ESTONIAN QUALITY AGENCY
FOR HIGHER AND VOCATIONAL EDUCATION

Report on Quality Assessment of PhD Study Programme Group of Life Sciences

Tallinn University

2021

Content

1. Introduction

Quality assessment of PhD study programme groups

Quality assessment of a study programme group involves the assessment of the conformity of study programmes and the studies and development activities that take place on their basis to legislation, national and international standards and developmental directions with the purpose of providing recommendations to improve the quality of studies.

The goal of quality assessment of a study programme group is supporting the internal evaluation and self-development of the institution of higher education. Quality assessment of study programme groups is not followed by sanctions: expert assessments should be considered recommendations.

Quality assessment of a study programme group takes place at least once every 7 years based on the regulation approved by EKKA Quality Assessment Council for Higher Education "Quality Assessment of Study Programme Groups at the Level of Doctoral Studies".

The aim of the expert panel was the evaluation of the **Study Programme Group (SPG) of Life Sciences at Tallinn University**.

The panel was asked to assess the conformity of the study programmes belonging to the study programme group and the instruction provided on the basis thereof to legislation and to national and international standards and/or recommendations, including the assessment of the level of the corresponding theoretical and practical instruction, the research and pedagogical qualification of the teaching staff and research staff, and the sufficiency of resources for the provision of instruction.

The assessment took place in April 2021. The Estonian Quality Agency for Higher and Vocational Education (EKKA) formed an international expert panel. **The following persons formed the expert panel:**

Laurent Counillon *Chair*	Professor, University Nice Sophia Antipolis; France
Asnate Kažoka	PhD student, University of Latvia; Latvia
Kari Keinänen	Professor, University of Helsinki; Finland
Rik Leemans	Professor, Wageningen University; The Netherlands
Andrus Tasa	ToxInvent OÜ; Competence Centre on Health Technologies; TBD Biodiscovery; Biotehnoloogia Park Kinnisvara Ltd; Estonia

Assessment process

The assessment process was coordinated by Mr Hillar Bauman (EKKA).

After the preparation phase, the work of the expert panel in Estonia started on March 12, with an introduction to the Higher Education System as well as the assessment procedure by EKKA, the Estonian Quality assurance organization for higher and vocational education. The members of the panel met online also in the morning, April 5, agreed the overall questions and areas to discuss with different groups at Tallinn University. The distribution of tasks between the members of the panel was organised and the detailed schedule of the site visit agreed.

During two days – Monday 5 and Tuesday 6 April – meetings were held with the representatives of Tallinn University.

On Wednesday, April 7, the panel held a meeting, during which both the structure of the final report was agreed and findings of panel were compiled in a first draft of the assessment report. This work was executed in a cooperative way and the members of the panel intensively discussed their individual views on the relevant topics.

In the following sections of the report, the expert panel summarise their general findings, conclusions and recommendations which are relevant across the whole SPG. The panel provides an external and objective perspective on the programmes and the contexts within which they are delivered. The intention is to provide constructive comment and critique which may form the basis upon which improvements in the quality of the programmes may be achieved.

Tallinn University provided some explanations and comments on the preliminary report of the panel. When finalizing the assessment report, the panel took into consideration comments made by the university and made some adjustments in the final report. The panel submitted the final report to EKKA on 20.05.2021.

Impressions of the institution, self-assessment report and the site-visit

Institution

TLU aims to implement a significant evolution from the previous reform that dated from 2015 (see later) in order to "offer higher education based on integrated study, research and development" (SER, page 13). To achieve this, they intend to build more interdisciplinary and more problem-based learning approaches and training programmes (panel interview with the Vice Rector April 5). This is an interesting move that fits well within the TLU pedagogical and educational agile model and may enable this establishment to build interesting niches that would differentiate them from the other Estonian Universities that have a stronger scientific disciplinary identity. The 14 TLU PhD programmes are expected to evolve in this context, thereby allowing more connections between students and opening to more interdisciplinary programmes. Pedagogically, the trend would be to decrease the volume of classical courses and open to more personal work and research that would include a larger use of textbooks, electronic resources, more interactive courses and less knowledge-based exams (panel interview with the Vice Rector, April 5, 2021). The committee however points out that such a move, that goes within a general trend observed within Universities might jeopardize the efforts to train students to interdisciplinarity. By its nature, such an approach requires to integrate knowledge and reasoning from different fields thereby increasing the volume of courses to properly train the students. Taken together the institution has to define an adequate trade-off between less academic courses and more self-learning and the necessity to train at high level from multiple angles to develop interdisciplinarity.

TLU has created different schools including the School of Natural Sciences and Health (SNSH) that has around 1300 students, 130 employees, including 12 professors, 14 associate professors, and 44 lecturers. It hosts the present program under its Natural Sciences and Sustainability axis. (SER P13)

In line with the strategic planning for TLU future development, SNHS has launched a new interdisciplinary doctoral study programme termed Health Behaviour and Wellbeing in 2016-2017.

The Complex Systems in Natural Sciences PhD programme under examination here is the second interdisciplinary programme.

To accompany this evolution, TLU expresses a strong support to research (see further in the report) and this is particularly important at the PhD level.

Self-Assessment Report

The self-assessment report is a 99 pages document including annexes. This report contains a large amount of information, in a well written English, that were used by the present panel to prepare the site visit. The document was compiled in 2019 and 2020 from a panel composed of the Head of Studies (for the first part of the report) and the persons, mostly in charge of the present programme (Ecology and Analytical Chemistry). The Self-Evaluation section of the document is well organized. Its chapters follow the evaluation criteria, each being followed by a rapid compilation of Strength, Area of improvement and Planned improvement. It has to be noted however that the great majority (64 pages) of the document is occupied by the annexes (Pages 35 to 99), and that the Self-analysis section itself is comprised between pages 20 and 33. While it is important to provide the panels background information and data, conveying the main message on the programme to be evaluated in about 13% of the total document is not fully informative. In addition, the very large annexes make the relevant information sometimes tedious to identify.

Site Visit

Due to the current pandemics, the site visit could not take place physically but instead was conducted through zoom meetings. This detracted from visiting the teaching and research facilities but as most of panel members had already participated in TLU evaluation panels this was not too detrimental for the evaluation. Importantly, all meetings functioned very well technically and were conducted in a with a very open and positive attitude that helped to share valuable information and conveyed the dynamic of the present restructuration and programme creation.

2. General information about Tallinn University and the PhD study programme group of Life Sciences

Tallinn University (hereafter also referred to as *the University* or *TLU)* is the third largest public university in Estonia and focuses primarily on the fields of humanities, social sciences, and natural sciences. TLU is a result of the merger of several higher education institutions (Tallinn Pedagogical University, Academy Nord*,* Estonian Institute of Humanities, Institute of History of the Estonian Academy of Sciences, and the Academic Library of Estonia) into a single institution, which resulted in the founding of TLU as a public university on 18 March 2005. The chief milestones in the history of the university's predecessors and founders since 1919 can be found on the TLU homepage.

