ESTONIAN QUALITY AGENCY
FOR HIGHER AND VOCATIONAL EDUCATION

EKKA

Assessment Report

Engineering, manufacturing and technology

Estonian University of Life Sciences

2019

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 in the First and Second Cycles of Higher Education*.

The aim of the assessment team was the evaluation of the Study Programme Group (SPG) of Engineering, Manufacturing and Technology in the Estonian University of Life Sciences (EMÜ). For the previous assessment of SPG (2015) the decision of EKKA Council was: next assessment in 4 years.

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 Richardson (chair)	**Professor Emeritus, University College Dublin, Ireland**
Petri Kärenlampi	**Professor, University of Eastern Finland; Finland**
Rebecka Lindvall	**Student, Lund University; Sweden**
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The assessment process was coordinated by Hillar Bauman (EKKA).

After the preparation phase, the work of the assessment team in Estonia started on Monday, 11 February 2019, 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 team collectively reviewed their preliminary impressions from the Self-Assessment Report (SAR) and the most recent Assessment Report (2015). They agreed the priority aspects to discuss with each group at EMÜ. The distribution of tasks between the members of the assessment team was organised and formally recorded in a spreadsheet circulated to members by e-mail that evening.

During the following days, meetings were held with the representatives of the Estonian University of Life Sciences (Tuesday 12 and Wednesday 13 February). The Assessment Team worked as a unit for meetings with University management and with Directors of the academic units hosting the programmes. The Assessment Team split into two groups to gather evidence from other stakeholders. One group concentrated on wood processing and food technology. The other concentrated on engineering, technotronics, energy, production engineering and ergonomics. In all cases, the schedule for discussion on site for each of the various study programmes only allowed for short time slots to be available for team members to exchange information, discuss conclusions and implications for further questions.

While primarily focussed on making recommendations in respect of quality enhancement, the Assessment Team was mindful of its responsibilities in assessing conformity of the study programmes and the instruction provided, *inter alia*, to legislation and to the level of theoretical and practical instruction. In respect of legislation, the Assessment Team carefully reviewed learning outcomes as set out in Government of Estonia Regulation 178 (18 December 2008), Annex 1. The Assessment Team particularly reviewed the changes that had occurred since the last assessment. The team recognised systematic factors at national level that inhibit the pace of change in quality improvement in respect of certain issues. The Assessment Team therefore concentrated their discussions on improvements that are largely within the power of EMÜ to solve alone. Nevertheless, certain national level issues are discussed, from which the University might formulate an approach. In formulating any of its recommendations, however, the Assessment Team has not evaluated the financial feasibility associated with their implementation.

On Thursday, February 14, the team held an all-day meeting. Written reports were tabled by each member, based on their individual preliminary reports and observations during the site visit. These reports were then tabled for discussion and the structure, draft text and findings of the final report were agreed.

In the following sections, the Assessment Team summarise their general findings, conclusions and recommendations which are relevant across the whole SPG in EMÜ. 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.

1. Assessment report of SPG at the Estonian University of Life Sciences

1.1. Introduction

Eesti Maaülikool, the Estonian University of Life Sciences (EMÜ) is the only university in Estonia providing higher education in agriculture, veterinary medicine and forestry. EMÜ promotes the smart and balanced management of rural life through research-based education. The main field of research concerns an integrated value chain approach in bio-economy sectors. The EMÜ Development Plan adopted in 2015, sets the fields of engineering, manufacture and technology (food science, wood technology, engineering) as the priority areas of the University.

The history of EMÜ dates back to 1848, when Tartu Veterinary School was founded. From 1873 to 1918 the school operated under the name of Tartu Veterinary Institute, being the first educational establishment in Estonia providing higher education with a full agricultural curriculum in veterinary medicine. In 1919, the Veterinary Institute was incorporated into Tartu University and re-named the Faculty of Veterinary Medicine. In the same year the Department of Agriculture was established in Tartu University. In 1920 it was divided into the Departments of Forestry and Agronomy, the latter comprising both plant production and animal husbandry. In 1946, a separate Faculty of Forestry was established. In 1951 the Estonian Agricultural Academy, which was re-named the Estonian Agricultural University in 1991, was established. In 2005 the structure of the University was reformed and the University was renamed Eesti Maaülikool, Estonian University of Life Sciences.

Today the University comprises five R&D institutes and one college. Each institute is an academic structural unit, enjoying a high degree of autonomy, providing education and research. The College is an educational institution within the University that provides professional higher education. The programmes assessed in this report are the responsibility of three of the institutes and the College, as set out in Table 1.

The detailed structure of programmes is set out in Appendix 1 to the SAR and is summarised in Table 2. Although practical training is not listed for master's degrees in the summary of curricula the Assessment Team learned that credits for practical training have been introduced in the master's degree programmes. These are of the order of 5 to 8 ECTS.

Table 1. EMÜ Programmes in SPG Engineering, manufacturing and technology

Programme	**Duration/ECTS**	**Launch**	**Responsible unit**
Prof HE, Technotronics	4 years / 240	2007	Tartu College of Technology
Prof HE, Wood Processing Technology	4 years / 240	2015	Institute of Forestry and Rural Engineering
BSc Engineering	3 years / 180	2002	Institute of Technology
BSc Food Technology	3 years / 180	2015	Institute of Veterinary Medicine and Animal Sciences
MSc Food Technology*	2 years / 120	2018*	Institute of Veterinary Medicine and Animal Sciences
MSc Energy Application Engineering	2 years / 120	2005	Institute of Technology
MSc Ergonomics	2 years / 120	2005	Institute of Technology
MSc Production Engineering	2 years / 120	2005	Institute of Technology
* Programme previously titled 'Meat and Dairy Technology', established 2005			

Table 2: Study Programme structure:

Programme	General	Speciality	Practical training	Elective subjects	Optional subjects	Graduation thesis
	ECTS	ECTS	ECTS	ECTS	ECTS	ECTS
Prof HE, Technotronics	57	77	39	34+10*	8	15
Prof HE, Wood Processing Technology	31	97	44	44	9	15
BSc Engineering	59	50	N/A	53	8	10
BSc Food Technology	51	99	N/A	12	8	10
MSc Food Technology	N/A	50	N/A	35	5	30
MSc Energy Application Engineering	N/A	72	N/A	13	5	30
MSc Ergonomics	N/A	44	N/A	30+10*	6	30
MSc Production Engineering	N/A	65	N/A	20	5	30
* speciality elective + general elective						

Source of data: SER, Appendix 1.

Typically less than half of the core staff delivering the programmes are qualified to doctoral level. The proportion is indicated in Table 3. The percentages would be even lower if the input of assistant lecturers was included. If visiting lecturers were included the proportion with Ph.D.'s would drop further – the University commented that all curricula involve specialists from outside the university that do not have a doctorate.

The problem cannot be solved quickly by international recruitment due to low salaries by international standards and language skills needed to teach in the Estonian language. A total of 190 staff appointments were made in the three Institutes responsible for the programmes in the period 2013-2018. The EMÜ Institute of Forestry and Rural Engineering had 120 positions, attracting only 136 applications of which 114 were appointed. The EMÜ Institute of Technology had 70 positions, attracting only 71 applications of which 56 were appointed. The EMÜ Institute of Veterinary Medicine and Animal Sciences had 23 positions, attracting only 24 applications of which 20 were appointed. In all cases the level of applications is very low compared to the number of positions available and not all positions were filled. The objective of having all academic staff at Ph.D. level by 2020, as stated in the SAR, seems unrealistic at this stage.

Table 3: Proportion of core staff at doctoral level delivering programmes

Programme	**Doctoral (%)**	**Total (no.)**
Prof HE, Technotronics	47	38
Prof HE, Wood Processing Technology	54	48
BSc Engineering	39	31
BSc Food Technology	48*	29
MSc Food Technology	44	16
MSc Energy Application Engineering	45	11
MSc Ergonomics	100	3
MSc Production Engineering	85	13
'Core' staff (i.e. excludes assistant lecturers)		
* Figure based on the 14 of 29, listed in SAR, Appendix 4.7. University commented that this should be 15 of 29, (52%).		

Source of data: SAR, Appendix 4

Further to Table 3, the University's Development Plan 2016-2025 includes the objective in respect of R&D of being listed in at least one internationally recognised university ranking table. The Plan includes a target level of at least one publication per academic staff member per year (mean number at the University: the Institute of Technology commented that their Institute includes lecturers from the Department of Mathematics and Physics, whose main contractual obligation is to carry out teaching). The aggregated figures for the Institutes delivering the programmes in the SPG are presented in Table 4. The

SAR draws attention to ever-increasing rates of research dissemination by staff. The current average contribution from those in the 'lecturer' category, at 0.4 publications per annum, indicates a positive direction of travel. It may also be noted that the average data for the Institute of Veterinary Medicine and Animal Sciences is particularly disadvantaged by the lack of publications at Professor level. This will be addressed shortly when the ERA Chair for Food (By-) Products Volarisation takes up the appointment later in 2019.

