ESTONIAN QUALITY AGENCY
FOR HIGHER AND VOCATIONAL EDUCATION

EKKA

# Assessment Report

## Architecture and Building

PhD studies

Tallinn University of Technology

2018

# Contents

# Introduction

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 assessment team was the evaluation of the Study Programme Group (SPG) of Architecture and Building at the level of doctoral studies in Tallinn University of Technology.

The team 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 following persons formed the assessment team:

| | |
|---|---|
| **Mark G Richardson (chairman)** | Professor Emeritus, University College Dublin |
| **Ruben Paul Borg** | University of Malta |
| **Indrek Raide** | Nordic Energy Solutions |
| **Piia Markkanen** | PhD student, University of Oulu |

The assessment process was coordinated by Karin Laansoo (EKKA).

The preparation phase included a Skype conference covering an introduction by EKKA to the Higher Education System as well as the assessment procedure, the Estonian Quality assurance organization for higher and vocational education. The work of the assessment team in Estonia started on Tuesday, 10 April 2018, with a review of preliminary observations from which priority issues for investigation on site were identified. The members of the team agreed the overall questions

and areas to discuss with the stakeholder groups at the University. The previously agreed distribution of tasks between the members of the assessment team was used to organise lead questioning during the detailed site visit schedule.

During the following days, meetings were held with the representatives of Tallinn University of Technology (Wednesday 11 and Thursday 12 April). The schedule for discussion on site only allowed for short time slots to be available for team members to exchange information, discuss conclusions and implications for further questions.

On Friday, April 13, the team held an all-day meeting, during which both the structure of the final report was agreed and findings of team meetings were compiled in a first draft of the assessment report. This work was executed in a cooperative way and the members of the team intensively discussed their individual views on the relevant topics.

In the following two sections, the assessment team summarise their general findings, conclusions and recommendations which are relevant across the whole SPG. In so doing, the team provides an external and objective perspective on the programmes and the contexts within which they are delivered. Ultimately, 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. In formulating its recommendations, however, the assessment team has not evaluated the financial feasibility associated with their implementation.

# 1. Assessment report of SPG at Tallinn University of Technology

## 1.1. Introduction

The history of Tallinn University of Technology (TTÜ) dates back to 17 September 1918 when the Estonian Engineering Society opened an engineering school called Special Engineering. Qualification of the university was granted to Tallinn University of Technology in 1936. The status of university in public law was granted on 12 January 1995 by the Universities Act. On 4 June 2014 the Estonian parliament adopted the Tallinn University of Technology Act that defines the role of TTÜ in the Estonian education and research landscape as well as the institutional management structure. The Act took effect 1 September 2014.

In the Estonian society TTÜ is recognised as an internationally high-ranked research university, providing quality research-based education. The current goal of the University is to enhance this further to become an internationally recognised research university. In accordance with its statutes, it is accountable for the new generation of engineers, the spirit and quality of engineering culture in Estonia, promoting sustainable development of the society and growth of national welfare by the innovative services. The Strategic Plan of TTÜ 2020 includes three main goals:

- Internationally outstanding university of engineering and technology, responding actively to the needs of the rapidly developing society.
- Being involved in tackling the challenges of the digital era.
- Contributing to knowledge and welfare in the society through cooperation between the university, enterprises and the public sector.

To realise its role, TTÜ provides opportunities for acquisition of higher education in line with developments of science and technology at all cycles in the areas of natural and exact sciences, engineering, manufacturing and technology, social sciences and in related areas. TTÜ fosters R&D in these areas, at the same time creating a synergy between different areas. TTÜ is a leading engineering and technology education and research centre in Estonia; TTÜ research activity has been granted positive evaluation in all four broad research areas (natural sciences and engineering and technology, bio- and environmental sciences, health sciences, society and culture). In 2014 TTÜ passed institutional accreditation resulting in a decision to accredit TTÜ for seven years as all the assessed components – organisational management and performance; teaching and learning; research, development and/or other creative activity; service to society – were assessed to conform with requirements.

TTÜ offers one doctoral programme in the study programme group 'Architecture and Building'. The programme, managed by the School of Engineering, is entitled 'Civil and Environmental Engineering' was launched in 2002. The registered Ph.D.

students in the study programme group 'Architecture and Building' in Estonia is overwhelmingly registered to the Doctoral School of Civil and Environmental Engineering led by TTÜ, with typically 90% registered in TTÜ itself. The TTÜ cohort in 'Architecture and Building' represents 11% of the University's Ph.D. students.

The 'Civil and Environmental Engineering' doctoral student cohort in TTÜ has averaged 70 over the past five academic years, progressively declining from 79 to 65. However this is not a true reflection of the number of full-time equivalent research-active students. It includes Industry Ph.D.'s, based in companies external to campus and External Ph.D.'s taking credits from courses and benefiting from 100 hours scheduled supervision per annum in a staff member's workload. Obviously these students do not contribute actively to research groups on a daily basis. The overall decline of 18% over the period compares favourably to the overall TTÜ trend of a drop of 24% but it should be emphasised that this reflects the collateral effect of the commendable practice of swifter action in suspending the registration of inactive researchers.

The number of students working in TTÜ represents typically 50% of the cohort, including those employed as early stage researchers. This cohort is increasing as the University is now routinely issuing research employment contracts to Ph.D. students as part of a top-up funding model to scholarship-holders to ensure a minimum monthly income. The contracts are funded from competitively-won research projects.

**THE NUMBER OF PHD STUDENTS**

| Curriculum | 2012/13 | | 2013/14 | | 2014/15 | | 2015/16 | | 2016/17 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total | working at TTÜ | Total | working at TTÜ | Total | working at TTÜ | Total | working at TTÜ | Total | working at TTÜ |
| Civil and Environmental Engineering | 79 | 39 | 74 | 35 | 72 | 28 | 69 | 32 | 65 | 30 |

The number of admitted students per annum shows a decline of 64% over the period compared to the overall TTÜ trend of a drop of 26%. The reasons are both internal and external to TTÜ. Internally, there is a laudable action of more stringent pre-conditions for creating new Ph.D. opportunities and also a concentration on bringing existing students to completion of studies, where their registration period exceeds nominal time. Externally, the demographics of Estonia continue to result in a year-on-year decline in students numbers in the HEI sector – a trend unlikely to change until 2022 – and at Ph.D. level there is also competition from the job market for talented master's degree graduates.

More than half of the students recruited for doctoral studies come from the graduating master's degree cohorts at TTÜ, at an average of 58% per annum.

**THE NUMBER OF ADMITTED PHD STUDENTS**

| Curriculum | 2012/13 | | 2013/14 | | 2014/15 | | 2015/16 | | 2016/17 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Directly from TTÜ MSc | Total | Directly from TTÜ MSc | Total | Directly from TTÜ MSc | Total | Directly from TTÜ MSc | Total | Directly from TTÜ MSc |
| Civil and Environmental Engineering | 14 | 8 | 10 | 5 | 14 | 11 | 6 | 4 | 5 | 2 |

The number of international students in the 'Civil and Environmental Engineering' doctoral programme has not shown any growth over the period, with 8 students per annum representing about 11% of the registered cohort. The percentage increase year-on-year has been flat-lining while other programmes in TTÜ have seen dramatic increases year-on-year with a doubling of international Ph.D. student numbers over the last five years.