In 2015, a significant structural and management reform took place. 26 existing then academic units were replaced by just 6 schools (Baltic Film, Media, Arts and Communication School; School of Humanities; School of Digital Technologies; School of Educational Sciences; School of Governance, Law and Society; School of Natural Sciences and Health), 1 regional college in Haapsalu, and the Academic Library. Also, 5 Centres of Excellence (e.g., CE in Behavioural and Neural Sciences, CE in Interdisciplinary Life-course Studies) and 6 research centres were established (e.g., Centre for

Innovation in Education; Competence Centre in Health Promotion and Rehabilitation; Estonian Institute for Population Studies; Institute of International Social Studies).

The strategic development priorities are set out in the Tallinn University Development Plan 2015–2020.

The strategic objective of TLU for 2015–2020 is to consolidate its activities into five focus fields:

1) educational innovation;

2) digital and media culture;

3) cultural competences;

4) healthy and sustainable lifestyle;

5) society and open governance.

From 2015, each focus field is represented by a separate school, while the School of Digital Technologies fulfils also a supporting role with digital technologies and analytics for all other schools.

TLU has currently about 7,100 students (10.6% of them international) and over 800 employees, including over 500 researchers and lecturers. The university campus is located mainly in the centre of Tallinn

Aggregate data about the study programme group

	2016	2017	2018	2019	2020
Number of doctoral students, *Analytical Biochemistry/Ecology*	9/20	6/16	8/14	9/9	8/8
Admissions, *Analytical Biochemistry/Ecology*	1/1	1/-	3/1	1/2*	2/1
Number of dropouts, *Analytical Biochemistry/Ecology* (incl. voluntary withdrawals)	-/2	2/4	1/1	-/4	2/-
Number of doctoral theses defended, *Analytical Biochemistry/ Ecology*	1/1	2/-	-/2	-/3	1/2
Number of international students, *Analytical Biochemistry/Ecology*	-/-	-/-	3/1	3/-	4/-

*External graduates

3. Main changes based on recommendations of the last quality assessment of the PhD study programme group of Life Sciences

The Complex Systems in Natural Sciences programme is a new PhD programme that will open in September 2021. Because it is also a merger of two existing programmes, the committee had the complex task to analyse data from the presently running programmes (e.g. research subjects, funding, PhDs, dropout rates, courses contents), while evaluating a programme that did not start yet. For clarity this section will first focus on the new programme creation before analysing the different indicators that pertain to the present situation. We will recapitulate here the more prominent points, the reader being referred to the specific sections (Programme, resources, staff, students) for a more detailed analysis.

The previous assessment (2018) pointed out a set of major problems and made main recommendation:
- The lack of critical mass of both students and supervisors within the programme.
- The need to better formulate an identity and find a niche where to be competitive.
- The necessity to network with other actors in particular from private companies.
- The need to develop a 5-year strategic plan.
- The necessity to release the "3 published papers rule" that prolonged the PhD duration in an undue manner.
- The need to reduce the dropout rates and overtime theses due to the too low PhD fellowships.

As stated above, the original solution found by the institution to address these problems as a whole is to make a **merger of the Ecology and Analytical Biochemistry programmes, in order to build a multidisciplinary PhD programme entitled "Complex Systems in Natural Sciences (CSNS)".** Within CSNS, the two previous programmes are still represented as two fields of study: "Environmental Ecology" and "Functional Biomolecules and systems". The new programme is reinforced by the addition of the former Physics programme, which was discontinued in itself. In this respect, it is interesting to notice that the **future programme director is Prof. Tõnu Laas, who is neither an ecologist nor a biochemist but a physicist**. Both the SER and the interviews with the administrators show that the elaboration of CSNS was done in a methodical manner (planned meetings, involved participants, minutes, documents…). The proposal for CSNS was then validated by the University Senate in May 2020 and registered by the Ministry of Education and Research in summer 2020.

The first important message from the present evaluation is that this bold merging had a positive impact on the community as it promoted discussions and collaborations between scientists. The students were also very satisfied of their enhanced possibilities of interaction, and of the novel dispositions such their newly organized PhD seminar series. Within all panels, the committee noticed a general sense of optimism and pride in belonging to an institution that allows flexibility and scientific freedom.
This collaborative spirit was also visible through the presence of visiting professors from Tartu University, and through strong links with TalTech confirming the active collaborations mentioned in the self-assessment report. TLU national and international network is also very effective through PhD shared co-supervisions that brings needed expertise to some projects. This openness is particularly appreciated by the students who don't hesitate to solicitate themselves co-supervisors, who are generally very well accepted. It is also an important asset in building a new and ambitious programme such as CSNS.

Besides these positive points, both the SER and the interviews showed that the new programme and its profile are still **very diffuse and have not yet reached a sufficient scientific and pedagogic maturity**. The SER states that the name of the programme "refers to research that covers systems comprehensively, as a conglomeration of interacting components" (SER Page 21) and describes possible intersections between biochemistry and ecology, notably at the level of environmental indicators and mathematical modelling. It also indicates that the "CSNS SP also supports research in the study area of health and disease prevention" (SER Page 22). During the interviews, the head of the programme explained that one of the programme main aims was to connect Ecology and Biochemistry through the use of Maths and Physics. When asked further on the choice of approaches and tools that would be prioritized both for teaching and the research, the interviewed panel was quite evasive. As the committee agrees that complexity is a difficult issue, a more defined strategy is needed, for example as modelling tools for ecology could significantly differ from those used in biochemistry.

This difficulty in defining an approach to complex systems also translates in the teaching programme as only one compulsory course to all CSNS students, Analysis methods and modelling of processes in natural sciences, has been introduced. In this respect the programme will need a greater volume of dedicated courses. This will require trade-offs with the university governance whose policy is to decrease the overall course volume towards more student active learning.
The evaluation committee points that these questions have to be thought deeply as all the originality and added value of the programme are based on them. The committee is also confident that the collaborative spirit and dynamics of the project and staff are **very good indicators that this will be successfully addressed.**

<u>Several other points have also been identified during this assessment</u>

Better funding of PhD students: TLU has decided to top the government €660 stipend by another €500 to be closer to the Estonian average salary (€1200-1400). In addition, two students are paid by Marie Curie fellowships that provide a strong visibility. This should yield shorter PhD as students will not be obliged to work outside, have very long PhD durations or dropout as it is still the case for some of the students enrolled in the previously existing programmes. The impact may be very rapid as already, interviewed students who were receiving a correct funding were confident that they would finish their PhD in 4 years. However, a precise analysis of the current funding shows that out of 15 students having an institutional fellowship, 2 have a government + TLU fellowship, 2 a Marie Curie Fellowship and the other have government fellowships, eventually topped by an internal work as a lecturer or early-stage researcher.
Such better fellowships are also creating an attractivity effect (see later for biochemistry), which is an important issue in solving the above mentioned critical mass issue. In this respect the number of government fellowships has now become the limiting factor and must be increased to ensure the attractivity and thereby the viability of PhD programmes in Estonia.
Another valuable initiative is the possibility given by the institution to students to apply for small grants for their own research. Table Page 24 of the additional information demanded by the committee shows that they are generally successful. In addition to being a significant effort in research funding (72k€ distributed in total) this is educationally an excellent idea to train the students to submit grant application during their PhDs.