Table 4: Research publication rates by the three Institutes, 2015-2018

Institute	**Grade**	**Number**	**Publications 2015-2018**	**Average per person per year**
Institute of Technology	Professors	6	120	5.0
	Associate Professors	15	45	0.8
	Research fellows	4	32	2.0
	Lecturers	25	31	0.3
		50	228	1.1
Institute of Forestry and Rural Engineering	Professors	5	56	2.8
	Associate Professors	5	35	1.8
	Research fellows	2	7	0.9
	Lecturers	6	14	0.6
		18	112	1.6
Institute of Veterinary Medicine and Animal Sciences	Professors	0	0	0.0
	Associate Professors	4	15	0.9
	Research fellows	1	0	0.0
	Lecturers	13	30	0.6
		18	45	0.6*
* The University commented that Prof. Avo Karus should be added to the list in the SAR (Appendix 5.7), at the IVMAS with 4 publications in the period. This raises average publications per person per year from 0.6 to 0.7.				

Source of data: 2018 ETIS 14.09.2018, SAR Appendix 5.7

The issue of drop-outs/interruption to studies is a significant problem nationally in Estonia. Successive assessment teams have noted the phenomenon and the limited success in tackling the issue at individual programme level. Anecdotally it may be noted that the reasons are systemic and are at national level.

Reviewing the application, admission and graduation numbers in the programmes, presented in Table 5, the severity of the problem at undergraduate level in this SPG at EMÜ is evident. While recognising that internationally a retention rate as low as 75% might be expected from admission to graduation in

respect of a particular cohort, the retention rate in the SPG programmes were of the order of 40% for Prof.HE, 47% for B.Sc. and 68% for M.Sc.

The level of recognised learning obtained from universities outside of Estonia is extremely low. The number of ECTS credits from foreign universities transferred in the curricula in the study group was 413 ECTS credits in the period 2013-2018. This represents 6.6 equivalent student years in a period when approximately 1200 students were admitted to the study group programmes, joining those already enrolled in the programmes in 2013. The trend is in the wrong direction, falling from a high of 249 ECTS in 2015/2016 to 12 ECTS in 2016/2017 and just 3 ECTS in 2017/2018. The University commented that the downward trend is related to the increased proportion of block learning in the SPG curricula (increasing the number of students working during their studies, who have difficulties in finding the time to study at a foreign university.

Table 5: Application, admission, interruption and graduation data in 2013-2018

Programme		2013	2014	2015	2016	2017	2018
Prof HE, Technotronics	Applications	108	115	111	85	94	91
	Admissions	36	25	26	30	24	37
	Interruptions	27	39	21	35	21	25
	Graduates	12	14	14	6	13	11
Prof HE, Wood Processing Technology	Applications	N/A	N/A	64	49	41	37
	Admissions	N/A	N/A	21	17	17	21
	Interruptions	N/A	N/A	2	5	7	11
	Graduates	N/A	N/A	N/A	N/A	N/A	N/A
BSc Engineering	Applications	120	275	278	200	178	189
	Admissions	108	78	69	60	67	81
	Interruptions	73	86	65	93	46	59
	Graduates	51	34	43	48	37	27
BSc Food Technology	Applications	233	257	231	228	164	140
	Admissions	29	25	19	24	22	24
	Interruptions	11	16	12	18	13	13
	Graduates	23	26	17	16	15	15
MSc Food Technology*	Applications	20	16	13	16	3	16
	Admissions	11	13	5	13	0	13
	Interruptions	5	9	8	3	7	2
	Graduates	9	6	13	7	4	5
MSc Energy Application Engineering	Applications	21	26	14	16	38	29
	Admissions	17	19	10	7	31	26
	Interruptions	4	8	6	12	5	12
	Graduates	15	10	9	15	8	6
MSc Ergonomics	Applications	17	15	13	10	5	11
	Admissions	16	13	6	9	4	10
	Interruptions	3	7	5	1	2	2
	Graduates	11	8	8	10	3	10
MSc Production Engineering	Applications	17	14	24	38	27	30
	Admissions	13	5	17	26	16	22
	Interruptions	4	5	6	12	12	3
	Graduates	6	11	11	3	11	12

Source of data: SAR, pp.17-18

1.2. General findings and recommendations at the study programme group level

Tartu is home to several Estonian universities and academies. These play a significant role at national level, in addition to their major contribution to regional societal and economic development. Amongst these, the Estonian University of Life Sciences (EMÜ) plays a national role as the only university in Estonia providing higher education in agriculture, veterinary medicine and forestry. Regarding the SPG reviewed in this report, EMÜ is one of the top 100 universities in the world in the field of agriculture and forestry, ranked 51 to 100 (QS World University Rankings by Subject 2018).

However EMÜ does not appear at all in the QS World University Rankings by university, nor in the subject rankings for engineering and technology. Although such ranking tables must be treated with caution in the strategic development of universities and programmes, there are aspects that are worthy of consideration by programme leaders. Among these are: academic reputation, employer reputation, research citations per paper, H-index. In the increasingly competitive international environment, EMÜ needs to make substantial progress if the 'Engineering, manufacturing and technology' SPG is to be of international standard, as represented by world ranking tables. Providing a teaching and learning infrastructure that encourages students to achieve their full potential will require a more challenging teaching and learning environment for both staff and students.

The Assessment Team found that although the University has set clear targets for development, progress is slow in respect of many aspects of relevance to delivering high quality programmes in the SPG. The Assessment Team wish to highlight nine areas of constructive comment and critique in Section 1.2, which may form the basis upon which improvements in the quality of the programmes may be achieved. Further detailed points for individual programmes are presented in Section 1.3.

The areas of constructive comment and critique are:

- **Tackling at national level the underlying factors that encourage high dropout rates**, in addition to trying to mitigate the trend at individual programme level;
- Developing enhanced learning outcomes to ensure **graduate attributes of initiative, critical thinking and creativity at first cycle** as set out in national legislation;
- Greater **support of research-led teaching** through inter-university collaboration until there is a significant increase in the level and impact of research activity at EMÜ relevant to the programmes, especially in engineering;

- Facilitate student-centred independent study and greater student mobility, nationally and internationally, by the development of **benchmarked University-wide norms in respect of student workload –** both the distribution of ECTS credits across sub-sections of programmes and in respect of individual course ECTS credits;
- Enhance the **interconnection of theory and practice within courses using problem-based learning** to ensure synergetic impact in achieving learning outcomes through appropriate sequencing and assessment strategies;
- Develop at Institutional level a **collegiate academic staff workload model** that distributes teaching, research and administration in a transparent manner, and develop at University level a **structured human resources development framework for all staff** that annually identifies and supports individual development needs linked to institutional targets set out in the EMÜ Development Plan;
- Target the resource of industry-experienced **graduate students as student-centred university-industry partners** by their greater inclusion in relevant University boards and committees;
- **Selectively internationalise the University's programmes** by developing a sufficient number of related courses (modules) taught in English that may be taken collectively as a coherent master's degree programme, building on courses (modules) already taken individually as courses contributing to programmes taught in Estonian.
- **Make the Programme Action Plans 'smarter'** by inclusion of measurables and timelines.

The Assessment Team has identified these areas where targeted action could assist in harnessing the full potential of bachelor, professional H.E. and masters students in the SPG. These recommendations take account of the constructive constraints of national legislation in the context of the Bologna Declaration and the University's Development Plan 2016-2025.

The following detailed comments on these nine aspects are provided to better inform and assist discussion at university and programme level.

<u>High dropout rates</u>

The significant number of interrupted studies is widely recognised as an unacceptable waste of national resources. The problem plagues all programmes and higher education institutions to some extent. A cultural change is required nationally. The underlying factors that encourage high dropout rates must be tackled at a national level, in addition to local efforts to mitigate the impact on each programme. The coloured-coded cells in Table 5 connect graduation

statistics for each intake cohort from 2013 onwards. It may be noted that at Prof.HE and B.Sc. level the average attrition rate in the period is over 65%. The situation at M.Sc. level is more satisfactory – average attrition rate 32% - but is still high by international standards.

Nationally-applicable themes emerged from discussions with academic staff, students, employers and alumni. These are:

- The B.Sc. qualification was not valued highly enough in the market to differentiate graduates from non-graduates in respect of competition for jobs or in the salaries paid to employees. Students were being tempted out of their programmes into employment before graduating, sometimes even by the companies that offered them internships as part of their studies.

- The financial situation for some students made the choice of working in industry extremely attractive, despite interrupting their studies. Although receiving financial support in the form of free fees and an allowance (sometimes several allowances/scholarship payments) from the state, some students found that their financial circumstances as a student were not sustainable, especially when an alternative relatively attractive remuneration package was attainable in their field of interest, without formal qualifications.

- Some students who interrupted their studies, or who missed some credits due to being in employment while registered as students, accumulated penalty fees. This acted as a further disincentive to investing time and money in the completion of their studies, given the poor financial return in salary differential that they perceived the formal qualification would bring.

- Industry representatives felt that the requirements for entry to some programmes are presently too low, leading to poor utilization of human and economic resources. Admission requirements for the curricula of Technotronics and Engineering ordain the applicants to have a grade in extensive mathematics (14 courses). The admission criteria for the curricula in Wood Processing Technology and BSc in Food technology require a grade in narrow mathematics (8 courses). Unsurprisingly, the University commented that candidates with low grade in mathematics are not competitive and fall by the wayside. Despite the mathematics threshold as an indicator of suitability, the University has found it necessary in student recruitment, from 2017, to offer the applicants a refresher course in mathematics, on successful completion of which they will be given an extra point in admission. This seems to be a counter-intuitive approach in the use of entry standards as a tool in guiding applicants towards the appropriate choice of a programme matched to aptitude.

