centre - Cisco Lab, Regional unit of Cisco Academy Hardware Lab + Mobile Applications TestLab	1. **Gert Jervan,** Tenured Full Professor, Dean, School of IT 2. **Kalle Tammemäe**, Director of IT College, School of IT 3. **Lauri Anton**, Head of HPC Centre, IT College, School of IT 4. **Mohammad Tariq Meeran,** Senior Lecturer, Head of Cisco Lab, IT College, School of IT 5. **Siim Vene**, Lecturer, IT College, School of IT
11.00-13.00 LINK TO THE MEETING	25. Demo of internal management tools – data (Power-BI reports), Organisation Manual SMART, Intranet services portal (Jira for different internal services, e.g IT, HR, real estate)	1. **Kaja Kuivjõgi**, Quality Manager-Strategy Manager, Rectorate Strategy Office 2. **Martin Malm**, Business Architect, Rectorate Strategy Office 3. **Raul Hanson**, Head of Information Technology Services, previous Business Architect 4. **Marden Nõmm**, Chief Analyst, Rectorate Strategy Office
	"open doors" *opportunity for those from TalTech who want to come to discuss various topics related to institutional accreditation with the expert panel*	
	ad hoc interviews *in case we have discovered during the visit that we need to talk (again) with someone*	
13.00 -14.00	*Lunch*	
14.00 -15.30	Panel meeting, preparing for the preliminary conclusions	

15.30-16.00	Open meeting to staff and students: presentation of preliminary conclusions by the panel	
16.00 – 18.00	*Panel meeting for summing up the visit. Next steps.*	