Internationalization of both students and staff is excellent: Most of students have been at least to one abroad meeting and/or a research visit. This is also the case for the staff members whom international mobilities (2016-2020) constitute an impressive list (15 pages). Those international stays are productive in a very concrete manner as several students have brought foreign co-

supervisors for their PhD programmes. Taken together, this is an extremely positive point that highlight the dynamism and openness of both the programme and the institution.

The staff members have a good to excellent academic record: and their research topics are well within the area of the two sub-programmes: Environmental Ecology" and "Functional Biomolecules and systems, with the addition of plasma physics for the physics colleagues joining the programme. Here also the difficulty will be to evaluate the ability of the staff and supervisors to implement a significant evolution of their research subjects towards the new programme. From the interviews it was apparent that a small number the supervisors were already ready and had started to write collaborative projects and PhD proposals (e.g. Rando Tuvikene and Jaanus Terasmaa, interview with supervisors, April 6, 2021) while others felt that this change was beyond their research scope. Dealing with research projects, it can be expected that a significant delay will take place before the effects of the present changes will be witnessed.

The present indicators for students (number, PhD duration, dropout rates, funding) are improving but are not optimal: While most causes can largely be found within the previous organization, there are still points of attention for the future.

- The SER shows a relative decrease in the Ecology programme, while the Analytical Biochemistry has a moderate growth, thanks to its European visibility and proactive advertising of PhD positions through Research Gate. Such initiatives could be generalized to the whole new CNSN programme.
- PhD durations are still globally too long because not all students receive a full salary for their thesis. Many still have to work outside (85% of TLU students in total, SER page 12), distracting them from fully using their research time that consequently cannot reach the mandatory 70% of the total PhD duration. We should expect a trend to decrease with the arrival of fully funded PhD students who are confident that they can graduate in four years.
- The "3 published articles rules" has been partially released with the possibility of defending a PhD with 2 published articles and one submitted but this is not enforced by Estonian universities at least in Life Sciences. Aside from the questionable ethical question of leaving a part of the decision on a PhD duration to a foreign editorial board; this rule is another obstacle that synergizes with the previous ones. The committee can only reiterate its previous recommendation to apply the new regulation.

The institution makes efforts in attracting funds from a diversity of sources including companies. In this context, the committee was pleased to learn that (i) a significant effort has been made by the institution, both in the definition of its objectives and in hiring a project specialist for this purpose and (ii) to interview a student making his PhD in a company with a Marie Curie Fellowship. Such a move towards the economic sector will have also a positive impact on training as more and more young PhDs turn towards industry of start-up creation.

Strengths

- The merging the two programmes that can find connections and to open to a wider biology area
- The resulting dynamics and collaborative spirit of a very invested staff
- The strong national links that creates interesting exchanges and synergies with the other national institutions
- The excellent international policy for both staff and students.
- The efforts in funding and attracting PhD students
- The openness towards co-supervision when needed
- The collaboration build-up with companies

Area of Concern and recommendation

- The approach to complexity lacks focus: The programme should include more mathematics and modelling and the use of physics should be better defined.
- There is an urgent need to better define the programme focus, its strategic orientation, its subjects and tools.
- The integration of the change in the research projects is unequal among supervisors. The adhesion of the great majority of supervisors to develop projects in this direction should be ensured, maybe through an incentive policy (students or research dedicated funding).
- The still too long PhD durations mostly due to the ancient funding system
- The three articles rule is still enforced while it has been released at the national level
- Several students still feel isolated in their research but those are mostly from the ancient system

Opportunities for further improvement

- The raise of the students' number to gather a critical mass should also be a preoccupation of the programme. Here also different tools for advertising should be considered and if well designed enough this programme should in principle competitive for external institutional (Europe) or private funding.
- The committee was satisfied to notice that scientific research and doctoral education have climbed in the government priorities (meeting with the employers and partners outside the University, April 6), reflecting great standards in the national ambition. This should translate in a greater fraction of GDP in research and in higher education. The administrators of the CSNS programme should take a maximal advantage of this favourable period to push the building of this ambitious programme and pushing to obtain more PhD funding.

4. Strengths and recommendations for improvement of study programmes by assessment areas

4.1 Study programme

Standards

✓ The launch and development of the study programme are based on the Standard of Higher Education and other legislation, national strategies, university development plans, the effectiveness of research and development, various analyses (including labour market and feasibility analyses); striving for the best overall programme quality.
✓ Doctoral programmes contain at least 70% research, development or other creative work by doctoral students, making the results thereof public in international peer-reviewed research journals or in other ways that have international dimensions.
✓ Study programmes incorporate doctoral student participation in conferences and/or other professional activities, and are counted towards completion of the study programme.
✓ Doctoral programmes enable doctoral students to acquire leadership and teamwork skills, develop coaching and teaching skills as well as a proficiency in foreign languages at the level needed for successful participation in international working environments.
✓ Different components of a doctoral programme form a coherent whole supporting the personal development of each doctoral student.
✓ Study programme development takes into account feedback from doctoral students, supervisors, employers, alumni and other stakeholders.

Evidence and analysis

The study programme group of Life Sciences includes two doctoral-level programmes, Analytical Biochemistry and Ecology, which have been recently merged into a single multidisciplinary programme of Complex Systems in Natural Sciences (CSNS), starting officially with the study year 2021/2022. In all programmes, doctoral studies comprise 240 ECTS of which the Doctoral Thesis accounts for 180 ECTS (75 %), and the rest 60 ECTS is divided between general, subject-specific, and individual studies with a 12 ECTS minimum in all three study modules. The structure of the programme is consistent with national legislature and University statutes.