**THE NUMBER OF INTERNATIONAL PHD STUDENTS**

| Curriculum | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 |
|---|---|---|---|---|---|
| Civil and Environmental Engineering | 7 | 8 | 8 | 8 | 8 |

There is an increase both in the absolute number graduating each year and the number graduating within an acceptable period of study, reflecting an institution wide trend. However the percentage of graduating students who graduate within the accepted duration of studies (nominal period of 4 years plus an allowance of 2 years) still only averages 55%. In 2016/2017 66% of all TTÜ´s doctoral students graduated in the nominal period of studies. Thus there is a still a significant accumulation of non-research active Ph.D. student registrations year-on-year. The overall number of students has declined at an average rate of 3 per annum, with average admission figures of 10 being counterbalanced by an average of 7 graduates per year and 6 dropouts per year (average of 3 dropouts by personal request). The number of full-time equivalent doctoral research students in the programme is 2 students per staff FTE, which compares favourably to an institution-wide unadjusted average of 0.6 Ph.D. students per academic staff member in TTÜ (Key Data 2016).

**THE NUMBER OF DEFENDED PHD THESES**

| Curriculum | 2012/13 | | 2013/14 | | 2014/15 | | 2015/16 | | 2016/17 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total | within 6 years | Total | within 6 years | Total | within 6 years | Total | within 6 years | Total | within 6 years |
| Civil and Environmental Engineering | 4 | 1 | 6 | 4 | 10 | 7 | 5 | 3 | 9 | 6 |

The retention rate in the programme is improving, which is a positive trend especially compared to the TTÜ average retention rate. New programme management structures are in place for monitoring progression rates.

### THE NUMBER OF PHD STUDENTS DISRUPTING THEIR STUDIES

| Curriculum | 2012/13 | | 2013/14 | | 2014/15 | | 2015/16 | | 2016/17 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Upon personal request | Total | Upon personal request | Total | Upon personal request | Total | Upon personal request | Total | Upon personal request |
| **Civil and Environmental Engineering** | **11** | **5** | **10** | **6** | **4** | **2** | **4** | **1** | **4** | **2** |

The proportion of registered students availing of mobility opportunities is typically one in three, during the last five academic years.

### THE NUMBER OF MOBILITY OPPORTUNITIES TAKEN UP

| Mobility Programme | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 |
|---|---|---|---|---|---|
| | Total | Total | Total | Total | Total |
| Dora Programm short-term mobility (1-30 days) | 20 | 8 | 4 | 14 | 17 |
| Dora Programm long-term mobility (semester) | 0 | 2 | 0 | 1 | 3 |
| Kristjan Jaak Programm short-term mobility (1-30 days) | 1 | 1 | 3 | 7 | 2 |
| Kristjan Jaak Programm long-term mobility (semester) | 0 | 0 | 0 | 0 | 2 |
| Doctoral School Mobility scholarship | 17 | 19 | 8 | 0 | 7 |
| **Total** | **38** | **30** | **15** | **22** | **31** |

## COMPARATIVE TRENDS FOR PROGRAMME AGAINST TTÜ AVERAGES

| Performance Indicator | | 2012/13 | | 2013/14 | | 2014/15 | | 2015/16 | | 2016/17 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Civil & Env. Eng. | TTÜ Total | Civil & Env. Eng. | TTÜ Total | Civil & Env. Eng. | TTÜ Total | Civil & Env. Eng. | TTÜ Total | Civil & Env. Eng. | TTÜ Total |
| PhD students | No. | 79 | 782 | 74 | 762 | 72 | 737 | 69 | 644 | 65 | 597 |
| | Change (%) from 2012 | | | -6 | -3 | -9 | -6 | -13 | -18 | -18 | -24 |
| International PhD students | No. | 7 | 62 | 8 | 93 | 8 | 107 | 8 | 112 | 8 | 128 |
| | Change (%) from 2012 | | | +14 | +50 | +14 | +73 | +14 | +81 | +14 | +106 |
| Admitted PhD students | No. | 14 | 122 | 10 | 117 | 14 | 112 | 6 | 71 | 5 | 90 |
| | Change (%) from 2012 | | | -29 | 0 | 0 | -8 | -57 | -42 | -64 | -26 |
| PhD students disrupting their studies | No. | 11 | 75 | 10 | 91 | 4 | 76 | 4 | 97 | 4 | 82 |
| | Change (%) from 2012 | | | -9 | +21 | -63 | +1 | -63 | +29 | -63 | +9 |
| PhD students disrupting their studies by personal request | No. | 5 | 32 | 6 | 44 | 2 | 24 | 1 | 33 | 2 | 35 |
| | Change (%) from 2012 | | | +20 | +38 | -60 | -25 | -80 | +3 | -60 | +9 |
| Defended PhD theses | No. | 4 | 54 | 6 | 57 | 10 | 62 | 5 | 75 | 9 | 62 |
| | Change (%) from 2012 | | | +50 | +6 | +150 | +15 | +25 | +39 | +125 | +15 |
| Defended PhD theses within 6 years (nominal period +2) | No. | 1 | 32 | 4 | 39 | 7 | 41 | 3 | 53 | 6 | 41 |
| | Change (%) from 2012 | | | +300 | +22 | +600 | +28 | +200 | +66 | +500 | +28 |

# 1.2. Strengths and areas for improvement of study programmes by assessment areas

## 1.2.1. Civil and Environmental Engineering

### 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.

Comments

Doctoral studies are conducted in both civil/environmental engineering and architecture. The studies are conducted through eight research groups based on specializations of enduring relevance to society and the economy. These include, for example, the Nearly Zero Energy Building and the Water & Environmental Engineering Research Groups. A place in the market has been identified to build a strong study programme in technology-themed architectural doctoral level studies in an increasingly interdisciplinary and technologically-driven industry, facilitated by the establishment of an Academy of Architecture and Urban Studies in a recently unified School of Civil Engineering and Architecture. The opportunity exists for civil engineering's research experience to guide the growth of technologically-themed architecture studies at doctoral level, building on Estonia's leadership in technology-related entrepreneurship. The new programme proposed for Architecture and Urban Studies draws on the already established study programme and can be considered to be set on solid foundations for its development.

Doctoral study programmes are underpinned by the Organisation of Research and Development Act, which provides for the preservation and further development of scientific and technological creation as a component of Estonian culture and the Estonian economy. In this context, the Strategic Plan of TTÜ 2020 includes three main goals including responding actively to the needs of the rapidly developing society; tackling the challenges of the digital era; and co-operation between the university, enterprises and the public sector. Translating these goals at doctoral study level is informed by an action plan with performance indicators which is being implemented at doctoral programme level by appointed Programme Directors, under the direction of the Vice-Rector for Research. There is buy-in from staff to the plan and its cohesive set of actions, with consensus on its benefits for the quality of the doctoral student experience, institutional reputation and contribution to society.

TTÜ, the only technological university in Estonia and one of only two HEI's offering doctoral studies in the Architecture and Building study programme group, has both traditional Ph.D. students and industrial PhD students. Some concern has been expressed that projects associated with an industry challenge do not guarantee success in doctoral studies, due to inadequate scope for doctoral level research and attendant difficulties in reaching the standard required for peer-reviewed journal publications. However the main cohort of doctoral students are traditional, based on campus in research groups, and industrial Ph.D.'s are in the minority, no more than one in six registered students.