- Some industry representatives felt that the number of university students in Estonia was disproportionately large, especially in programmes that did

not have strategic economic importance. While not wishing to restrict a person's chance for realisation of academic potential, it must be recognised that strong competition for admission to a limited number of places in higher level education motivates applicants to value the opportunity and thereby hesitate to drop-out of the programme, if successful in gaining admission.

Addressing the high drop-out rate will require tackling these systematic problems. Clearly this cannot be done at the programme level – it requires a national approach. **As pointers to assisting the initiation of a national discussion between stakeholders the Assessment Team would note:**

- The **state needs to consider more targeted use of the current investment** in direct student support. Consideration should be given to both increasing the level of payment to worthy individual students and raising the value that society places on admission to higher level educational opportunities. The latter might include a financial model that includes a mix of fees, for those who can afford them, and grants, to supplement the finances of those who cannot afford full fees.
- The **universities and institutes of higher education must provide a more challenging teaching and learning experience** that inspires retention of students through pride in achieving differentiated graduate attributes of recognised extra value to employers and society.
- The **employers must recognise the long-term value for them of a highly educated workforce and not be complicit in encouraging students into employment before they have completed their studies**. Current practice by some employers represents a short-term gain to the employer and student, but is ultimately unhelpful to individual students whose opportunities for later advancement in the company are being restricted by an incomplete third level education.
- **Undergraduate students must be encouraged to place a greater value on higher education** such that interrupting their studies would be a last resort, rather than the norm for over half of the undergraduate students in this SPG at EMÜ.
- Recognising the loss to the state of drop-outs, options should be explored to exclude students who are not progressing at a reasonable rate from their incomplete B.Sc. programmes but with **an exit award certificate**, if they have successfully completed a coherent set of courses of at least 120 ECTS. Equally, universities should offer **structured CPD courses** in small blocks (e.g. 10, 15 ECTS) for drop-outs within the existing system who have a certificate listing the courses taken and the number of credits awarded but who do not have a coherent set of undergraduate credits totaling 120 or 180 ECTS for a relevant award.

Clearly the issue is one that is beyond the scope of the programme leaders to solve alone. Equally clearly the problem is very significant in Prof.HE (Technotronics) and B.Sc. (Engineering) in EMÜ. It cannot be ignored, in that the high drop-out rate creates an environment that detracts from the staff and students' teaching and learning experience in this SPG at EMÜ.

Developing enhanced learning outcomes to ensure graduate attributes of initiative, critical thinking and creativity

The Assessment Team noted a greater than expected difference between the limited educational aspirations and low level of ambition demonstrated by undergraduate students compared to master's degree students, especially in engineering programmes. The portrayal by the students of the undergraduate programme, both in respect of the academic challenge and in respect of their personal career ambitions on graduation, fell short of that which would nationally and internationally be expected in first cycle engineering programmes. According to the current Standard of Higher Education, BSc curricula are primarily aimed at preparing the students for the entry to the Master's degree and therefore the Assessment Team expected that a similar level of educational aspiration and ambition would have been demonstrated. This was not the case.

The programme learning outcomes set out in the SAR Appendix 1 for the Prof.HE programmes (p.119 and p.123-124) are dominated by the lower order of learning domains: "has systematic knowledge....."; "have a systematic approach...."; "has an overview ....."; "knows....."; "able to organise....."; and "understands ....". The programme learning outcomes set out in the SAR Appendix 1 for the B.Sc programmes (p.129-130 and p.143) are similarly dominated: "has a systematic overview....."; "can explain....."; "can apply...."; "can recognise....."; "can combine their knowledge .....". These learning outcomes do not fully address the learning outcomes set out in national legislation (Government of Estonia Regulation 178, 18 December 2008, Annex 1) in respect of formulating problems relating to the field of study and to analyse and evaluate different solutions; showing initiative in initiating projects; critical thinking; and creativity.

The Assessment Team is concerned that the evidence from its meeting with undergraduate students demonstrates a lack of sufficient progress on updating teaching and learning since the previous (2015) Assessment Team noted the need for "internal quality systems .....based on overarching learning outcomes in the National Qualification Framework of Estonia." It is therefore **recommended that a mapping exercise be carried out to identify and address any gaps that currently exist between student achievement of programme learning outcomes at Prof.HE and B.Sc. level and those prescribed in Annex 1 of Government of Estonia Regulation 178**. This should form a major focus of the activity plan for the ASTRA project in 2019, including the revamp of several courses and introduction of problem-based learning at the BSc and professional higher education level and a detailed review

of the learning outcomes of the curricula, including the learning outcomes of the modules and subjects, in connection with the amendments to the Statute of Curriculum (October 30 2018). Programme learning outcomes should be updated accordingly and the trickle-down effect of gaps in learning outcomes at course level should then be investigated by a mapping exercise between revised programme learning outcomes and course learning outcomes.

Research-led teaching: inter-university collaboration

It is a matter of concern in respect of research-led teaching that typically less than 50% of the core staff delivering the programmes are qualified to doctoral level in 2019, despite the University's target of 100% by 2020. The University has set out in its development plan that by 2020 there will be no lecturers without a doctorate but there will still be the positions of a teacher and junior lecturer, whose main task is teaching. This two-tier system will perpetuate a culture where the SPG students are 'knowledge takers' rather than 'knowledge seekers' and is a disappointment. The negative impact on teaching and learning for the master's degree programme is self-evident. Even more worrying, however, is the situation in the B.Sc. programmes, where the transition of students' learning culture from high school to university ('knowledge takers' to 'knowledge seekers') is heavily influenced by quality of research-led teaching. The situation in the B.Sc. Engineering is particularly acute with only 39% of the staff qualified to doctoral level. It is particularly surprising that the proportion is less in the case of the B.Sc. Engineering programme (39%) than in the Professional HE programmes (average 51%), given the differentiation of learning outcomes set out in Government Regulation No. 178 (18 December 2008).

The University has created 20 chairs to take responsibility for, *inter alia*, "the management of research-based teaching..." but there is difficulty finding suitable candidates to fill the positions. In respect of the M.Sc. in Food Technology, a newly-appointed staff member will soon take up duties as ERA Chair for Food (By-) Products Volarisation. This is a positive development.

There is commendable cooperation between EMÜ and Tallinn University of Technology (TalTech). Further to an obligation imposed by the Ministry of Education and Research, through a funding model that includes performance indicators related to intra-university cooperation, EMÜ and TalTech negotiate the division of responsibility areas within this study programme group in such a way that the number of graduates required and the integrity of the field would be guaranteed. This co-operation has been further extended to delineate areas in which research and development is to be carried out in each university. This efficient use of national resources is an example of good practice for other EU countries. It seems that it should also be extended more in the area of programme delivery.

In 2018, the International Evaluation Committee evaluated the research and development activities in technology and engineering and established that the

scientific level, sustainability of research, resources and personnel in the field of technology and engineering were in line with international standards without finding any significant shortcomings and R&D activities were granted positive evaluation. However this finding should not be conflated with student experience in relation to research-led teaching, when typically less than 50% of the core staff delivering the programmes are qualified to doctoral level in 2019, despite the University's target of 100% by 2020. Research-led teaching is at the heart of university teaching and learning, enriching the learning experience for students and contributing to their skill-set as graduates.

Until the proportion of suitably qualified staff reaches 100%, it is recommended that the University seek collaboration with other universities, where necessary, on module delivery by those qualified to doctoral level. The priority for this collaboration should be addressed at B.Sc. Engineering level, where the previous (2015) Assessment Team noted that "high achieving students consider the programme(s) to be not challenging enough." There remains a need to change the learning culture by inspiring and challenging the students more through research-led teaching.

Development of benchmarked University-wide norms in respect of student workload distribution

The distribution of credits, set out in Table 2 is very variable within each category of programme (Prof HE, B.Sc. and M.Sc.). Although the programmes are compliant with national legislation, which prescribes minimum values for practical training (Prof.HE) and graduation thesis (B.Sc., MSc.), it is nevertheless surprising that the design of each category does not reflect a University norm for programme structures within that category. For example, 'General' modules in the Prof.HE progammes are 24% of total load in one case but almost half of this value in the other, at 13%. 'Speciality' modules in the B.Sc. programmes are 55% of total load in one case but only half of this value in the other, at 28%.

Additionally, there is great variability in the value of individual course credits. Similarly-titled courses have credit values differing by a factor of 3. For example MS.0030, 'General course in Enterprise Management' has 2 ECTS, while TE.0147, 'General course in Microprocessors' has 6 ECTS. This indicates the lack of a University norm for the workload associated with a typical module. This must limit flexibility in the delivery and updating of the programme – whatever about limiting free elective choices across disciplines. A more student-centred approach would divide each programme into building blocks of courses that are more equal in workload. This would assist each student's time management in the independent learning part of each course. It would also remove a barrier to student mobility, by increasing the mapping opportunities to courses in other programmes, nationally and internationally, while easing the negotiation of RPL transfer credits.

The terms 'ECTS' and 'Credit points' are used interchangeably in the SAR Appendix 3 (Study Plans) to refer to the same value of workload. Although this interchangeability is permissible under national legislation, which uses both terms, there is a danger that some members of academic staff could subconsciously still associate '1 Credit Point' with its pre-2009 value of 1.5 ECTS and unwittingly overestimate the student workload being assessed in examinations and coursework. In one example from the SAR (Appendix 2.7, Module VL.0653) the workload totaled 156 hours, equating to 6 ECTS modules at the workload-credit ratio of 26 hours per ECTS credit in the same programme, but the module is valued at 9 ECTS.