The launching of the new CSNS programme has been a response to the recommendations of the previous assessment in order to increase student numbers and scientific impact of the two parental programmes and to enhance collaboration in research and teaching. According to information obtained in the interviews or presented in SER, the new programme has been planned and established in compliance with national and university-level legislation and regulations and its design is based on analysis of the situation within the programmes in TLU, including feedback from students, alumni, and employers. In interviews by the panel, the study programme administrators, supervisors and students alike regarded the merger as a positive act, at least in principle, and felt that it has already resulted in new collaborations between research teams and shared supervision of students. At the level of curriculum, the change to a new multidisciplinary programme with a broad title of Complex Systems in Natural Sciences, is not very clear and the old programmes can still be seen in the form of two "fields of study" named as Environmental Ecology and Functional Biomolecules and Systems, reminiscent of the parental programmes of Ecology and Analytical Biochemistry, respectively, both with their own course palettes. Two new courses, compulsory to all CSNS students, have been incorporated into the curriculum: Doctoral seminar in natural sciences (4 ECTS) and Analysis methods and modelling of processes in natural sciences (6 ECTS). The latter course focuses on statistical tools and especially on R programming in data analysis, but the panel feels that studies of complexity should include more extensive training of mathematical and modelling skills than is evident from the curriculum. This problem is discussed in SER (page 14) in the context of comparison of the TLU programme with other related doctoral programmes in Estonia and abroad, and it is emphasized that CSNS aims at providing a wider perspective to complex systems than what is provided by mathematics-heavy programmes and thus can occupy a novel niche in the field. The true meaning of this, and a clear view of the programme´s profile and especially how it differs from the separate old programmes remained, however, unclear to the panel even after discussions with programme administrators and supervisors. Therefore, the panel feels that even though launching of the new programme has already catalysed invigoration of research and doctoral training activities, a commendable achievement, it still falls short of realizing its full potential and of creating a solid identity. The optimistic and energetic spirit of the personnel and students, together with the recruitment plans provide good tools to address these challenges.

Students admitted earlier to the doctoral programmes in Analytical Biochemistry and Ecology up till the ongoing study year (2020/2021) continue in these programmes, but from the next study year (2021/2022) on, new students will be admitted only to the new programme (SER, page 17). Currently there are eight students in Analytical Biochemistry programme and seven students in Ecology programme. Annual admissions in the period 2016-2020 have ranged from zero to three students per programme (SER, page 20) with an average of 1.3 students per programme per year. From 2016 to present, a total 12 doctoral theses have been defended, eight in Ecology and four in Analytical Biochemistry (average 2.3 defences per year). It is unclear if the new doctoral programme will bring any significant improvement to the relatively low student numbers. On the other hand, the admissions are strongly influenced by the government which decides the number of doctoral training positions (and the associated funding) in different fields in the universities.

The students of programmes of Analytical Biochemistry and Ecology have been associated with Doctoral School of Earth Sciences and Ecology and Doctoral School of Biomedicine and Biotechnology, respectively, which have provided support at national level, e.g., by organizing and funding some special courses. According to information in SER (including Additional material with annexes 1 and 2) and interviews, the doctoral students in the new programme will join either one of these doctoral schools, depending on their research topic. In addition, it is suggested that students who have a topic which falls into the area of physical sciences may join the Doctoral School of Functional Materials and Technologies in which SNSH is member. As a result, the students of the new programme may eventually fall into three different national doctoral schools which possibly have different resources and practises. This apparent diversity and potentially unequal treatment of the students may not necessarily form a significant problem as the teaching and financial support for doctoral students is mostly arranged locally at TLU.

Doctoral studies comprise 240 ECTS of which the Doctoral Thesis accounts for 180 ECTS (75%). According to regulations established by University senate, "doctoral programmes should contain at least 70% research, development, or other creative work by doctoral students" and the results should "be made public in international, peer-reviewed research journals or in other international publications" (SER, page 10). The requirement at least 70 % of research in the studies is clearly met at least arithmetically. However, 85% of doctoral students in TLU work part-time or full-time during their studies (SER, page 12) leading to extended graduation times and difficulties in defining whether the 70 % research requirement is met in reality. The requirement of scientific publications included in the Ph.D. Theses is fulfilled in the programmes as all 12 doctoral theses accepted in 2016-2021 are article- based. In practise, an unwritten rule that three publications should be included in the thesis is followed.

According to SER and additional documents sent to the panel, student mobility is supported by many funding sources (e.g., DoRa, ASTRA, Kristjan Jaak Foundation, Doctoral Schools; SER p.17, 27), and the students actively participate in international courses and congresses and make research visits to foreign laboratories. Interview with students confirmed this view and indicated that students generally feel that once proper time and destination are available, funding will be found. Indeed, almost all current students have made international visits during the period 2016 -present, some of them even 8-10 times. Student mobility in the programme is excellent and strongly promotes the international networking of students and likely improves their future employability. The students can incorporate congresses and research visits in their studies (e.g., Laboratory Practice Abroad, 6 ECTS; Presentations in Conferences, Seminars, Writing, 4 ECTS).

Curriculum of the new CSNS study programme includes in its learning goals that the student "masters leadership and teamwork skills for working in an international environment and is independently capable of making strategically sustainable decisions related to the field of research" (SER, page 49). Apart from the elective courses of Learning and teaching in University (4 ECTS) and University (6 ECTS) (SER, pages 93-95) which are focused more on teaching-related aspects, the curriculum does not appear to include any systematic treatment of leadership and teamwork issues. Obviously, these skills are often trained largely in the context of the actual research work, but considering the rather small size of the research groups and the current situation in which many students work practically alone on their projects, achieving these goals can be challenging. Language skills (English) of the students, as judged by the interviews, are excellent and as such sufficient for working in an international environment.

The curriculum contains only three compulsory courses, totalling 14 ECTS, and therefore leaves substantial room for students' own choices. This may be seen as an advantage but considering the wide range of topics of the research projects it does not necessarily help in building a coherent whole, especially in a programme which was built to unify and integrate components of earlier

programmes. Of positive note, the introduction of a new course research ethics (from 2018, and to become compulsory in 2023; SER, page 11), is a good addition to the curriculum.

The graduation times are quite long and presently only a minority of students graduate within the nominal time (4 years) plus two years (i.e., 6 years). TLU aims at 50% of students graduating within 6 years by 2022 (SER, page 9). In interviews with the programme administrators, it became clear that the reasons for the slow progress in doctoral studies are often financial and social rather than directly connected to the studies or supervision. However, the panel also heard of examples of students graduating within close to nominal time when working in a well-funded research group. TLU doctoral scholarships (500 €/mo) introduced from the beginning of the study year 2019/2020 have substantially improved the financial situation of doctoral students by supplementing the governmental support (660 €/mo) to levels comparable to average salary outside the university (SER, page 8). This may help in shortening the graduation times, along with other measures taken by the university, including topic-based admission to provide better financial support for the project, and the use of co-supervisors, often from other universities and research institutes in Estonia and abroad to improve scientific support for the doctoral projects (SER, page 29). With the new career model, each tenure professor has been given extra money by the university, which the professor can use for a PhD student.