The requirements for the doctoral study programme are set out in TTÜ Curriculum Statute. The programme, comprising 240 ECTS credits, consists of 79% research and 21% of taught modules, exceeding the minimum requirement of 70% research. The students are required to demonstrate dissemination of research in at least three peer-reviewed publications and present these in their final thesis.

Conference participation is encouraged. Doctoral students participate at international conferences at least once per annum. Typically journal papers (published, accepted or submitted) have been required to demonstrate compliance with the 'three paper' rule but the eligibility of published international peer-reviewed conference papers is gaining acceptance. Conference papers provide a route for swifter feedback through both the review process and live conference discussion, which may be taken into consideration at an earlier point in the student's experimental research plan. In this regard it was noted during the assessment that increased participation in conferences is foreseen to expose doctoral students to external peer review.

The taught module component comprises 50 ECTS credits and equips the students with transferable skills (leadership, management, teamwork, innovation); supervision and teaching skills; and specialist skills related to their subject area of research. Irrespective of specialization, all students take at least 12 ECTS of general studies, through selecting at least three modules from seven, covering key features of modern science, its role and relevance in and for society; the main methodological proceeding points in modern teaching methodology; and the higher education and research landscape in Estonia and

the European Union. Also irrespective of specialization, all students take 20 ECTS credits of special courses through three compulsory modules, covering the skill of discussing detailed scientific issues in their scientific field; promoting skills in modern subjects methodology and research strategy, methodology and research strategy; and advancing skills in academic supervising and teaching. Students are trained in project financing by constructing a research proposal for a live research call. Experience is gained through supervising and/or giving lectures at bachelor or master level, preparing them for a possible academic career. Additionally the students select at least 18 ECTS credits through two modules from four in advanced topics that deepen students skills for discussing detailed scientific issues in their field; develop knowledge for composing their thesis; and develop the scientific work habit. Students are guaranteed places on certain advertised courses. For very special courses a survey is conducted to assess viability. If a course cannot be run, special studies can be taken in another university. Provision has also been made for students to proposed self-designed courses, for example through on-line resources.

The goals and learning outcomes of each component, including the 190 ECTS thesis, are clearly articulated ensuring the coherence of the different components of the programme in the personal development plan of each student. The progress of students in their development is monitored through a formal attestation process, conducted annually.

Leadership and teamwork are encouraged through management courses. Furthermore students gain additional experience by opportunities in supervising masters' degree students. Students are also encouraged to participate and collaborate in European research projects. It is noted that the experience of a student depends on the size of the research group they work in. Further to the interview with students it was concluded that language skills are sufficient, particularly with regards spoken English. It is noted that the use of the English language throughout can help avoid the avoid creation of barriers and at the same time enhance the international working environment.

At the student community level, the integration of international students could be enhanced further to strengthen the social experience of the students.

The quality of the programme is internally assessed in accordance with the TTÜ Regulations on Completion of Studies. Formal student feedback is harvested through the TTÜ Study Information System (ÕIS). Participation rates have increased from below 10% prior to 2016 to full participation in 2017, since the introduction of compulsory feedback. High satisfaction ratings have been recorded, with scores over 4 ex 5. The six standard questions are not very searching, reflecting formulaic questions designed for a broad student body. Student feedback is also collected from a Student Union project (Student Education Quality Working Groups) but doctoral student surveys are rare – the last one was in 2013/2014. Feedback from alumni is collected through graduate surveys, collected centrally, but response rates are very low. Thus, although a multi-stakeholder feedback system is in place and indicates deep satisfaction (score over 4.0 ex 5) it is not a strong tool in development of the course. The level of engagement of doctoral students in the feedback could be enhanced

further and this can be further strengthened as an effective tool for quality assessment.

Strengths

- The ongoing development of the study programme, underpinned by appropriate performance indicators, is conducted in the context of clear strategic direction from management. The increased significance of doctoral research in the University's mission to serve Estonian economic and societal development is forward-looking and consistent with accepted international benchmarks for highly-ranked universities in a global market.
- The study programme is predominantly delivered through research groups of critical mass, themed on topics consistent with national strategies and aligned with the aims of the University's strategic plans.
- A highly relevant research area is being developed in technology-themed architectural doctoral level studies, for an increasingly interdisciplinary and technologically-driven construction industry, facilitated by the establishment of an Academy of Architecture and Urban Studies in a recently unified School of Civil Engineering and Architecture.
- The move to recognise high quality conference papers, especially those presented at international conferences, as qualifying for doctoral candidates' publication requirements enhances the quality of the study programme's students' learning experience, and provides constructive input to on-going research activity in a timely manner.
- Industry collaboration complements the study programme's research group activity in a balanced manner, through an informal target of no more than one in six Ph.D. projects being conducted entirely through Industry Ph.D.'s.

Areas of improvement and recommendations

- The Programme Director for doctoral studies in the Department needs to actively manage achievement of the significant potential of doctoral studies in the Academy of Architecture and Urban Studies through the synergies and mentorship available from long-established and successful research groups in civil engineering.
- More personal and in-depth ways to capture feedback for course development need to be piloted, in an age when many stakeholders suffer from survey fatigue and a 'tick box' approach to mandatory participation in online surveys.
- The social experience of students in particular in the case of the international students can benefit from an improved community structure supporting the needs of students and better integration.

## 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.

Comments

The resources for the doctoral programme come through the Department of Civil Engineering and Architecture, one of seven departments in the School of Engineering, following recent restructuring. The School is one of five such units (four schools and an academy). The budget for the School is of the order of €5 million, with a 60/40 teaching/research split. The formation of a single department covering the two subject areas of civil engineering and architecture is quite recent and it is still in the 'bedding-in' process. The two subject areas are located in different campuses and there is considerable asymmetry between resource demands, staff capacity and experience between research groups in the engineering and architecture clusters, but great opportunity for resource synergies to boost architecture doctoral studies.

An adequate number of teaching staff members and researchers participate in the doctoral study programmes. They have appropriate qualifications and experience to lecture on the programme and/or to supervise the doctoral theses with respect to a given study programme. Each PhD position is only created when there is adequate resources in place, demonstrating a robust system of support.

Doctoral schools have been established in Estonia that are project-based and start-up funded from the European Union Structural Funds. One such doctoral school has been established in 'Civil and Environmental Engineering', led by TTÜ, to enhance the efficiency and quality of doctoral studies and to assure accordance with the needs of the labour market. Doctoral schools represent a significant resource for doctoral studies but their ongoing costs may present difficulties. The doctoral schools support, *inter alia*: winter and summer schools; interdisciplinary research projects; curriculum development to improve the quality of teaching;

promoting co-operation between the universities, private and public sectors; and facilitating the mobility of doctoral candidates. The Doctoral School in Civil and Environmental Engineering, serves the two institutions holding performance agreements with the Ministry of Education and Research in respect of doctoral students in the field of Architecture and Building: TTÜ and the Estonian Academy of Arts. Approximately 90% of these students are registered in TTÜ, thus the impact of the resources from the European Union Structural Funds have benefitted TTÜ significantly and ongoing support costs, falling perhaps 100% on TTÜ as leader, will give good payback.