For these combined reasons, building on the previous (2015) Assessment Team observations of "not much coordination between programmes" and "the structure seems to fit faculty demands more than students'" it is **recommended that programme structures be re-designed around the development of benchmarked University-wide norms in respect of ECTS values – both the distribution of credits across sub-sections of programmes and in respect of individual course credits**.

The University commented that the new Statute of Curriculum was adopted on October 30 2018 and that according to the new Statute of Curriculum and the recommendations of the EMÜ Study Committee, terminology used in course titles is being harmonized across the University. The requirements for the curricula and the modules and individual courses contained therein will be brought in line with the amended Statutes by the beginning of the next academic year. The Assessment Team hope that this opportunity will therefore be used to address this recommendation by the beginning of the next academic year.

Interconnection of theory and practice

Achieving the right balance between theory and practice in courses can often be a struggle for the teaching staff if many students find the theory difficult to engage with. This is particularly so in courses where admission requirements do not include a threshold level in mathematics score or evidence of prior learning to a certain standard in a science subject. Programmes in the EMÜ Institute of Technology are especially impacted at a time of falling interest in engineering studies, the demographic decline in available candidates and the Ministry obligation to reduce the number of curricula. The discontinuation of the B.Sc. Biosystems Engineering programme in a university most highly ranked in agriculture is a testament to the scale of the challenge in attracting students – 'chasing the curve' rather than setting the standard.

In respect of theoretical/practical instruction, the Assessment Team interpreted 'theoretical instruction' to refer to teaching and learning related to the mathematical, scientific and engineering principles underpinning technological practice. This differs from an alternative interpretation ('theoretical studies'

referring to classroom education, possibly along with literature study) that arose in discussion with staff during the site visit.

Discussions with undergraduate students revealed interest in practice but there was no corresponding demonstration of a deep appreciation of the importance of strong theoretical understanding. This is more of a concern in the B.Sc. Engineering programme, which seems to be continuing to have difficulty finding the correct balance – the previous (2015) Assessment Team had noted in the context of engineering studies that "employers consider the graduates from the Prof.HE programmes as being fit for the labour market. For academic bachelors however a master degree seems to be the prerequisite." Looking at various strands of evidence, there is clearly a gap between the graduate attributes for first cycle bachelors programmes set out in national legislation and that being achieved in EMÜ at present if employers require their engineers to return to masters studies before advancement in the company. This was born out in meetings with masters students, some of whom were returning to do masters studies so that they could get roles of sufficient challenge from their employers. Undergraduate students commented that they sometimes felt the sequencing of theory and practice was not properly integrated in their courses.

The Assessment Team would wish to see a greater appreciation of the interconnection between theory and practice by undergraduate students being achieved as part of the increased use of problem-based learning. It is recommended that, **as part of the possible redesign of courses around a student workload norm, (e.g. 5 ECTS per course), the redesign would be used to arrange closer integration in the presentation of underlying theory and its related practice within a single course**. Theory and practice should not be divorced into separate courses. This should be reflected in both the mode of delivery of the course and student assessment tasks. The **greater use of problem-based learning to emphasise the significance of underlying theory** should be exploited where possible to increase student engagement with theoretical principles.

The University commented that the introduction of the core concepts of problem-based learning (PBL) in all the curricula in the SPG have been set out in the Activity Plan for 2019 of the ASTRA project. The Assessment Team hope that this will be used to successfully address its recommendation in a manner that includes strong 'buy-in' from staff around the core point of the recommendation. In general, PBL does not necessarily always address the interaction of theory and practice. In PBL the learning process can becomes more important than the learning result. While welcoming PBL as an interactive/iterative/creative process, especially for students on the B.Sc. Engineering programme, in the recommendation the learning result is important.

Staff workload model and structured human resources development framework

The EMÜ Development Plan 2016-2025 sets out a clear roadmap for the University to create a study environment in which high quality teaching is supported by a culture of active and impactful research. The targets set out in the Plan are aggregated at University level, for example a target of at least one publication per academic staff member per year (mean number at the University). The programmes in this SPG would greatly benefit from a teaching and learning environment in which the targets are achieved or exceeded on an on-going basis. Two observations may be made from the current performance data relating to the three Institutes delivering the programmes in the SPG, presented in Table 4. Firstly, there is still some distance to go before the targets are met, indicating a need for mentorship support. Secondly the distribution of research publication output is very uneven across categories of staff. Although this second observation is not unusual, caution is required that a division does not arise between 'teachers' and 'researchers'.

In meetings with staff some concern was expressed that high teaching loads allocated to some staff members prevented them from engaging in research. To prevent an unhelpful division arising, it is recommended that **each Institute should agree a collegiate staff workload model that meets its teaching needs while distributing teaching, research and administration in a transparent manner. Allied to this the University level should support individual staff members through a structured human resources development framework**. Such a framework should include annual appraisals of staff to identify their teaching and research developmental support needs, linked to the University targets set out in the EMÜ Development Plan targets. Given the difficulty of recruiting international staff and the relatively low number of staff delivering the programmes who are qualified to Ph.D. level, as indicated in Table 3, mentorship of 'home grown' talent at early stages in their careers should be a priority.

The University commented that a new procedure for work organization and remuneration will be applied in the University from 01.05.2019 and that a new career model will be introduced in 2020. Precise details were not supplied but the Assessment Team hope that its recommendation will raise awareness of the significance of collegiality in any emerging staff workload model, given that a two-tier system is still being envisaged for the teams delivering the programmes.

Graduate students as a bridge between a student-centred university and a supportive industry

A student-centred approach to every aspect of University life is best achieved by involving students in as many university decision-making bodies as possible. Many, if not all, masters degree students are both currently in employment and are mature students with several years work experience. This is a wonderful resource for EMÜ, who could use graduate students as student-centred university-industry partners. This would increase the likelihood of their continued

association with the University as well-informed stakeholders in the delivery of the EMÜ Development Plan.

In addition to the representatives of the Student Council who sits on the Council of the University and curriculum development committees, **it is recommended that targeted opportunities be explored for greater inclusion of industry experienced graduate students, on relevant boards and committees**.

Selectively internationalise the University's programmes

The importance of internationalisation was stressed by the previous (2015) Assessment Team. The current Assessment Team also highly value the role of internationalisation in defining a research-intensive world-ranked university of today in an intensely competitive global market. Failure to internationalise will surely inhibit EMÜ's ability to maintain its current subject world ranking in agriculture. However there are significant impediments to truly internationalising the student experience, both for Estonian students studying at EMÜ and in attracting international students to Estonia. The Assessment Team recognise that universities such as EMÜ have a significant societal role in the preservation of Estonian language and culture. Although all curricula (except Technotronics) offer some courses or modules in English, widespread introduction of teaching through English is not necessarily consistent with the University's mission. On the other hand, the opportunity of attracting high quality international students should not be lost if the critical mass of such students can be reached to internationalise the campus. The Assessment Team are therefore hesitant to blandly include an 'internationalise' recommendation for this SPG, much as they would like to. The foregoing paragraphs have drawn attention to more local priority issues, especially at undergraduate level in the SPG that require more targeted action. Nevertheless, one suggestion is offered regarding the launch of a low-risk pilot programme at masters degree level in engineering targeted at the international market.

The Assessment Team recommend that a coherent suite of at least eighteen 5 ECTS masters degree level modules in English be developed that may be taken collectively as a master's degree programme or individually as courses contributing to programmes taught in Estonian. Thus the modules would form part of the offerings in current engineering master degree courses and as elective modules for the fourth year of Prof HE programmes. These should be themed such that they could be offered, together with a 30 ECTS thesis module, as a coherent 120 ECTS masters degree programme to international students.

Programme Action Plans need to be 'smarter'

The SAR includes laudable Action Plans to improve each programme. However the effectiveness of the plans is somewhat diminished by the fact that the actions do not always reflect the weaknesses/opportunities identified in the self-assessment process. The timelines are also somewhat ineffective as tools for improvement (for example the timeline "continuous") and the expected results are not always clearly measurable (for example "higher quality of the curriculum"). It is recommended that the combination of weaknesses/opportunities identified in the SAR and in this evaluation report be used **to update the Action Plans in a manner that is Specific, Measurable and Timed**.

1.3. Strengths and areas for improvement of study programmes by assessment areas

1.3.1. Wood processing Technology (Prof HE)

Study programme and study programme development

Standards

- ✓ The launch or development of the study programme is based on the Standard of Higher Education and other legislation, development plans, analyses (including labour market and feasibility analyses), and professional standards; and the best quality is being sought.
- ✓ The structure and content of modules and courses in a study programme support achievement of the objectives and designed learning outcomes of the study programme.
- ✓ Different parts of the study programme form a coherent whole.
- ✓ The study programme includes practical training, the content and scope of which are based on the planned learning outcomes of the study programme.
- ✓ The study programme development takes into account feedback from students, employers, alumni and other stakeholders.

Comments

The EMÜ Institute of Forestry and Rural Engineering developed the new Wood Processing Technology programme based on the requirements of the sectoral industry representative body. The curriculum is carefully designed, and the structure is well documented. In addition to the academic personnel, industry representatives have participated in the design of the curriculum. Learning objectives are well documented. The Year 2 spring semester of Wood Processing Technology is taught at the Võru County Vocational Education Centre (VKHK), 80 km from Tartu.

Industry representatives raised an issue with the Assessment Team that the number of university students in Estonia is too large, in particular in social sciences. They felt that resources should be directed more to programmes of industrial importance. The study programme under discussion was mentioned as one of the clearly necessary ones.