For collecting feedback from students, a university-wide survey focusing on students´ satisfaction with teaching, supervision and university support was carried out in 2017, but has apparently been used only once (SER, page 12). In the survey, 60% of responding students were satisfied with supervision. It is unclear if this means that the rest, 40%, were not satisfied with supervision or did not express explicitly their opinion. A new survey with a revised protocol will be performed in 2021. Clearly, feedback is also collected via multiple other routes, but in a less systematic fashion. Feedback is also given to the students, most formally in the context of annual PhD Progress Reviews (SER, page 13) which include written feedback by the review committee to the student based on the reported progress and passed studies.

Strengths

- Reorganization of the former two doctoral programmes has resulted into one integrative doctoral programme of Complex Systems in Natural Sciences which occupies a unique niche in Estonian postgraduate education and has high potential for further development
- Positive and energetic spirit of the staff
- Active measures have been taken to shorten the graduation times, including increased economic support to students, changes in publication requirements, use of co-supervisors and topic-based admission
- Students participate in international meetings and mobility programmes and have access to multiple funding sources supporting mobility

Areas of concern and recommendations

- The new interdisciplinary doctoral programme is still quite diffuse and lacks a clear, solid profile
- The curriculum of the doctoral programme of Complex Systems in Natural Sciences contains little training in mathematical and modelling skills, generally considered an integral component of studies of complex systems
- The relation of the new programme to national doctoral schools is complicated and the division between several schools may not be optimal in the long run.
- Two problems recognized in the previous assessment, long graduation times and low student numbers have remained, and although the new integrated programme and improvements in student support may help the situation, this is not all clear and remains a challenge

- For students associated with small research groups or working largely alone, achieving leadership and teamwork skills may be difficult.

Opportunities for further improvement

- Active recruitment policy including the planned five professors (in biopolymer chemistry, physics, environmental management and sustainable development, systems biology and eco-hydrology) and their integration into the new programme, if successful, will provide great possibilities for strengthening and solidifying the programme and increase its scientific impact

4.2 Resources

Standards

- ✓ In conducting doctoral study programmes, an adequate number of teaching staff and researchers participate, who hold the appropriate qualifications required to carry out doctoral studies and supervise doctoral theses in a given study programme.
- ✓ Universities shall ensure that sufficient funds are available to conduct doctoral studies, to provide development activities associated with doctoral studies and research, and to support the professional development of teaching staff and researchers.
- ✓ Resources (teaching, learning and research environments; libraries; resources required for teaching, learning and research) support the achievement of objectives set out in study programmes as well as the actual teaching, learning and research at the level of doctoral studies. Resource development is sustainable.
- ✓ Trends in the numbers of current learners, admitted learners and graduates (by study programme) in doctoral studies under the study programme group during the last five years indicate sustainability.

Evidence and analysis

Staff and resources with appropriate qualification

A major concern of the previous report was the lack of a critical number of students within the areas evaluated and the lack of synergy between them. The committee was also concerned by the limited number of supervisors and by the fact that their competencies were not always fitting to students' research subjects because most of students were allowed to choose their own research subject and the supervisors had to adapt to it.

From the SER, there is a reasonable fit as for the analysis of the table in annex 5: 19 teaching/researchers work in the field of Ecology/ Analytical Biochemistry. All have a good CV with international experience. 5 teaching/research staff are in other fields but in support to this programme (humanities, law, education…)

In fact, the supervisor number fits with the students' number, because they are both relatively small. However, as noticed in the previous evaluation, there is a quite large array of subject topics which make the adequacy difficult.

In 2021 the committee found that more and more PhD projects are linked to externally funded research projects. However, the selection of PhD topics still has some flexibility and prospective PhD

candidates can propose their own topics when choosing their supervisors. Consequently, the available expertise among the TLU supervisors does not always guarantee adequate supervision. In such cases, co-supervisors are chosen from other Estonian universities or research institutes, or from foreign universities. Experienced visiting professors from the University of Tartu) have been appointed to fill voids in expertise. TLU also actively identifies expertise gaps and fills them where-ever possible (e.g., a professor in Systems Biology to be hired in 2023). The co-supervision system globally provides a sound basis for adequate supervision but the recruitment of a Systems Biology Professor in 2023 might be late for a programme that will open in 2021.

Quality rules for the teaching staff are clear. The rules comply well with international standards. PhD supervisors are generally assessed annually by an informal interview and formally every five years. Strict rules for staff scientific productivity and training are rigorously enforced. For example, each faculty member must have one PhD student defending her/his thesis at least every five years and this rule is strictly followed.

PhD Students, however, mentioned that the supervising skills of some staff members should be improved, especially when students have chosen their own thesis subject. TLU provides training to achieve this but unfortunately not all supervisors use this.

Funds available

In general, the study programme obeys the same rules as the other programmes in TLU:
The Estonian government supports doctoral students with a 660 € scholarship per month. From the year 2019 TLU adds an additional 550 EUR per month for each funded student, with the aim to increase the students funding. The main goal is to reach over the years 1.5 times the average Estonian salary. During the period 2015 – 2019 the university budget was increased 21%. To support PhD studies and increase their attractivity, the Doctoral Performance Reward from the Ministry will be redirected directly to the PhD programmes without any overhead from the University.

It is important to point out that there is an additional funding possibility for TLU students and staff. A remarkable initiative is the possibility for the PhD students to directly apply for the SNSH Research Fund, in order to finance their projects. Significant sums have been attributed to the students of the present Analytical Biochemistry and Ecology programmes in the past years.

Taken together, the institutional funding situation significantly improved in comparison with last evaluation, thanks to a significant effort from the institution and from the ministry.

To increase future funding, TLU and the present programme have emphasized collaboration with industry as a priority. In order to support this action, a chief specialist in product innovation was hired in order to increase university – industry contacts and cooperation.

Several representatives of the socio-economic sector expressed their opinion that research in all Estonian universities is underfunded, and that the government should continue its efforts to fund research and higher education at a greater level.

There are sufficient funds available to support both students and staff travel and mobility who both show a very good record for this aspect. Paradoxically, the limiting resource is time. For obvious reason (COVID-19) last year travel is very restricted but the University has setup a virtual mobility process.

Resources available

Due to the pandemics it was not possible to visit the site and therefore the committee had to rely on the SER and on previous visits. In general, TLU has adequate infrastructure for learning also at the level of doctoral studies. E-learning possibilities exists and are actively used. Students and researchers can use several databases and resources of the TLU Academic Library. Concerning the present programme; the laboratory equipment is largely adequate in general and of high level for analytical chemistry. Like in last report, the committee can note that the possibilities of continuous renewal of instrumentation seems to be limited, making the programme less competitive of vulnerable in case of equipment failure due to aging for example.

Trends in number of current learners, admitted learners and graduates

The number of students admitted and graduated, and the drop-out rate of the students show very marginal change compared to three years ago but here the reorganization did not have time to take place.