The resources to conduct doctoral research are organised across eight research groups, which prior to restructuring were effectively separate departments. To a large extent the doctoral student experience is still strongly dependent on the resources allocated to, generated by, or existing in, a research group more so than the resources at departmental level. The Assessment Team found this level of resource sub-division to be working effectively in promoting change allied to the University's laudable aims for higher quality research aligned with impactful centres conducting internationally recognised research. The current resources, of 130 staff members, including administrative and laboratory technical staff support, are managed in the following departmental research groups:

- Academy of Architecture and Urban Studies. Membership of 14, most of whom are also active in other research and creative groups, both within the university and external to the university. However the group does not currently have many staff with Ph.D.'s, eligible to supervise doctoral students. The group is not on the same campus as the sister engineering research groups, hindering personal contacts regarding research facilities that could be shared. Currently there are 2 registered Ph.D. students. Staff recruitment plans that would assist the development of doctoral studies are well-advanced
- Structural Engineering Research Group. Membership of 13, including 4 registered for Ph.D. studies. There is a dedicated Structural Engineering Laboratory. The University also has a major test hall including a strong-floor but the large volume space is more likely to be used in the future for large scale nZEB research than heavy structural testing. The University should not lose sight of the value of a strong-floor test facility as these become globally scarcer over time.
- Building Lifecycle Research Group. Membership of 16, including 6 registered for Ph.D. studies.
- Wave Engineering Research Group. Membership of only 4, including 3 registered for Ph.D. studies. The University might consider whether or not a research group should have a minimum number of affiliated academic staff to qualify for recognition.
- Nearly Zero Energy Buildings Research Group. Membership of 29, including 14 registered for Ph.D. studies. The Group has excellent research facilities including a purpose-built nZEB technological test building and also has large volume modern climatic chambers.
- Structural and Fluids Mechanics Research Group. Membership of 15, including 5 registered for Ph.D. studies. The Fluids Mechanics Laboratory

has access to state-of-the-art measuring equipment, some shared with the Centre for Biorobotics).
- Road Engineering and Geodesy Research Group. Membership of 17, including 5 registered for Ph.D. studies. Supported by a dedicated Roads and Traffic Laboratory.
- Water and Environmental Engineering Research Group. Membership of 20, including 8 registered for Ph.D. studies. Dedicated Water Quality Research Laboratory.

As a rule, the principal supervisor of a Ph.D. student is a member of a specific research group. The choke point for resources in engineering is supervisor time but the Assessment Team support the recommended upper limit of 5 doctoral students per supervisor. The choke point in architecture is the number of qualified supervisors. This will be resolved over time. Co-supervisors may be appointed and the Academy of Architecture and Urban Studies has much to gain by collaboration with its experienced engineering research group colleagues.

A multi-annual budget must be in place for financing each Ph.D. student research project, as a pre-requisite for admission of new entrants (from 2016/2017). This is typically achieved through externally-funded projects. This allows the University to support a minimum income per month which is double the state stipend and is equal to the livable wage. The total is achieved through a combination of state stipend (scholarship), research funded salary for work as an early stage researcher and/or employment as a lecturer or engineer. Staff are financially supported proactively in applying for nationally-funded research projects. Invitations to participate as partners in preparing proposals for European funded projects are accepted by the University in a reactive rather than proactive manner without committing special funds in support of proposal preparation. Currently this ensures best use of scarce resources because of the low success rate in the highly competitive EU funding calls.

The Assessment Team applaud the University for ensuring a livable wage for doctoral students but sound two notes of caution. Firstly, the doctoral students need protection from overloading by research or teaching duties that are unrelated to their research. This could negate the intent of state funding of scholarship, which is directed at the education of the individual. Secondly the University needs protection against ongoing contractual commitments to doctoral students, if contracts are renewed in circumstances where the EU Council Directive 1999/70/EC (28 June 1999 concerning the framework agreement on fixed-term work) applies. Renewals typically come about from contracts reliant on external funding. The students rely on the renewal of an externally funded research project to guarantee the funding for the next phase of their studies since funded positions normally cover a two year period, whereas the PhD extends over a longer timeframe. The priorities of the project need to be managed with respect to a project timeline, reflecting the student deliverables and commitments envisaged in the PhD programme, their study programme and percentage completion of the mentioned programme in a defined study period. While this presents a challenge for the supervisor it is noted that the research

group is fully committed to support the student through continued funding towards completion of the doctoral research.

This financial pre-requisite leads towards PhD positions set by the institution in defined areas of study. In principle, PhD positions are bound to those promoted by staff based on funded research or positions supported by industry in Industrial PhDs. Mechanisms exist to enable research students to propose or discuss new research activities as long as these can be supported with adequate expertise of supervisors and access to equipment, but these are not mainstream. Such a theme proposed by a prospective student, and supported by the institution based on a funded research still needs to be presented through the competitive process.

Sufficient funds are made available to support development activities associated with doctoral studies and research, the professional development of teaching staff and researchers. Possibilities and funding for international mobility are available. There are appropriate mechanisms for long-term plans supported with successful research grants. Specific funding as a fall-back position to support unsuccessful submissions by academics can strengthen the system, as can co-supervision opportunities for junior academics. International exchange provides opportunities for development for the academics involved. Industry collaboration also strengthens opportunities for development.

Resource development is in general sustainable but the continuity of funding, in particular from European Research grants, needs to be actively competed for to ensure maintenance of research activity.

Funds are allocated for student mobility, especially in support of international conferences and overseas study. Applications are such that the funds are more than adequate through being undersubscribed.

The laboratory research facilities are excellent. Notable is the nZEB technological test building of the Nearly Zero Energy Buildings Research Group, which is a model for collaborative interdisciplinary research, generating valuable research data from a full-scale purpose-built instrumented building. Much of the laboratory research infrastructure has recently been upgraded through significant investment. Maintaining the infrastructure to the current standard will be challenging. The strong leadership that has been successful in attracting EU capital funds now needs to turn its attention to a funding plan for maintenance, upgrading and replacement, based on baseline funding, success in commercialization of patents and ringfencing of overheads from research grants. There is good co-operation with other universities in respect of sharing access to specialist equipment and facilities on a 'user pays' basis. At present no bottlenecks exist on access to equipment due to the distribution of students across the infrastructure of so many research groups.

The library resources are excellent with a modern layout of private and groupwork spaces. There is access to a good range of databases including European standards. Some research groups have their own library resources. The benefits of centralising all library resources is worthy of consideration.

Individual or shared office workspaces for each student are good to excellent, in respect of space and working conditions. Doctoral students lack a shared space dedicated for recovery, discussions and collaborative working. Such spaces provide chance encounters during which doctoral students have opportunity to discuss both research topics and doctoral studies, thus being able to provide and receive peer-support. Doctoral students typically use their own laptops but can be provided with desktop computers if required and specialized engineering software is provided within groups through research group licenses.

The number of admitted doctoral students has decreased in 2016 and 2017. However management informed the Assessment Team that the priority at present is to clear the backlog of students who have over-run their nominal period. No concerns were expressed about sustainability and the Assessment Team is confident that the emergence of a number of impactful research groups in the Department will lead to growth. Maintaining staff motivation to continuously apply for research project funding is key to ensuring sustainability.