The student's understanding of materials science fundamentals, even if mentioned in the required learning outcomes, appears to be inadequately developed. As an example, the students indicated that the mechanics of materials familiar to them was essentially one-dimensional, which is unsatisfactory in the case of strongly anisotropic materials.

The students feel there is too much course content not related to the actual subject field of study, especially during the first study year. The students even stated that some of course content is introduced at high-school level. The Assessment Team feels that basic science courses should be clearly at university level, and contain exercises demanding enough to ensure development of student skills.

It is stated in the SAR that the "curriculum has been monitored to be in compliance with the requirements of higher education....." but the Assessment Team recommend that, in order to comply with Government of Estonia Regulation 178 (18 December 2008), Annex 1, at least the materials science courses, but possibly also other courses of basic sciences should be developed to a more challenging level. It is possible that the science courses are good but do not contribute to the skill profile of the students due to missing interconnection between theoretical and practical studies.

Strengths

- The curriculum is carefully designed, and the structure is well documented.
- Learning objectives are well documented.
- In addition to the academic personnel, industry representatives have participated to the design of the curriculum

Areas of improvement and recommendations

- Theoretical elements appear to be missing from student skills, even if mentioned in the curriculum.
- Basic science courses should be pitched more at university level and contain assignments of sufficient challenge to ensure development of student skills to the required level.
- Materials science fundamentals, although listed in learning outcomes, appear to be inadequately developed. At least materials science courses, but possibly also other courses of basic sciences should be developed, with theory better integrated with more practical study elements.

Resources

Standards

- ✓ Resources (teaching and learning environments, teaching materials, teaching aids and equipment, premises, financial resources) support the achievement of objectives in the study programme.
- ✓ There is a sufficient supply of textbooks and other teaching aids and they are available.
- ✓ Adequacy of resources is ensured for changing circumstances (change in student numbers, etc.).
- ✓ Resource development is sustainable.

Comments

Laboratory resources are mostly of standard character, and not specially designed for research purposes, with one (electronic) exception. Innovative process technology study, as well as materials science study, possibly would require experimentation beyond the present industrial range of treatments. Nevertheless, the students are satisfied that there are no essential deficiencies in the resources available to them.

The laboratory resources are comprehensive and are supported by personnel who are motivated in maintaining and developing them.

Strengths

- Laboratory personnel are motivated to maintain and develop the resources.

Areas of improvement and recommendations

- The study of innovative process technology will require experimental testing equipment beyond the current standard industrial range

Teaching and learning

Standards

- ✓ The process of teaching and learning supports learners' individual and social development.
- ✓ The process of teaching and learning is flexible, takes into account the specifics of the form of study and facilitates the achievement of planned learning outcomes.
- ✓ Teaching methods and tools used in teaching are modern, effective and support the development of digital culture.
- ✓ Practical and theoretical studies are interconnected.
- ✓ The organisation and the content of practical training support achievement of planned learning outcomes and meet the needs of the stakeholders.
- ✓ The process of teaching and learning supports learning mobility.
- ✓ Assessment of learning outcomes is appropriate, transparent and objective, and supports the development of learners.

Comments

Teaching is implemented with enthusiasm, and the students experience is as such. Students are encouraged to engage in international exchange but there is little take-up of the opportunities. Foreign lecturers are invited.

Theoretical and practical studies are not effectively interconnected as theoretical elements appear to be missing. As an example, the interview with the students

indicated that the mechanics of materials familiar to them was essentially one-dimensional, which is unsatisfactory in the case of strongly anisotropic materials.

The student workload challenge does not appear to be sufficiently high enough for high achievers to utilize their full learning potential. Teachers possibly should place higher requirements to students within individual courses, in order to effectively utilize their learning capacity.

According to interviews with students, coursework submissions do not always receive co-ordinated feedback from the teachers.

Strengths

- Teaching is implemented with enthusiasm, and the students experience it as such.
- Foreign lecturers are invited.

Areas of improvement and recommendations

- Review the interconnection of the teaching of theoretical principals and their related practical studies to optimise achievement of learning outcomes.
- Review the relationship between learning outcomes and student workload of contact hours and hours of independent learning to ensure that average students are assigned learning of 25 to 30 hours of work per one credit (ECTS) and that weaker students are aware that it may take them longer to achieve the learning outcomes. Emphasise that the stated hours per ECTS credit are a minimum figure, not a target, especially in respect of independent learning.
- Review the timeliness and comprehensiveness of feedback from the teachers to students in respect of coursework assignments and update guidelines on this to staff if necessary.

Teaching staff

Standards

- ✓ There is teaching staff with adequate qualifications to achieve the objectives and planned learning outcomes of the study programme, and to ensure quality and sustainability of the teaching and learning.
- ✓ Overall student assessment on teaching skills of the teaching staff is positive.
- ✓ The teaching staff collaborate in the fields of teaching and research within the higher education institution and with partners outside of the higher education institution (practitioners in their fields, employers, and staff members at other Estonian or foreign higher education institutions).
- ✓ Recognised foreign and visiting members of the teaching staff and practitioners participate in teaching the study programme.

- ✓ The teaching staff is routinely engaged in professional and teaching-skills development.
- ✓ Assessment of the work by members of the teaching staff (including staff evaluation) takes into account the quality of their teaching as well as of their research, development and creative work, including development of their teaching skills, and their international mobility.
- ✓

Comments

Teachers are generally skilled and motivated. Such an impression is also shared by the students. There are some acknowledged gaps in the capacity of EMÜ to cover all topics. Two courses are therefore delivered by the University of Tartu and TalTech. Practitioners are also involved in the study process The Assessment Team found that the combination has revealed some skills gaps in respect of integrating theoretical and practical studies.

Teachers may be given a teaching-free semester, once every five years, but the SAR notes that this option is not widely used.

Strengths

- Teachers are generally skilled and motivated.

Areas of improvement and recommendations

- Some attention should be paid to developing teaching skills in theoretical fundamentals so that teachers of practice may adequately integrate theoretical and practical studies

Students

Standards

- ✓ Student places are filled with motivated and capable students.
- ✓ The dropout rate is low; the proportion of students graduating within the standard period of study is large.
- ✓ Students are motivated to learn and their satisfaction with the content, form and methods of their studies is high.
- ✓ As part of their studies, students attend other Estonian and/or foreign higher education institutions as visiting or international students.
- ✓ Employment rate of alumni is high.
- ✓ Alumni and their employers are pleased with their professional preparation and social competencies.

Comments

Students are motivated due to high demand in the labour market. Feedback (response rate 60%) rates the programme highly at 4.3. Exit questionnaires from those who dropped out of the programme indicate that the main reason is

incorrect choice of course – unsuited to the speciality. The present level of alumni employment cannot be evaluated because of the programme is new but future employment rate is expected by all stakeholders to be very positive.

Students elementary science skills are typically low at entry, making integration of theoretical and practical study rather difficult.

Student mobility is low but is showing a positive trend of increase.

Strengths

- Students are highly motivated.
- Students mobility is increasing.

Areas of improvement and recommendations

- Measures should be taken to enhance students elementary science skills at an early stage in the programme.

1.3.2. Food Technology (BSc, MSc)

Study programme and study programme development

Standards

- ✓ The launch or development of the study programme is based on the Standard of Higher Education and other legislation, development plans, analyses (including labour market and feasibility analyses), and professional standards; and the best quality is being sought.
- ✓ The structure and content of modules and courses in a study programme support achievement of the objectives and designed learning outcomes of the study programme.
- ✓ Different parts of the study programme form a coherent whole.
- ✓ The study programme includes practical training, the content and scope of which are based on the planned learning outcomes of the study programme.
- ✓ The study programme development takes into account feedback from students, employers, alumni and other stakeholders.

Comments

The BSc and MSc study programmes are designed appropriately to meet the requirements of programmes at these levels. The EMÜ Institute of Veterinary Medicine and Animal Sciences renamed the previous Master's programme "Meat and Dairy Technology" to "Food technology" with the introduction of a third speciality - bakery and confectionery technology - based on the needs of the labour market and stakeholder feedback.

The BSc programme has both obligatory ("base" module and "speciality" modules) and elective (free choice module) components, followed by a research project/paper. Similarly the MSc programme has obligatory (core subject module) and elective (speciality module) components, followed by an MSc thesis. Practical training, delivered both in-house and through industry internships, are a significant component of both programmes. Both programmes have adapted to needs based on feedback sought from stakeholders including students and employers. Graduate learning outcomes have been defined for both programmes and the courses offered are appropriate to meet these programme outcomes. There are three specialisations in the M.Sc. programme which reflect reference to a need for achieving "in-depth knowledge in a narrower research field of the field of research", in accordance with the generic learning outcomes prescribed in Annex 1 of Government of Estonia Regulation 178.

In 2016, the BSc curriculum in Food Technology was modified in line with Statutes (involving changes in the distribution and titles of modules, introduction of a speciality elective module and changes to the credit weightings in some courses). These changes were also in response to the quality assessment of the curriculum in 2015. There is an increased focus on food technology (as opposed to meat and dairy) and courses related to economics, entrepreneurship, management and innovation. The teaching and research of speciality subjects has been enhanced by recent infrastructural developments.

Strengths

- There is engagement with food industry stakeholders and responding to their recommendations/needs.
- There is evidence of responding to employer and to student feedback, e.g. decreasing the emphasis on milk and meat, increasing the focus on plant-based technology in both the BSc and MSc.
- There is a high level of practical training (commented on favourably by the students).
- The academic staff meet weekly and curricular issues are discussed at these meetings.