The number of students admitted depend on the number of fellowships provided by the Ministry of Education of Estonia. The University representatives said that they admitted even more students than the number of funded PhDs by the ministry.

We note a regular decrease in the total number of students in Ecology (20 to 8 in 4 years) and the low number of defended PhDs. The number of international students in Analytical Biochemistry is increasing steadily. The number of dropouts is still relatively high in both parts of the programme.

This was in part due to the fact that many students had a very limited funding and had to work outside of their PhD project. This resulted in overextended PhD durations, students' discouragement and significant dropout. As stated previously, the funding situation of the students has improved institutionally and also through the effect of external funding (e.g. Marie Curie Fellowships in the Analytical Biochemistry section).The effects of the present changes are probably not visible yet, but the number of students able to complete their PhD within 4 years is expected to grow, as several PhD students explained that they were expecting to graduate during this period as they could spend 100% of their time on the PhD.

Strengths

- Adequate infrastructure for research and PhD studies. The excellent infrastructure for analytical chemistry supports both research and collaboration with industry.
- Good access to several databases.
- Adequate funding of PhD students (governmental scholarship plus university decision to top all doctoral students fellowship).
- Possibilities to apply for research grants inside the university.
- University flexibility and support to find supervisors outside university if needed.
- Support for collaboration with industry.
- Strong collaboration with other universities (shared resources, invited professors etc.).

Areas of concern and recommendations

- The committee recommends developing a business plan for the next five to ten years. The present small number of students is not sustainable for the long run. There must be found alternative revenue sources to increase the present number of PhD students.
- The committee recommends increasing efforts to get more EU/international funding for research and development activities. For that activity plan (long term and for next year(s)) must be developed.
- The committee is concerned about a wide range of subjects and no stated priorities in research. To be more competitive, the programme must be more targeted and focused. It will be easier to find more resources and to increase the critical mass of competencies for a more focused programme.
- The committee is concerned because both a plan and funding for infrastructure development are missing. The committee recommends that an infrastructure planning committee be formed at the university level, to formulate a strategy after identifying the areas which should have priority for renewal.

Opportunities for further improvement

- The committee recommends to continue the development of relationships with industry. The potential for collaboration is underused. The committee suggest to map areas, where the collaboration potential is large and to form workgroup, including members of industry, for developing plan of increasing industry-academy collaboration. One of the possibilities to increase collaboration with industry might be to offer more services for industrial partners using existing equipment and competencies (for example analytical services in chemistry). A second possibility might be to offer business-related doctoral studies or joint doctoral subjects with industrial partners.

4.3 Teaching, learning, research and / or other creative activity

Standards

- ✓ Uniform principles, based on best international practices and agreed upon at the university level, shall be followed while implementing doctoral programmes and assuring the quality of the doctoral studies (including supervision of doctoral theses).
- ✓ Doctoral studies support students' personal and social development, including creating an environment which will prepare them to successfully participate in international working environments at research and development institutions, as well as in the business and public sectors.
- ✓ Supervision of doctoral theses; modern methodology used in teaching and research; organisation of studies; and doctoral students' professional research, development and/or other creative activities all support achievement of the objectives and learning outcomes of doctoral studies.
- ✓ Assessment of outcomes of the learning, research and creative work done by doctoral students is relevant, transparent and objective, and supports the development of doctoral students.
- ✓ Doctoral students are asked for feedback regarding supervision on a regular basis and the results of these surveys are taken into account for quality improvement activities.
- ✓ Effectiveness of the doctoral studies is analysed and such analyses serve as a basis for planning quality improvement activities.

Evidence and analysis

The main challenge that was listed in the 2018-evaluation report, was the critical mass for effective learning and research in the Analytical Biochemistry and Ecology programmes. This could jeopardize the effectiveness of the programmes in supporting PhD students' personal developments. The merger of these two programmes into the Complex Systems in Natural Science Programme in 2020 and the collaboration with the Physic and SNHS programmes likely has started to remediate this. The merger is strongly supported by administrators (including directors), supervisors and students. They all already see the advances of more interdisciplinary interactions and it certainly already enriched the obligatory PhD seminars and discussions.

Research and development activities are well supported by TLU's central Research Administration Office (including preparation of major project applications, interdisciplinary development of research activity) and by the support provided by all schools for research and development activities (including research coordinators, assistants and financial specialists).

Although PhD students were critical on the utility of many courses in the 2018-evaluation report, they were now more positive as provided topics were broader and interdisciplinarity was explicitly addressed. Besides conducting their research, PhD students follow compulsorily and other courses. Within TLU many skills and topical courses are provided, and the programme provides several dedicated courses. However, the PhD students believe that, although many courses are beneficial, some compulsorily courses are too rigid or not always suited for students with, for example, a natural-science background. They also did not fully recognize the utility and need of a few courses. However, they now especially liked the broadening and interdisciplinarity of the regular PhD seminars. Finally, they very much would like to obtain more flexibility in selecting and following courses, including those organized by other (foreign) universities and research institutes.

Several PhD students, however, affirmed that the restrictions of working students should be considered in constructing the timetables. PhD students should also be offered more possibilities to work at the university campus.

The main obstacle to graduating within the nominal period of studies was the strict publication criterion of three published papers. Although this criterion has been released recently by Estonian universities (two published papers and one submittable), most supervisors still adhere to the old criterion as the best guarantee for good scientific quality of the PhD thesis. However, most PhD students believe that this criterion is not the main bottleneck any more for a timely graduation and think that it can well be realized with good support. Current major causes for delays include the weather that interferes with ecological experiments and observations, and the teaching and project work to obtain additional university financing.

In the 2018-evaluation report, monitoring the PhD-student's progress was criticized. In the new programme this has certainly be improved. This will help to further reduce delays. In conclusion, the merger and several improvements installed after the previous evaluation have advanced the teaching, learning, research and other activities.

Strengths

- The selection of PhD topics and supervisors is still flexible and can be initiated by the PhD candidate, or by the supervisors, who needs a PhD student on a funded research project;
- PhD candidates can apply for additional research funds from TLU;
- In general, teaching principles and overall organization of the courses are very good and enhance the interdisciplinary skills of the PhD candidates.

Areas of concern and recommendations

- Assessment of the courses is traditional and is done by an exam (for courses concluded with a grade) or pass-fail assessment. Both include different possibilities for assessing competencies. This indicates that also the subjects are probably also taught in a traditional way. Recently online and interactive teaching and testing approaches have quickly evolved (e.g., flipped classroom, project-based learning and dialogue). These approaches actively inspire students and can require less examinations, and the Evaluation Committee recommends to more frequently apply those in PhD education.
- Although the selection of PhD topics and supervisors is flexible, too many individual PhD topics lead to an undesired fragmentation. The Evaluation Committee recommends developing a more comprehensive overarching research strategy, that clearly describes an integrated research niche for the programme in the near future and checks if proposed projects and PhD topics follow this strategy. Such a strategy should not be cast in stone but only directs a better integration of the programme's research.
- As the students are not unanimously happy with the courses, an enhanced selection flexibility could be developed; and
- Develop a clearer strategy to select and develop skills (e.g., integrated modelling) and content courses (e.g., systems analysis) to support the interdisciplinary complex systems.