Strengths

- High quality doctoral study programmes are supported by synergetic actions in a coherent combinations of initiatives including use of resources to ensure a common salary structure for doctoral level researchers, with minimum funding per month which is double the state stipend.
- The availability of staff to doctoral students for one-to-one discussions is enhanced by a workload model for staff that includes a recommended maximum limit of five doctoral students per supervisor.
- The well-equipped and modern infrastructure, notably the laboratory facilities, is of a very high standard. Well-managed laboratory quality control protocols help to shape graduate attributes in respect of high personal research standards.
- The nZEB technological test building of the Nearly Zero Energy Buildings Research Group is a model for collaborative interdisciplinary research, generating valuable research data from a full-scale purpose-built instrumented building.

Areas of improvement and recommendations

- Provision for the future cost of maintaining, upgrading and replacing current laboratory research assets needs to be made based on a financial model that will not come as a shock to the system when funding for new equipment becomes ineligible in future research grant proposals and upgrading costs are expected to be covered by research overheads.
- In order that resources may best be used to support doctoral studies, the University might consider whether or not a research group should have a minimum number of affiliated academic staff to qualify for recognition.

- Some research groups have their own library resources. The benefits of centralising all library resources is worthy of consideration.

## Teaching, learning, research and/or 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.

Comments

Doctoral studies at TTÜ are underpinned by a comprehensive set of regulations, principles, guidelines and policies for the use of both doctoral students and their supervisors. These include:

- Good Practice of Doctoral Study at TTÜ.
- Academic Policies.
- Admission Requirements, Chapter 4.
- Academic Policies, Chapter 5, Section, 17, (attestation).
- Guidelines for Drawing up a PhD Students Action Plan, Rector's directive.
- Requirements for doctoral theses and procedure for publishing.

The documents are readily available and accessible. These present a useful guidance for both students and supervisors and encourage uniform principles throughout. In this manner the experience of the students would not be exclusive on the experience of the supervisor but draws on a consistent set of principles in particular the "Good Practice of Doctoral Study at TTÜ". This document refers also to the self-evaluation report (page 11) as a critical item also in the

attestation process. A degree of concern was expressed because of a gap in the number of students being effectively aware of these documents. Students may not be fully aware of these guidelines and where to retrieve them. In this regard an orientation programme can facilitate the process and inform students about the documents. In this way the students do not rely solely on communication with their supervisor.

Orientation is somewhat taken for granted, given that many of the doctoral students completed years of prior study at TTÜ. However orientation is officially provided for all entrants to the programme. Despite this, there remains an over-reliance on helpful departmental administrative staff as a source of information. Students need to take more ownership of their responsibility to be informed and this could be addressed through improved orientation programmes. This will be useful for all students but in particular for students originating from other universities and for international students. Students need to be instructed on the system, documentation and procedure and better informed on the links to the sources of information. Failing this, the students will learn from other students and will be misinformed if procedure change, such as attestation requirements.

The strategy in respect of high quality doctoral studies includes the social working environment, with doctoral students being treated as fellow work colleagues in their research groups. The experience within the research groups in general presents a satisfactory environment and allows students to develop and contribute within a team. The students are offered the opportunity to participate in research within research groups specialized in areas of specific relevance in society including established groups for example the Nearly Zero Energy Building Group and the Water & Environmental Engineering Group.

National policies and university strategies encourage greater co-operation with industry. The Department SER indicates that the low number of industry project could be higher. However some concern has also been expressed regarding the scope of industry projects, which may fall short of doctoral study requirements. TTÜ offers two routes of PhD studies and has both traditional Ph.D. students and industrial PhD students. Some concern has been expressed regarding industrial PhD studies mainly due to the scope of industrial problems addressed in an Industrial PhD which may not necessarily and may not always lead to sufficient level and standards required for a PhD and for the associated journal publications. However Industrial PhD's are relatively a small number, at about one in six students pursuing this route. In general the main cohort of students are based on campus and active in research groups with Industrial PhD students being a minority. It is opportune to take into account this challenge and the potential risk of limitation of intense PhD level conductive to peer reviewed high impact international journal publications, when opening new positions for PhD based on industrial projects. While in general results of Industrial PhDs have been published in International journals and in the Thesis, some concern was expressed regarding the possible situation arising and the potential limitations in publication of industry related research or limitation in inclusion of industry related work in the PhD Thesis.

Industry partners were in general positive on the level of preparation of PhD students within their team. In addition the students participating in Industrial PhD can serve as an important link with the private sector bridging between academia and industry. Industry partners feel that Industrial PhDs need to be promoted more to get academic work closer to the realities of industry. The relevance of the research areas and the societal and economic impact were self-evident with students enthusiastic in general about their research. The relation to the social and economic realities further allows for engagement with external and industry realities.

Students were also positive as to the experience in the respective research groups, in industry and where relevant, in their participation in international research projects. The research groups support Masters level graduates in some levels but are predominantly focused on PhD students particularly in areas which are more intense. In general students were not much involved in grant applications even though there are important skills developed in this process particularly for PhD students.

Further support to the student's social development is necessary to address specific deficiencies arising in social involvement and participation during the course of studies. The social experience of students in particular in the case of the international students can benefit from an improved community structure supporting the needs of students and better integration. Positions are advertised internationally and effectively attracting also international students. The better integration of the students promoting greater synergies can support students further in their academic development.

The opportunity of students to communicate research to a wider audience leads to a greater appreciation of the research, its relevance to the wider world and its impact on society. This can be enhanced through training in communication.

Students' personal and social development, in preparation for participation in international working environments, is strengthened through a flexible study programme that takes account of doctoral students' individual professional needs and the training needs arising from their research work.

In general modern methodologies are adopted in teaching and research. The organisation of the studies and the PhD students' professional research, development and creative activities all support the achievement of the objectives and the learning outcomes of the doctoral studies. In general the laboratories are well organised and structured with availability of equipment and supporting technical staff to facilitate student activities. No barriers to the purchase of consumables and equipment were noted. The University is also noted to be well connected to access international facilities when this is necessary. International opportunities including the programme DORA supporting student exchange are known. However the opportunities for international exchange of doctoral students which exist and which can allow for access to facilities in other institutions, need to be better communicated and exploited by students at strategic times during their studies, possibly with the support of their supervisors for proper integration in the programme of studies.

Teaching, learning and research activities rely on effective methods to promote the development of the students. Innovative methods are introduced and their efficacy in their implementation requires close monitoring. Training in supervision and pedagogy is provided but a greater effort is necessary to improve training and monitor it's the effectiveness in teaching and tutoring supervision. In addition more opportunities for junior academic staff need to be created to encourage greater participation, and to provide for the necessary skills to attract funding for new positions. Collaborative frameworks through programmes such as ERASMUS+ exist with external entities intended to encourage sharing in teaching methods and new ideas. These opportunities can be better promoted and participation encouraged further, even properly integrated within a programme.

Students are involved within the research groups in various departmental activities including teaching and supervision and even participation in project activities. They can be engaged more with research proposal writing and in supporting various academic activities including international conferences, workshops and other activities within the department. The compulsory module does not cover other aspects of working in a research and academic institution such as research proposal writing but that is covered elsewhere in the programme.

The students activities including parallel activities such a teaching and other activities such as support on research projects need to be assessed holistically in the context of the study programme and in relation to other academic activities including the PhD research commitments. These have to be assessed also in the context of changing situations during the course of the studies.