Areas of improvement and recommendations

- Student feedback on perceived inadequacies in practical training should be further explored and addressed where necessary. The Assessment Team draw particular attention to the practical training associated with the newly introduced baking and confectionary technology, in this regard.
- A mapping exercise should be conducted between the learning outcomes in the M.Sc. courses and the generic learning outcomes prescribed in Annex 1 of Government of Estonia Regulation 178 to ensure that recent changes in the programme, responding to student and employer feedback, has not caused any dilution in meeting the prescribed expectation of

graduate attributes at masters degree level in respect of the 'field' (Food Technology) and those for the 'narrower field' (Meat Technology, Dairy Technology or Bakery and Confectionary Technology).

Resources

Standards

- ✓ Resources (teaching and learning environments, teaching materials, teaching aids and equipment, premises, financial resources) support the achievement of objectives in the study programme.
- ✓ There is a sufficient supply of textbooks and other teaching aids and they are available.
- ✓ Adequacy of resources is ensured for changing circumstances (change in student numbers, etc.).
- ✓ Resource development is sustainable.

Comments

The infrastructure is of good quality and is being progressively renewed and upgraded. It is a key asset and practically all institutes and research units dealing with a part of the food chain benefit from the laboratory complex. The teaching of speciality subjects has been enhanced by the completion of Stage I of the Food Science and Food Technology Laboratory Complex (analytical chemistry, food technology) in 2017 with EU funding. Funding has been secured for renovation and upgrading of the Molecular Microbiology Laboratory during 2019. The renovation of the Chemistry Laboratory is planned for 2022.

Study materials are available online to students through the study information system (ÕIS). Students confirm that the university library provides adequate support in respect of specialty articles and databases. These resources include original study materials prepared and published in Estonian.

The preparation of teaching materials has been funded from a variety of sources, mainly from EU structural funds. Costs are also covered from the income derived from Institute general research and development activities. The University has established both a Development Fund for supporting research initiatives and a Depreciation Fund for the continuous renewal of instrumentation to stay current and competitive. In 2016-2018, the Chair of Food Science and Technology has been involved in more than 15 joint grants with different partners from industry (ETIS data), as well as in different consultations and analyses that are not reflected in ETIS. This demonstrates the scope for income to be derived from such activities on a sustainable basis to assist in funding renewal of equipment.

Nevertheless, there are some remaining infrastructure deficits. These relate to resources for carrying out practicals and laboratory studies. Some of the

laboratory equipment requires upgrading. Thus the facilities, while of good quality remain sub-optimal for delivery of a top quality programme.

Strengths

- Infrastructural developments to date have seen completion of "Stage I of the Food Science and Food Technology Laboratory Complex" in 2017.
- Budgets for running the laboratory complex recognise the onus of the Institute to part-fund costs by research and development activities, although a Depreciation Fund is also in place.
- Upgrading of infrastructure includes compliance with requirements for special physical needs access to the building and within the laboratory complex

Areas of improvement and recommendations

- The development plan for the University to address remaining inadequacies in the size of laboratories should by implemented.
- There is a need for more collaboration with industry (for example BioCC) to apply for joint grants. A strategic plan should be put in place for industry to jointly support the University in securing R&D grants to ensure ongoing availability of state-of-the-art equipment used in the teaching process. In addition, existing industry collaborations should be recognized and recorded, as having a value in themselves, on the academic staff research management system, ETIS.

Teaching and learning

Standards

- ✓ The process of teaching and learning supports learners' individual and social development.
- ✓ The process of teaching and learning is flexible, takes into account the specifics of the form of study and facilitates the achievement of planned learning outcomes.
- ✓ Teaching methods and tools used in teaching are modern, effective and support the development of digital culture.
- ✓ Practical and theoretical studies are interconnected.
- ✓ The organisation and the content of practical training support achievement of planned learning outcomes and meet the needs of the stakeholders.
- ✓ The process of teaching and learning supports learning mobility.
- ✓ Assessment of learning outcomes is appropriate, transparent and objective, and supports the development of learners.

Comments

Both programmes have practical and theoretical components which were positively viewed by students and employers. Practical training in industry is a strong component of the B.Sc. programme. However, the connection between theory and practice is not sufficiently integrated to be seamlessly understood by the students. Thus students did not always appreciate the relevance of some modules delivered in the early stages of the programme.

The increased hands-on approach to the learning through practical training has been enabled with the new laboratory complex. This supports methods of active learning across a range of teaching methods including problem-based learning and group work. Different digital devices and e-learning options are offered, e.g. Moodle, videos, web-based simulations. Case-based learning is used in the MSc programme. However, teaching methods are not consistent across all courses and, not surprisingly, more traditional delivery methods ('chalk and talk') are increasingly failing to engage all learners. The potential for extending case-based learning to capstone-type modules is an option worthy of consideration in helping students use modern teaching and learning methods to 'connect the dots' between courses, rather than considering each course in isolation.

The number of courses delivered in English has increased with the objective of increasing the attractiveness of the programmes to overseas exchange students.

Research-informed teaching is currently limited by the factors outlined in Section 1.2. The Assessment Team emphasise that this is a particular problem at present for the M.Sc. (Food Technology) programme.

Employers pointed out that the managerial skills of graduates needs to be improved to be competitive. They encourage the teaching more of soft skills, such as business, project planning and management.

<u>Strengths</u>

- A range of teaching methods are used including problem-based learning, case-based learning (MSc level) and group work, supported by e-learning options.
- Practical training in industry is a strong component of the programme.
- There are elective options in the programmes enabling students to deepen their knowledge in areas of specific interest to them.

<u>Areas of improvement and recommendations</u>

- The students' perception of a lack of imagination in teaching methods used in certain courses (little interaction with students) should be addressed by a more consistent approach to use of new technologies (including digital technologies) and current best practice in teaching and learning by all lecturers.

- Options should be explored for capstone-type modules to help students 'connect the dots' between courses, especially for those students who consider each course in isolation.
- The capacity of the programmes to include more teaching of soft skills, without diluting strong technical skills, should be investigated.

Teaching staff

Standards

- ✓ There is teaching staff with adequate qualifications to achieve the objectives and planned learning outcomes of the study programme, and to ensure quality and sustainability of the teaching and learning.
- ✓ Overall student assessment on teaching skills of the teaching staff is positive.
- ✓ The teaching staff collaborate in the fields of teaching and research within the higher education institution and with partners outside of the higher education institution (practitioners in their fields, employers, and staff members at other Estonian or foreign higher education institutions).
- ✓ Recognised foreign and visiting members of the teaching staff and practitioners participate in teaching the study programme.
- ✓ The teaching staff is routinely engaged in professional and teaching-skills development.
- ✓ Assessment of the work by members of the teaching staff (including staff evaluation) takes into account the quality of their teaching as well as of their research, development and creative work, including development of their teaching skills, and their international mobility.
- ✓

Comments

There is a recognition that the proportion of academic staff with a doctoral degree, and with active research programmes, is low and must increase (See Section 1.2). A significant problem identified in the SAR, which was reinforced during the site visit, was the lack of competition for academic positions due to the non-competitiveness of salaries on offer.

The importance of supporting continuing professional development among academic staff, including obtaining a Teaching & Learning qualification, is also recognised. However, while opportunities for CPD are on offer staff indicated that it is difficult to find time to avail of the opportunities.

The SAR states that "lecturers are generally involved in research and development activities". However across 15 academic staff members (1 professor, 3 associate professors, 11 lecturers) only 5 students are following the doctoral programme. Using this as a gauge of the level of R&D activity, it may be deduced that research activity is low by international standards. Staff need to be motivated more to apply for research funding. Staff should be supported by the

University in developing their skills in the procurement and management of funded research projects.

The SAR stated that "The distribution of workload between lecturers is uneven. The high teaching load of some members of academic staff may prove to be a hindrance to self-improvement and participation in R&D activities". It would therefore be useful to introduce a workload model to ensure equity in teaching, research and administrative responsibilities. See Section 1.2.

Student evaluation of lecturers is sought and acted upon by the Chair.

International experts are invited to deliver lectures and there is adequate monetary support for these initiatives.

External stakeholders (industry and alumni) indicated engagement with the programme by acting as referees and supervisors of student activity.

Strengths

- Qualified teaching staff at a range of career stages (Professor, Associate Professor, Lecturer)
- Academic staff meet regularly in a collegial atmosphere (the students referred to the friendly atmosphere in the programmes)
- Academic staff give "feedback on each other's performance"; there is an openness to continuous improvement which is to be lauded.

Areas of improvement and recommendations

- There is a need to better insure a consistent approach in engaging students with their courses through the use of new technologies and current best teaching practice. To this end, the needs of individual staff in respect of professional development through courses in Teaching and Learning should be identified and supported. Recognition of a Teaching and Learning Qualification should be included in the academic staff promotion process to encourage staff to obtain a T&L qualification.
- Build research capacity by ensuring that a PhD is a pre-requisite for all future academic appointments, supporting existing staff to undertake PhDs and availing of opportunities for recruitment of PhD students under the ERA-Chair for Food (By-) Products Valorisation Technologies.
- A workload model should be introduced to ensure equity in teaching, research and administrative responsibilities.
- There are difficulties with academic staff recruitment due to the unattractiveness of salaries offered. This is particularly relevant in the context of hiring staff for new areas (e.g. lectureships in baking and confectionary technology).