Opportunities for further improvement

- The financial situation of the students has improved substantially through governmental and university rulings. Earlier lack of funding was a major cause of delays and dropouts. However, PhD students now have to regularly work on projects or teach to qualify for funding. This could lead to delays in their PhD project. Such additional activities should be better integrated into the PhD projects.

4.4 Teaching staff

Standards

- ✓ Teaching staff participate in research, development and/or creative activity at the level of and to the extent sufficient to conduct doctoral studies in the curriculum group and to supervise doctoral theses.
- ✓ Teaching staff develop their supervisory competences and share best practices with one other.
- ✓ Teaching staff collaborate in fields of teaching, research and creative work within the university and also with stakeholders outside the university (public sector organisations, enterprises, other research and development institutions).
- ✓ Teaching staff further their skills at foreign universities or other research institutions, participate in international research and creative projects, and present papers at high-level conferences.
- ✓ Qualified international and visiting teaching staff are involved in conducting doctoral studies, participating in doctoral thesis defence panels and/or reviewing doctoral theses.
- ✓ When assessing the work of teaching staff (including their evaluations), the effectiveness of their teaching as well as of their research, development and creative works is taken into account; including the effectiveness of their student supervision, development of their teaching and supervisory skills, and their international mobility.

Evidence and analysis

The Evaluation Committee was impressed by the dedication and enthusiasm of both the teaching staff and administrators (and directors) within the programme. The programme management has a clear vision on the future development of the programme and is well aware of the pitfalls and challenges. The interviews with the staff clearly indicated their commitment to the programme, the PhD education and the research, as well as the necessary operative procedures at the institutional level.

The staff members have a good to excellent academic record: and their research topics are well within the area of the two sub-programmes: Environmental Ecology" and "Functional Biomolecules and systems, with the addition of plasma physics for the physics colleagues joining the programme. Here also the difficulty will be to evaluate the ability of the staff and supervisors to implement a significant evolution of their research subjects towards the new programme. From the interviews it was apparent that a small number the supervisors were already ready and had started to write collaborative projects and PhD proposals (e.g., Rando Tuvikene and Jaanus Terasmaa, interview with supervisors, April 6, 2021) while others felt that this change was beyond their research scope. Dealing with research projects, it can be expected that a significant delay will take place before the effects of the present changes are witnessed.

Quality rules for the teaching staff are clear. The rules also comply well with international standards. PhD supervisors are generally assessed annually by an informal interview and formally every five years. The rules are also followed. For example, the Evaluation Committee was told that each professor should have one defended PhD thesis at least every five years. This rule has been used to terminate a professor who did not adhere to it.

PhD Students, however, mentioned that the supervising skills of some staff members should be improved. TLU provides training to achieve this but unfortunately not all supervisors use this.

Strengths

- The staff members have a good to excellent academic record.
- The staff is generally very dedicated and enthusiastic and has an energetic spirit. In the new programme, they also much appreciate the enhanced interdisciplinary and integration and want to expand this further; and
- The supervisors are frequently evaluated on the basis of a clear protocol and are asked to enhance their supervision and research skills, if needed.

Areas of concern and recommendations

- The teaching and supervision staff have little expertise in complex system analysis. As this is now at the heart of the programme, the Evaluation Committee would like to see more skills (e.g., integrated modelling) and expertise (e.g., systems analysis) to support new research on interdisciplinary complex systems.

Opportunities for further improvement

- Although the merger substantially improved the critical mass, the programme is still relatively small. This could well jeopardize the skills and expertise needed to further broaden the programme. The Evaluation Committee therefore recommends developing a more comprehensive overarching research strategy, that clearly describers an integrated research niche for the programme in the near future (c.f. Section 4.3). Such a strategy can be used to identify voids in expertise and skills and helps to identify the appropriate peers (nationally and internationally) who can be invited as co-supervisors, guest researchers or guest lecturers to broaden the knowledge base.

4.5 Doctoral students

Standards

- ✓ When admitting students to doctoral study, their suitability for successful completion of their studies is assessed on the basis of transparent criteria.
- ✓ Doctoral students plan their studies as well as research and development activities in collaboration with their supervisor(s), setting out specific objectives for each year and taking responsibility for achieving these objectives.
- ✓ Evaluation of doctoral students is transparent and impartial. Its purpose is to support development of the doctoral students, provide an opinion regarding the effectiveness of their work to date, and assess their capabilities to complete their studies on time and successfully defend their doctoral theses.
- ✓ Universities offer doctoral students counselling on completing their studies and planning their further careers.
- ✓ Doctoral students' extracurricular teaching, research and/or creative activities or other work-related activities at the university support successful completion of their doctoral studies.
- ✓ Doctoral students participate in international mobility programmes or take advantage of other opportunities for learning or research at foreign universities and/or research and development institutions[1].
- ✓ Alumni are regularly asked for feedback on the quality of the doctoral study, and employers are asked for feedback on the preparation of the graduates.

Evidence and analysis

Students' admission process

The admission system for the new study programme is research-based, meaning that students have to undergo a defined selection, based on the defence of a PhD project draft in front of an ad hoc committee (SER, p.10). Beforehand, the proposed PhD research topics have to undergo approval for admissions with supervisors defending them. The topics of the doctoral school would be, as a rule, related to a certain research group thus ensuring the necessary critical mass in a certain area.

Another improvement and example of good practice is the advertisement of some PhD positions on ResearchGate (AB) which has resulted in an increased number of applications and level of competition. In the SER (p.17) TLU concludes that from 2018-2020 there has been a significant increase of interest in TLU doctoral studies among international students, and as a result the doctoral study programme has become more internationalised (p.17, SER). A significant number of international students (10) have been admitted to the Analytical Biochemistry thus indicating further potential for internationalisation there.

The admission system for the new study programme has been changed in comparison with the situation what was in place at the time of the previous assessment when student admission was done based on open call, without links to a certain research group or a supervisor who would be highly qualified to lead the topic.

This new approach for admission is commendable. The administration of SNSH claims that the research-based admission is a more appropriate admission mechanism for assessing the candidates'

[1] In the context of this document, 'research and development institutions' denote both research institutions and research-intensive companies.

motivation which is said to be one of the main reasons for the high rate of non-completion. However, a number of other organisational arrangements have also changed since the last evaluation thus improving the student progression rate and minimizing the possible reasons for dropout. The graduation times, that are still an issue in TLU, are limited by other, mainly external, factors.