A compulsory 5 ECTS module 'Teaching Practice' (EXX9021) is designed to develop teaching and supervising skills. Doctoral students give lectures, conduct laboratory works and exercises to bachelor and master degree students. The SER however indicates that the involvement of PhD students in the teaching and supervision of BSc and MSc students can be improved. Increasing participation of students in teaching and supervision is desirable but can be improved by a better understanding by the Faculty regarding student concerns, the teaching work-load and how they can manage it and student views regarding the design of their study programme, its structure and organization, the credit system for teaching and supervising experience and possible improvements which can be implemented. A system promoting an improved assessment of student workload sensitive to the different phases of their studies, can be based on a better organised programme of studies.

Students can be encouraged to participate more in the design of the study unit. course or programme and its development rather than engage them solely to fill in specific gaps. This may effectively bring new ideas to the programme enriching it in the process.

Although the doctoral students teach in a particular module in the BSc or MSc the feedback provided does not necessarily reflect the specific input of the students. Therefore the feedback is not effective in improving the doctoral students learning in respect of quality of teaching. This should be addressed in order to

make students more aware of the importance of teaching and tutoring in academia. This will motivate them further and will enhance their involvement in teaching within the department.

The gathering of feedback from students can be effectively improved and opportunities can be created through a greater effort for the gathering of information from students. When analysed and processed effectively, this will in turn provide invaluable input when designing specific courses that respond to the actual needs of the students. The communication with supervisors is in general effective and clear and the main supervisors are accessible for supervision of the doctoral thesis. While this does not guarantee that all the student needs are responded equally, this proves to be an important aspect in ensuring that the study programme addresses the specific needs of the students.

Feedback concerning supervision and the management of doctoral studies as a whole is collected at the department level through attestation and doctoral seminars. The PhD 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. While the feedback is requested this measure is not necessarily implemented effectively and it is not clear how the data collected from students in the self-evaluation reports is collected and processed for quality improvement. Some concern was expressed as to the options available for students to discuss problems confidentially, in case of poor or inadequate supervision. The feedback of the students is requested before the attestation. Attestation self-evaluation reports are required annually and evaluation is by the supervisor.

The assessment of the outcomes of the learning, research and creative work of the PhD students needs to be relevant, transparent and objective in order to support the development of students during the course of their studies. Students present their work in front of their colleagues, supervisors and other academics and receive feedback and get review of their work from peers. The doctoral seminars have the potential to be more relevant and fruitful for students. There is an understanding that more can be achieved through more relevant and structured seminars. While doctoral seminars can in general be based on thematic areas and focused to a specific group instead of the whole faculty, with feedback restricted to and based on the knowledge within the group, there are advantages in opening up the doctoral seminars to a larger audience, at faculty level, leading to a more diverse feedback. The students can even benefit further through external comments and feedback including through outsider perspective from academics from other entities within the faculty or from industry.

With regards to the assessment of the outcomes of the learning, research and creative work in the new programme proposed for Architecture and Urban Studies, the latter has the potential to draw on the experience of the already established study programme, towards new technologically oriented architectural doctoral level studies. The programme can benefit through effective and reinforcing synergies with the successful and established civil engineering groups.

Research areas are related to the expertise and research interests of the academics. In addition the research areas also relate to the resources and facilities available within the institution. The research students are presented with research positions which are promoted online with sufficient detail. This attracts both national and international students. In addition, in the case of research groups with a sound track record, the research opportunities related to the research direction of the academics and department, the research developments are well communicated even attracting a wide interest in the field.

Attestation is carried out on an annual basis with reference to the student work presented formally. The attestation is considered seriously by students, as an important step in their progression. It provides the students with feedback and indication on how to improve the work. The attestation can lead to the dismissal of a student even later during the course of studies. Concern was expressed at the fact that students can be dismissed even late during their studies with no distinction between the initial attestation which may be considered as a progression point recommending continuation or discontinuation of studies, and later attestation which can be conducted in the context of supporting students to timely success in their studies.

In respect of assessment of doctoral thesis dissertations, examiners are selected on the basis of their expertise in the subject and experience and are typically drawn from universities outside of the country.

The effectiveness of the doctoral studies requires regular analyses and such analyses should serve as a basis for the planning of quality improvement activities, through updates to the programme as can be determined by the Doctoral Studies committee.

Strengths

- The attestation procedure in doctoral studies is increasingly being used to achieve greater compliance with nominal study durations through a combination of timely feedback on progress and the early identification of non-performing students.
- The collaboration with industry through the Industrial PhDs is effective in fostering important links and collaborative frameworks between academia and industry and also in promoting a greater appreciation of societal and economic realities.

Areas of improvement and recommendations

- An orientation programme for students should include specific reference to the set of principles outlined in the document "Good Practice of Doctoral Study at TTÜ".
- The creation of each industrial PhD study position should require an extra approval stage which validates the scope of the industrial problem as

being of sufficient level and standards required for a PhD and for the associated journal publications.

- Doctoral student salaries are laudably constructed to ensure an acceptable minimum level of monthly income through a combination of state scholarships and University researcher contracts. The latter could be more specific on workload expectations to ensure that students are not overloaded by teaching, whether credits are given or not, nor unduly side-tracked by research contract administration or investigations unrelated to the personal Ph.D. research question. Consideration should also be given to contractual recommendations that teaching duties should directly relate to their thesis topic.
- Although students are exposed to modern teaching methods in both taught courses and supervision within research groups, it is recommended that best practice be shared such that the student experience (good or bad) is not unduly influenced by the size, group dynamic and/or leadership style in their allocated research group. This could be achieved for example by increasing the annual number and the scope of pan-research group doctoral seminars.
- A greater sense of community across the doctoral student cohort should be fostered through doctoral study seminars and a coffee-room 'bump space' designed to encourage more occasions for quality conversations – a key component in maintaining the physical and mental health of sometimes isolated solo researchers.
- Students should be encouraged to participate in writing research proposals as part of their training.
- Students should be encouraged and trained to communicate their research to a wider audience, both for self-development and to foster a greater appreciation of the research, its relevance to the wider world and its impact on society.
- Feedback from students taking modules taught in part by doctoral students should invite specific feedback for improving the doctoral students' learning in respect of quality of teaching.
- Supervisors should be more proactive in facilitating the identification of opportunities for international exchange of doctoral students and encouraging students to have an expectation of requiring access to specialist facilities in other institutions as a routine part of their pursuit of new knowledge at doctoral studies level.
- The attestation procedure should be redesigned to emphasise a difference between the first attestation meeting and later ones. The first attestation, held in a period of 12 to 18 months after first registration should be a milestone progression point either recommending continuation or discontinuation of studies. Later attestation meetings should then be conducted in the context of supporting students to timely successful completion of studies. Consideration might also be given to the

introduction of an appeals procedure for students who feel that a recommendation that they exit their studies is not justified.

## 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.

Comments

The number of staff associated with the programme, as lecturers and/or supervisors is over 40 and qualification to Ph.D. level is the norm. Staff supporting the research element of the doctoral studies are organized into 8 research groups. These groups are led by eminent academics at the level of professor (6 research groups), associate professor (1 group) and by a visiting associate professor (1 group, the Academy of Architecture and Urban Studies). All comply with the qualification requirements set out in the Personnel Strategy of Tallinn University of Technology 2011-2015. The average age of the supervisors – currently 56 years – is decreasing year-on-year as older staff retire. This point is significant as the proportion of supervisors over 65 years of age was over half a decade ago but now represents a minority, at 15%. The succession is working effectively under strong University leadership, with the translation of retiring staff positions into new ones based on criteria related to the strategic plan of the University.