Students

Standards

- ✓ Student places are filled with motivated and capable students.
- ✓ The dropout rate is low; the proportion of students graduating within the standard period of study is large.
- ✓ Students are motivated to learn and their satisfaction with the content, form and methods of their studies is high.
- ✓ As part of their studies, students attend other Estonian and/or foreign higher education institutions as visiting or international students.
- ✓ Employment rate of alumni is high.
- ✓ Alumni and their employers are pleased with their professional preparation and social competencies.

Comments

Students with an interest in science are motivated by the availability of these programmes, which enable them to apply science in their careers. On the other hand the dropout rate of the students is very high. It was said that for B.Sc. students it is about one third of the total students. Students described the dropout mainly as wrong choice of programme by some students – many drop-outs are by those unhappy with the amount of study required of chemistry and biochemistry. This has prompted the staff to contribute to pre-university preparation of students through the organization of workshops for students from the schools and gymnasiums.

MSc students drop-out rate is also high. The University changed the mode of delivery of the programme to a block system in 2018/19 (students attend for one week in four) in recognition of the reality that most masters students are in employment. This attracted students into the programme initially but 50% had dropped out by semester 2, suggesting more underlying problems.

Students who remain in the programme are satisfied with the content, form and methods of the studies. Most MSc students are in employment also and indicated the significance of research quality in attracting and retaining them in the programme. The linkage between R&D activities with studies needs attention to attract and retain more MSc students. The Assessment Team found that the level of research activities has to be raised in the field of food technology if the M.Sc. is to be a sustainable and successful programme.

Inter-university teaching is encouraged by the university. Students can take subjects from other universities (for example Chemistry from University of Tartu). However some concern was expressed by students about the general ease of ECTS transfers in Estonia due to bureaucratic hurdles. See Section 1.2.

Adequate resources are available for foreign travel but the use of these resources is not very high. Students have the opportunity to study as ERASMUS+ exchange

students in different higher education institutions during their studies but in the period 2015-2018 only three students availed of this option.

Food technology programmes are also offered in TalTech (Tallinn University of Technology). It is said that there is no competition between the subjects and both universities find options to avoid duplication. Measures to ensure a lack of duplication, through distinct programme outcomes, will become even more important in the context of sustainability during periods of decreasing number of school leavers.

The employment rate of graduates is high, around 80%.

Strengths

- There is high number of applications for the food technology programmes.
- Demand for specialists in food technology at the labour market is high.
- There is general satisfaction with the graduates' skill set, and this is reflected in a high level of graduate employment, despite the wish of some employers for more soft skills.

Areas of improvement and recommendations

- Differentiate clearly and manage the distinct benefits of each food technology programme in EMÜ and Tallinn University of Technology through ongoing monitoring of any changes to curricula and learning outcomes in each programme until demographics of school leavers change in a positive direction to sustainably support each regional offering.
- Create more opportunities for active research in BSc/MSc programmes by building on existing offerings, thereby increasing the level of activity in research increasing the level of activity in research, especially applied research projects.
- Strongly promote internationalisation and associated measures to encourage greater uptake of existing funding opportunities for student and staff mobility.
- Collaboration with other academic institutions and industry inside Estonia and abroad is strongly encouraged.

1.3.3. Engineering (BSc); Technotronics (Prof HE)

Study programme and study programme development

Standards

- ✓ The launch or development of the study programme is based on the Standard of Higher Education and other legislation, development plans, analyses (including labour market and feasibility analyses), and professional standards; and the best quality is being sought.
- ✓ The structure and content of modules and courses in a study programme support achievement of the objectives and designed learning outcomes of the study programme.
- ✓ Different parts of the study programme form a coherent whole.
- ✓ The study programme includes practical training, the content and scope of which are based on the planned learning outcomes of the study programme.
- ✓ The study programme development takes into account feedback from students, employers, alumni and other stakeholders.

Comments

Curriculum development in the B.Sc. Engineering has been overly responsive to external factors to an extent that may be devaluing the integrity of the programme. Some mixed messages exist for those trying to define programme outcomes for this B.Sc. following orders laid down by the Ministry of Education and Research to reduce the number of curricula, with a transition to broad-based Bachelor's curricula at EMÜ from 2005. For example the SAR, Section 2.3.1 states that the curriculum in the B.Sc. Engineering is intended to form the "academic basis for the occupational qualification in engineering" and "corresponds to the basic FEANI requirements on the profession of engineer." However according to the decisions of the Estonian Qualifications Authority, the Estonian Association of Engineers and professional associations, the graduates of the Bachelor's programmes are not awarded the occupational education qualification at the initial higher education level. It is stated that Bachelor's degree is a preparation for the Master's studies but in practice the Assessment team found that the bachelor's and master's programmes are not used as an integrated set in a classic '3+2' manner since most students do not enroll in the master's until they are mature students, following additional experiential learning in industry.

The Curriculum Development Committee considered that the presence of agriculture-related courses in the curriculum had a negative impact on student applications and the Biosystems Engineering programme was discontinued in 2018. Regrettably, students have constantly listed agriculture-related courses among the ones they consider unnecessary. The University has therefore moved away from its agricultural sector expertise in respect of the B.Sc. Engineering and now tries to satisfy the multiple demands of this first cycle programme as a

preparation for entry to one of three master's degree programmes in Mechanical Engineering. This involves reserving 30% of credits for the selected masters theme (Ergonomics, Energy Application Engineering or Production Engineering). It is not clear that the remaining 70% of credits can effectively equip the graduate with a classic generic engineering mindset, as understood internationally, nor necessarily satisfy the national requirements for first cycle higher education. In practice most B.Sc. graduates do not enter the masters programmes until they have gained experience and further learning in employment. Indeed many employers require graduates to undertake the follow-on masters before they can progress in the companies, which further undermines the perceived value of the B.Sc. as a significant milestone in the development of an engineer. The laudable intent of the B.Sc. as a broad-based education has, it appears, created some slippage in developing sufficiently strong analytical and creative skills.

Recent changes to the curriculum have addressed contemporary needs in respect of graphics and design; rural entrepreneurship; marketing; safety; energy use. The programme has also been broadened in content to increase the opportunities for the students to gain admission to one of the various master's programmes. The combination of these developments has diluted the application of core scientific and theoretical components of the programme in developing key analytical and design competences. This impression was also borne out in discussions that the Assessment Team had with students, who portrayed the programme and their learning experience as dominated by knowledge and practice. They made no reference to theory and analytical skills, even when prompted to expand on their impressions. The Action Plan for 2019 of the ASTRA Project includes the development and introduction of three new joint modules in Technotronics and Engineering curricula: CAD Systems, Robotics and Programming as development tasks. The modules will follow the problem-based approach and end with a course project. The Assessment Team encourage those delivering these modules to use the opportunity for greater development of analytical and creative skills, and that this will be reflected in the phraseology of the learning outcomes associated with the modules.

Table 6 presents an overview of the situation in respect of the Production Engineering theme of the B.Sc. Engineering. The classic engineering education at first cycle may be characterised as a set of building blocks, related to Bloom’s taxonomy of learning. It may be observed from Table 6 that there is a significant gap in the courses which develop the core engineering competences of analysis, synthesis and design. Drilling further into the learning outcomes of individual courses yields concern about the students’ educational challenge in respect of grasping principles. For example, the course TE.0228 ‘Calculus I’ involves solving “...simple problems by using computer package Mathcad.” The Assessment Team learned that the Institute of Technology is currently focusing on the development of the B.Sc. study programme in Engineering. A Master’s thesis study is underway that will make a comparative study of the curricula in engineering.

However it was not clear if this will address a comparative study of learning outcomes and their relationship to programme outcomes.

The draft review of the current curriculum presented in Table 6 reveals an overemphasis on qualitative/practical courses rather than quantitative/theoretical courses. In order to better comply with Government of Estonia Regulation 178 (18 December 2008), Annex 1, the B.Sc. programme should have stronger learning outcomes in courses that address the development of competence in:

- have a systematic overview of the basic concepts, theoretical principles and research methods of the field of study;
- be able to formulate problems relating to the field of study and to analyse and evaluate different solutions;
- be able to collect information independently by using appropriate methods and means and to interpret it critically and creatively;
- be able to evaluate the role of knowledge and the role and consequences of his or her professional activities in society, with consideration of scientific, social and ethical aspects.

The curriculum in the Prof.HE Technotronics is such that Estonian Occupational Authority (SA Kutsekoda) granted EMÜ the right to award occupational qualification (OQS) of Mechatronics Engineer level 6, Initial Higher Education level in 2016. The programme has a strong industrial relevance through frequent contacts between academia and industry through a variety of very good informal methods to improve the programmes. These complement the more formal forms of collaborations between industry and the university.

Table 6: Distribution of courses in B.Sc. Engineering, in respect of learning order (production engineering theme)

Learning order	Example of Engineering category	Mapping of courses to learning order			
		General	**Speciality**	**Production Engineering Theme**	**Thesis**
		59 ECTS	**50 ECTS**	**53 ECTS**	**10 ECTS**
Creativity	Synthesis and Design				TE.0950
Analysis	Application of mathematical models to complex engineering problems. Independent research skills development		TE.0981		
Understanding	Engineering sciences, quantitative engineering courses.		TE.0115,TE.0309, TE.0207,TE.0244, TE.0457,TE.0044	TE.0487,TE.0260, TE.0395,TE.0391, TE.0519,TE.0393, TE.0272,MI.1886, MI.1887,TE.0979	
Knowledge	Basic sciences, mathematics, qualitative courses, practical training.	TE.0231,MS.0083, TE.0259,MS.0812, TE.0228,TE.0951, VL.0558,MI.0348, TE.0225,TE.0952, MS.0080,MS.0119, PK.0059,KE.0027	TE.0949,TE.0556, TE.0466,TE.0245,	TE.0012,TE.0230, TE.0401	

Strengths

- The academic staff, in collaboration with industry, follows trends and developments and implement selected elements into the courses.