As the system experienced by the current students is quite different from the one that is planned, the expert team could not assess the quality of the practical implementation of the new system.

Students' planning and collaboration with their supervisors

The policy of TLU in regard to student progression has not been changed and is not intended to be changed with the new study programme. All students submitted to a doctoral study programme must submit an individual plan at the beginning and a report at the end of each academic year (SER, p.10). This review aims both at evaluating the progress of the student's research and theoretical training. Such a progress review is mandatory to continue the PhD. The different criteria assessed and how they are credited are explained in the Progress Review Table approved by the Doctoral Studies Council of Natural Sciences. The reports are reviewed by Progress Review Committees that consist of at least three members holding a doctoral degree or equivalent qualification in a field of study that corresponds with the study programme.
The SER (p.12) states that each academic year, all PhD students must write an individual study and research plan. This plan must be approved by the supervisor. The study plan stresses individual work (individual subjects, seminars, etc.).
The content is usually discussed and agreed upon in advance by supervisors and students. The reports are then reviewed by the PhD Progress Review Committee at the School.
The students interviewed by the expert team expressed their general satisfaction with the formal process for progression. However, they admitted that the annual progression results of each student would depend on students' individual situation and availability. The students expressed their opinion that with the new situation where research topics are predefined, students are partially employed at the university and all students receive a scholarship that partially covers their daily expenses, the progression rates and the quality of annual results would be much higher.
As the study process is mostly a mutual cooperation between student and supervisor, the students do not think that the changes in programme administration will affect their study process much. They appreciate the possibilities for networking and discussion that would be created by bigger groups of students in study courses and research groups.
The expert team would also like to make a note that the achievement of objectives in normal circumstances when student has time and motivation for studies is to a large extent related to the quality of supervision and the possibilities provided by the supervisor. The expert team commends the TLU policies in regard to ensuring the quality of supervision but at the same time it would recommend to ensure mandatory training for supervisors but some supervisors were not aware of such a possibility.

Evaluation of doctoral students

The evaluation of doctoral students is performed through the Annual Progress Review and defence of PhD thesis. The policies for review and defence are established at TLU level and they are clear and follow the national and international regulations. The Annual Progress Review gives a good overview of the student progress and the steps to be completed until the PhD defence. According to the regulations the student must claim at least 30 credit points per study year to remain as a full-time or part-time student.

Currently the main obstacle related to defence of doctoral theses has been the publications. The expert team in the previous review has noted that a mandatory criterion for a defendable thesis has been the publication of three peer-reviewed papers in recognized international journals (i.e., those listed in either the ISI Web-of-Science or SCOPUS databases). From the interviews conducted, the expert team received information that this rule has now been abolished and the third publication could be in a peer-review stage but not necessarily published. While this has been a general policy of TLU, the supervisors interviewed did not fully support it.
The expert team would like to make a note in relation to the evaluation of study modules that could be more creative and interactive (other than traditional exams). This issue is further analysed in the section on Study Programme and Teaching, Learning Research.

Students' counselling on studies and career

The SER (p.10) lists several counselling services offered by the following specialists - Study Counsellor and Specialist, Study Programme Administrator, Coordinator of International Cooperation, Head of Studies – as well as the opportunity to seek assistance from the Career and Counselling Centre).

It was evident from the meeting with the doctoral students that they work closely with their supervisor and receive most of the necessary information from their supervisor. At the same time, some supervisors state that they only do research related supervision and are not that related to any administrative issues. In general, the students expressed satisfaction with the support services and were confident that they could find any support needed at a certain point.
The new system with governmental and institutional scholarships and a mandatory employment position at TLU would even more facilitate the situation that PhD graduates would become employees of TLU rather than look elsewhere. It is therefore recommended to actively cooperate with the industry in identifying the needs of PhD graduates there. During the interviews the expert team learned of the governmental initiative to promote doctoral education in the industry and would recommend the TLU take an active role in it.

Doctoral students' activities and doctoral studies

There has been a shift in the employment situation of doctoral students due to the changes in financing policy in TLU and in Estonia in general. Until recently the doctoral students had to engage in parallel activities outside the university to ensure sufficient income for covering the living costs, resulting in extended thesis duration and dropout. Currently the monthly scholarship provided to TLU students – 660 EUR by the government and 500 EUR by TLU – allows the students to focus on research and be fully engaged in TLU. However, the expert team would like to point out that during the interviews, several students still complained about the heavy workload in teaching and other activities that could cause delays in PhD progression and this risk should be closely monitored.

International mobility

The expert team would like to commend the achievement of TLU in regard to internationalisation of the doctoral study programme.
SER (p.29) states that students are encouraged to spend a semester in a foreign lab and to apply for mobility and travel funds through the Mobilitas+ programme, Dora+ programme, Kristjan Jaak Scholarship programme, Smart Specialisation Scholarships, etc.

Almost all students whom the expert team met had spent some time in international mobility or attended international conferences and highly appreciated the benefits. All students were aware of the funding opportunities and the procedures how to apply for funding. Those rare students who had not participated in such activities, confirmed that it was their individual decision and not related to lack of possibilities or information. Participants of the meeting with the students claimed that their mobility possibilities would only be limited by the study period and expected graduation time
The expert team also appreciates the "virtual mobility" set up by TLU as a reaction to the pandemic situation that "allows students to also participate in studies or practice abroad remotely, provided certain prerequisites are met".

Alumni and Employers Feedback

The SER (p.9) states that the feedback of students and alumni is regularly collected and taken into account in the development of the study programme. The SER (p.12) refers to a student survey that has taken place in 2017, at the end of 2020 and is planned for spring semester 2021 but does not refer to alumni surveys. During the meeting with alumni the expert team got the impression that all representatives of alumni who took part in the meeting were either employed by TLU or closely linked with TLU. This might be the main reason why all representatives were fully aware of the changes to the study programme and other arrangements related to doctoral studies in general. During the meeting with TLU administration, it referred to the fact that the SNSH is a small and close community therefore all issues are discussed regularly.

Strengths

- Introduction of research-based admission where students choose a pre-defined topic of research and are assigned a supervisor who is highly specialised in the topic.
- Different student counselling mechanisms available to the students.
- Strong incentive and support for further internationalization in SNSH.
- Flexibility in terms of study content and supervision (external co-supervisors) compared to other universities in Estonia.

Areas of concern and recommendations

- More effort should be put into identifying and promoting the career opportunities of PhD graduates in the industry.
- High drop-out rates for the current students that should be decreasing in the future due to the financial support mechanisms introduced.
- Survey mechanism for alumni should be formalised and used regularly in addition to the student surveys.

Opportunities for further improvement

- Enhancement of the mentoring system
- Stronger "motivation" component included in admission process to allow to assess the potential of each applicant