The staff resources qualified to supervise is strong, except in the case of one research group (Academy of Architecture and Urban Studies) such that allocation of staff opportunities for supervision of doctoral students is now competitive. On the positive side, this means that students are assured that academic staff acting as supervisors are highly experienced researchers, actively involved in national

and international research projects and industry projects that lead to impactful and well-cited publications. On the negative side, this may disadvantage early stage researchers on the staff whose ranking has yet to reach a comparable benchmark with highly experienced colleagues. However safeguards are built into the system, in that takes account of active performance (currently measured over the previous 10 years) and limits supervisors to a maximum of 5 current students (measured as those registered but yet to submit their thesis). The average performance over a 10-year window should allow fairness to academics whose research careers have been interrupted by maternity leave, compassionate leave or extended sick leave. Nevertheless, perhaps the University might wish to include formal guidelines for consideration of such extenuating circumstances.

Incentives exist for academic staff to attract international research projects and industry collaborations through a monetary reward system which permits recognition of externally-generated funding for the University. This in turn should increasingly translate into an enhanced internationally-focused working environment in which to mentor doctoral students.

Comprehensive supports are in place for staff development. These include the resources of the Staff Development and Mobility Centre and International Engineering Educator. A two-year study programme is available in the Estonian Centre for Engineering Pedagogy at TTÜ. Doctoral supervisors as a rule will have already supervised at the bachelor's and/or master's degree programme level. Additionally, novice doctoral supervisors typically start off as co-supervisors of doctoral students under the mentorship of experienced staff. Seasoned academics and researchers can be great mentors and so the challenge is to involve junior staff in the doctoral students work without hindering the overall progression of research activities.

Constraints to improve the quality of doctoral supervision are constantly being rolled out. Regarding teaching staff, the 'Good Practice of TTÜ Doctoral Studies' now limits any one supervisor to a maximum of five doctoral students to ensure adequate attention to each student.

The development of academic skills at foreign universities and research institutions, participation in international research projects, and present of papers at high-level conferences is encouraged, not least through a new academic career model.

Regarding supervisor-student working relationships, the evidence indicates that academic staff are competent in managing this in a good manner. Although it would be difficult to capture data about this sensitive issue from annual surveys because of the asymmetrical relationship, it is noted that the drop-out rate is low, has dropped by 63% compared to 5 years ago and is performing better than the University average.

There is active involvement by international visiting lecturers in the programme. International visiting staff are the norm in theses defence panels. Partners in international research collaborations visit the University for project meetings.

Such visitors typically accept an invitation to give a lecture on their research activities to doctoral students. However a higher proportion of full-time international teaching staff in the School would be beneficial for doctoral students. A specific plan needs to be put in place at University level to examine and address any systematic inhibitors to international recruitment at doctoral researcher, post-doctoral researcher and academic staff level.

A new academic career model has recently been introduced in the University, which will enhance the quality of doctoral studies through its encouragement of strong international research reputations by academic staff. Sustainability of this model will require support from the University and recognition by the State in respect of reward structures, not least in salary scales for highly qualified, internationally respected researchers.

The growth of architectural doctoral studies is welcomed, especially in breaking new ground with technologically-themed doctoral studies for an increasingly technologically-based construction industry. However unhelpful divisions may impede the connectedness of architectural doctoral students with the school arising from the historically low number of architects with Ph.D. level qualifications eligible to act as supervisors. The University should review foreseeable and unforeseen negative consequences of this systematic constraint so that it can be managed in a way that allows full participation of architectural staff, especially internationally renowned staff without Ph.D.'s, in supporting doctoral scholarship as an integral pillar of the School.

Strengths

- The academic staff includes internationally recognised professionals in the fields of civil engineering and architecture.
- Recommendations are in place aimed at limiting the number of doctoral students per supervisor to a maximum of five, better assuring strong student-supervisor working relationships.
- A system is in place to allow new staff to be mentored by experienced supervisors through formal co-supervision of a thesis.
- Appropriate incentives are part of management's strategy to encourage greater research activity by staff, who thereby have positive motivating factors in further development of high quality and impactful doctoral studies.
- Complementing incentives, a competitive performance model for staff forms part of the process for creating and allocating doctoral study supervisor opportunities.

Areas of improvement and recommendations

- The use of performance indicators, using data from the previous 10 years, in the allocation to academic staff of doctoral supervision places is praiseworthy in respect of ensuring high quality supervision of doctoral studies. However the University might wish to include formal guidelines for consideration of extenuating circumstances to moderate scores in the case of staff potentially disadvantaged by research careers interrupted through maternity leave, compassionate leave or extended sick leave in the previous 10 years.
- The growth of technologically-themed architectural doctoral studies is welcomed, especially in the context of a research group (Academy of Architecture and Urban Studies) that forms one of eight such groups in a united School of Civil Engineering and Architecture. The shared learning and exchange of best practices between the two disciplines provides a great opportunity. However differences will emerge and need to be managed positively. One such difference is that leadership in architectural innovation and scholarship is often conducted by eminent architects who do not have Ph.D. level qualifications. Thus they may be ineligible to act as doctoral supervisors. The University should anticipate this potential source of tension and manage it such doctoral scholarship is a shared strength and integral pillar of the School.
- The proportion of international teaching staff should be increased to assist in the speedier development of strong internationally-connected research groups, to support, *inter alia*, greater mobility by doctoral students during their studies. A specific plan needs to be put in place at University level to examine and address any systematic inhibitors to international recruitment at doctoral researcher, post-doctoral researcher and academic staff level.
- Expectations on staff, in the context of the new academic career model, will need to be balanced by support from the University and recognition by the State in respect of reward structures, not least in salary scales for highly qualified, internationally respected researchers.

## 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

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| | 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. |

Comments

The criteria for admission is presented in the document 'Admission to Doctoral Studies'. Admission procedures have been changed since academic year 2016/2017 to improve the return on investment of staff and infrastructure resources. Admission to doctoral studies now takes place by way of a competition announced based on the topics of doctoral theses approved by the Vice-Rector for Research, on the proposal of the admission committee for doctoral studies. There is a separate competition for each doctoral thesis topic. An applicant may apply for one or several competitions. Furthermore, there are now greater constraints on the creation of each doctoral position prior to filling on a competitive basis. Evidence is required of the supervisor and the supervisor's department capacity to create a Ph.D. position, including adequate multi-annual funding in place to guarantee a minimum salary for the researcher. Supervisors are ranked based on research track record: number of published research articles in the last 10 years, quality of the articles, efficiency of supervision so far in respect of total number of students supervised and graduated in the last 10 years shall be taken into account. Competition is therefore present among the staff for allocation of Ph.D. positions and then among the applicants ranked for these Ph.D. positions. The ranking drawn up takes into account the applicant's academic skills, performance and motivation in accordance with the documents submitted for the competition and an interview made with the applicant and the supervisor's opinion.

Based on discussions with supervisors, employers, cooperation partners and doctoral students, it is apparent that the necessity to compete for doctoral student positions arise from different needs that may influence candidate selection. To maintain and increase the high level of doctoral students in the study program, it is important to pay attention to the students' recruitment process when doctoral students are recruited directly by their supervisors from TTÜ master's programs or alternatively, when doctoral students are recruited by their own request to start a project. Thus although applicants are well-informed of the selection criteria in connection with the call for doctoral students and although these criteria are appropriate, the weight of the supervisor's opinion is not clear. This needs to be moderated, especially in respect of tackling any conscious or unconscious bias which influences supervisor-led selection that

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

might unduly favour the appointment of TTÜ master's degree graduates over others.

The number of recruited international students compared to students graduated from TTÜ is low and the number in the programme has remained static despite an growth of over 100% in TTU since 2012. However, it is apparent that recruitment of international doctoral students can be successful through online published open calls. This indicates that the study programme has tools to increase the number of international students in the programme. The University should investigate the causes of the recent lack of growth in line with University averages and draw up an action plan to address any impediments to growth.

Developing a personal study plan enables scheduling and dividing the workload between research, teaching and studies. The study plan is created together with supervisor, submitted to ÕIS and updated annually. General courses are organized by TTÜ and students are informed on course timetable to help organizing their study plan. Interviewed students were satisfied with the organized special courses that support their needs to deepen their skills in their fields of research and felt that their special needs were accommodated. Students are aware of their chances to influence the contents of special courses and also of attending courses provided by other universities, on national and international level. However, the descriptions of courses are on general level in the study guides and more detailed content would support each student's process to plan and update their personal study plans.

Students' progress is evaluated through two separate mechanisms: attestation and doctoral seminars. Yearly attestation follows students' academic progress in terms of completed courses, submitted and published research articles, and annual plans and progress of their research. The requirements to pass attestation are described in Academic policies. The Academic Policies and other guidelines documents are available online. Under Academic Policies, in full-time studies a PhD student is required to accumulate, by the end of each academic year, at least 75% of the study load subject to completion under the doctoral curriculum. Students whose progress is below expectation may have their study load reduced – with a consequent loss of government-funded scholarship. Altogether, it is important that the contents of the policies and guidelines are discussed between supervisor and doctoral student. Students would benefit from orientation seminars for PhD studies arranged specifically to cover these areas. Also, attestation is used as a tool to evaluate co-operation between the PhD student and the supervisor. Doctoral seminars are organized annually and students' progress is subjected to scientific evaluation by their own research community, including supervisors, other researchers and doctoral students.

Notwithstanding the positive working atmosphere for doctoral students in TTÜ, the completion rates within the nominal time (accepted in reality as 6 years) remain disappointing. The European Regional Development Project ASTRA "TTÜ Institutional Development Programme for 2016-2022" sets an aim to increase the graduation efficiency of doctoral students during nominal time of studies to 35% by 2018 and to 50% by 2022. Significantly improved procedures for the annual attestation of doctoral students is proving to be effective. Clear goals are set to

be achieved at the end of each academic year and supervisors must evaluate completion of research cumulatively at the end of each academic year. Thus students are provided with timely and clear feedback on their rate of progress and standard of work. This should contribute significantly to ever-increasing compliance with a study period that does not exceed 6 years (nominal period 4 years). Attestation is now being used as a tool to promote graduation within nominal time frame of 4 + 2 years. After reaching the nominal time frame of 4 years for PhD studies, the attestation is performed twice a year for a more thorough follow-up of the students' progress. Negatively attested students can be exmatriculated on the grounds of inadequate academic performance. Importantly, regular attestation enables study program to identify and detect possible reasons for prolonged study times. Students' workload may consists of extracurricular teaching, research or creative activities designated by supervisors. In order to support graduation within nominal times, students' workload concerning these should be followed closely.

TTÜ offers student, psychological and career counselling services for its doctoral students through online student guide. The academic policies are also communicated through online service, including provisions for academic leave of absence. However, based on discussions with students, they would benefit from more direct communication on these services and rights. Students consider peer support highly important in different phases of their studies but the level of such support varies within research groups depending on the number of doctoral students. More consistent opportunities for doctoral students to share experiences and discuss these with peers would be valuable. This is especially important for those in research groups with few members, where the student experience is overly dependent on the quality and availability of the supervisor.

Students are encouraged to take advantage of an international mobility period. During 2013-2017 eight student spent more than 4 months in foreign research institutions and universities. Short-term international mobility is mainly financed by the research group or international mobility programmes such as Dora Programme (2008-2015) Dora Plus (since 2016) and Kristjan Jaak and by graduate school. Long-term international mobility is mainly financed by mobility programmes such as Erasmus and Dora Programme, incl Dora Plus. Based on the discussion with students, they are encouraged to be mobile, but they need support from their supervisors in planning research visits. The University needs to push doctoral students into the mindset of 'When and Where?' for their mobility period rather than 'If and Why? Mindset. Small steps, such as ensuring that noticeboards advertising any mobility opportunities are also in English, may help to 'nudge' mindset change.

Feedback from alumni is collected centrally through surveys but does not provide enough responses as the number of study programme graduates yearly is less than ten. Based on discussion with alumni, feedback on doctoral studies is also given directly to supervisors. Graduating doctoral students are not informed on the surveys and their importance to the study programme.

Strengths

- New doctoral positions, which can only be created when sustainable funding is in place for the nominal duration of study, are advertised nationally and internationally.
- International mobility opportunities are actively promoted and supported by the University.
- The University is pro-actively tackling the inefficient deployment of doctoral studies research capacity by encouraging completion of studies by those students currently two years beyond the nominal duration of studies and by removing non-performing doctoral level researchers from the register.
- Supervisors and doctoral students work closely to create the study plan. Special courses are offered in response to students' needs and students actively participate on courses organized by other universities and institutes on national and international level to gain necessary skills for their line of research.
- Alumni and employers are involved in doctoral seminars and the Study Programme Committee, thus being able to give feedback and develop the study programme to respond to the needs of the doctoral graduates' future employers.

Areas of improvement and recommendations

- The process for admission to a PhD programme needs to be reviewed to ensure greater transparency, especially in respect of tackling any conscious or unconscious bias which influences supervisor-led selection that might unduly favour the appointment of TTÜ master's degree graduates over others.
- More pro-active measures are required to bring the international student numbers in the programme up to the University average. The University should investigate the causes of the recent lack of growth in line with University averages and draw up an action plan to address any impediments to growth.
- Students are not comprehensively aware of their rights and responsibilities regarding to available counselling, Academic Policies and TTÜ regulations for PhD studies. Students would benefit from orientation seminars for PhD studies arranged specifically to cover these areas.
- The descriptions of courses are on general level in the study guides and it is recommended that more detailed content be included to support each student's process to plan and update their personal study plans.
- Student workloads need to be monitored by their supervisors to ensure that a combination of extracurricular teaching, research and creative activities designated by supervisors do not delay graduation within nominal time.

- Students consider peer support highly important in different phases of their studies but the level of such support varies within research groups depending on the number of doctoral students. This is critical for those in research groups with few members or lone researchers, where the student experience is overly dependent on the quality and availability of the supervisor. Pro-active measures to enable more consistent opportunities for doctoral students to share experiences and discuss are recommended, for example through frequently organized informal events, research seminars or dedicated space for encounters, discussions and collaboration opportunities.

- More pro-active measures are required to encourage the take up of mobility opportunities, not only for the good of the student learning experience but also so that they may be 'brand ambassadors' for TTÜ's ambition to be increasingly recognised as a vibrant research university on the international stage.