Areas of improvement and recommendations

- A priority regarding the B.Sc. Engineering is the need for a comprehensive mapping exercise to be carried out to evaluate gaps that currently exist in the learning outcomes at course level that collectively fail to deliver the graduate attributes expected from the learning outcomes at programme level and the attributes expected from the learning outcomes prescribed in Annex 1 of Government of Estonia Regulation 178.

Resources

Standards

- ✓ Resources (teaching and learning environments, teaching materials, teaching aids and equipment, premises, financial resources) support the achievement of objectives in the study programme.
- ✓ There is a sufficient supply of textbooks and other teaching aids and they are available.
- ✓ Adequacy of resources is ensured for changing circumstances (change in student numbers, etc.).
- ✓ Resource development is sustainable.

Comments

The laboratories are excellent due to recent capital funding. The general resources in terms of equipment and infrastructure are also perceived as good by the students. The Technology Building was completely renovated and reopened in 2011 based on EU Structural Funds. However, it is important that programme directors and the academic staff have a foresight in terms of maintenance and new investments in the coming decade. Maintaining and developing the labs will most probably require success in winning research grants, as opposed to capital development from infrastructure grants, in addition to support from the EMÜ Depreciation Fund.

Strengths

- The programme currently has excellent resources.

Areas of improvement and recommendations

- The programme leaders and the academic staff should develop a plan for new investments in equipment for research and education. The plan should harmonize with the overall development plan for the Department (research priorities) and contribute to meeting targets in the University Development Plan.

Teaching and learning

Standards

- ✓ The process of teaching and learning supports learners' individual and social development.
- ✓ The process of teaching and learning is flexible, takes into account the specifics of the form of study and facilitates the achievement of planned learning outcomes.
- ✓ Teaching methods and tools used in teaching are modern, effective and support the development of digital culture.
- ✓ Practical and theoretical studies are interconnected.

- ✓ The organisation and the content of practical training support achievement of planned learning outcomes and meet the needs of the stakeholders.
- ✓ The process of teaching and learning supports learning mobility.
- ✓ Assessment of learning outcomes is appropriate, transparent and objective, and supports the development of learners.

Comments

Students at the Tartu Technology College are taught by academic staff from various institutes of the University and by the University of Tartu. Teaching and learning methods vary across lecturers. There are also links with TalTech, through seminars. However, the students find that this can lead to a loss of coherence between the order in which material is presented, especially between theory and practice.

There is increasing reliance on electronic communication by staff with the students.

The links with industry are strong, especially in respect of internships and involvement of practitioners in teaching courses. Through the project "Development of cooperation between the Estonian University of Life Sciences and enterprises offering traineeships" (supported by INNOVE and the EU Social Fund), long-term cooperation agreements have been concluded with leading companies. As part of this 18 supervisors from host institutions have been offered training.

The pre-determined sequence of courses is no longer compulsory for students, which means that they can draw up their personal study plan. Timely graduation is still encouraged by a financial penalty of €30 per credit point if a student falls short more than 8 ECTS of the annual full-time study load requirement.

Strengths

- The interaction between the academic staff and students is perceived as good.

Areas of improvement and recommendations

- The order between theory and practice should be reviewed and evaluated. An even balance between theory, theoretical understanding and practical skills must be continually evaluated by programme directors when the mix of lecturers and practitioners from industry is strong.

Teaching staff

Standards

- ✓ There is teaching staff with adequate qualifications to achieve the objectives and planned learning outcomes of the study programme, and to ensure quality and sustainability of the teaching and learning.
- ✓ Overall student assessment on teaching skills of the teaching staff is positive.
- ✓ The teaching staff collaborate in the fields of teaching and research within the higher education institution and with partners outside of the higher education institution (practitioners in their fields, employers, and staff members at other Estonian or foreign higher education institutions).
- ✓ Recognised foreign and visiting members of the teaching staff and practitioners participate in teaching the study programme.
- ✓ The teaching staff is routinely engaged in professional and teaching-skills development.
- ✓ Assessment of the work by members of the teaching staff (including staff evaluation) takes into account the quality of their teaching as well as of their research, development and creative work, including development of their teaching skills, and their international mobility.

Comments

Senior members of staff are closely involved with practice through board membership and management of societies including the Board of the Estonian Association of Engineers and the Estonian Society for Electrical Power Engineering (ESEPE) and the Occupational Qualification Board. Practitioners are involved in seminar teaching, following the project "Development of cooperation between the Estonian University of Life Sciences and enterprises offering traineeships" (supported by INNOVE and the EU Social Fund).

Professional development of lecturers includes the opportunity to take courses on new teaching methods at the Lifelong Learning Centre of the University of Tartu.

The targets in the University Development Plan to encourage more research activity are clear. This is critical to research-informed teaching, the hallmark of a university. As noted in Table 3 the proportion of core university staff with Ph.D.'s who are teaching on the programme is low. The University commented that the BSc curriculum in Engineering is taught by a large number of doctoral students and that a large proportion of staff allocated to teach on the programme from the Department of Mathematics and Physics do not have a doctorate. However the involvement of the teaching staff in research activities in the period 2013-2018 is increasing and under the Estonian Research Information System (ETIS) classification, the number of staff members noted as authors of peer-reviewed scientific articles was 47% higher in 2017 compared to 2013. The University utilises 27 key performance indicators to monitor the implementation of objectives in five strategic areas necessary for achieving long-term goals. Staff are somewhat concerned these KPI's and success in initiating and performing research projects is receiving growing attention at a time when lecturers'

teaching load may not be changing to reflect a more realistic balance between teaching and research.

Strengths

- The staff is loyal to the general goals and take responsibility when it comes to developments and quality.
- The staff has interest in development and regeneration of the programmes, among other things through industry collaboration.

Areas of improvement and recommendations

- The academic staff should intensify visits abroad in universities and industries in order to strengthen their skills and build experience that can be applied in their research and teaching at EMU.

Students

Standards

- ✓ Student places are filled with motivated and capable students.
- ✓ The dropout rate is low; the proportion of students graduating within the standard period of study is large.
- ✓ Students are motivated to learn and their satisfaction with the content, form and methods of their studies is high.
- ✓ As part of their studies, students attend other Estonian and/or foreign higher education institutions as visiting or international students.
- ✓ Employment rate of alumni is high.
- ✓ Alumni and their employers are pleased with their professional preparation and social competencies.

Comments

Staff report that many students struggle to pass first year due to lack of prior ability in mathematics and physics, combined with low motivation and commitment to learning. The Assessment Team are concerned that these obstacles are contributing to the broadening of qualitative courses in the programmes at the expense of more challenging quantitative courses. An over-emphasis on 'knowledge' learning outcomes has been alluded to elsewhere in this report and is of relevance to this point also.

In respect of technotronics, the speciality is in demand. Many students are already in employment at time of study and are formalising qualifications for their field of employment. However this discourages international mobility. One third of the students on the technotronics programme get a specialty scholarship (160 €/month) in addition to the national needs-based study allowance (70-220 €/month). Two of the best students studying on this curriculum may receive performance-based study allowance (100 €/month).

The students of technotronics will receive practical training in robotics from the Lahti University of Applied Sciences, Finland in 2018/2019.

Strengths

- There are financial incentives for talented students to join the technotronics programme.

Areas of improvement and recommendations

- Consideration should be given to pre-requisite high scores in a combination of relevant indicators of aptitude, for admission to the programme, such as mathematics and physics.
- If such a combination of pre-requisite high scores is not introduced, there is a need for a dedicated Mathematics Support Unit during the first year to increase learning support.
- Accepting that mobility is restricted for those students already in employment, consideration could be given to encouraging traineeships in other countries.

1.3.4. Energy Application Engineering (MSc); Production Engineering (MSc); Ergonomics (MSc)

Study programme and study programme development

Standards

- ✓ The launch or development of the study programme is based on the Standard of Higher Education and other legislation, development plans, analyses (including labour market and feasibility analyses), and professional standards; and the best quality is being sought.
- ✓ The structure and content of modules and courses in a study programme support achievement of the objectives and designed learning outcomes of the study programme.
- ✓ Different parts of the study programme form a coherent whole.
- ✓ The study programme includes practical training, the content and scope of which are based on the planned learning outcomes of the study programme.
- ✓ The study programme development takes into account feedback from students, employers, alumni and other stakeholders.

Comments

In respect of the curriculum of the M.Sc. Energy Application Engineering, the Estonian Occupational Authority (SA Kutsekoda) granted EMÜ the right to award

occupational qualification (OQS) of Diploma Electrical Engineer level 7, Initial Higher Education level, from 2015.

In respect of the curriculum of the M.Sc. Production Engineering, the Estonian Occupational Authority (SA Kutsekoda) granted EMÜ the right to award occupational qualification (OQS) of Diploma Mechanical Engineer level 7, Initial Higher Education level, from 2015. The Production Engineering curriculum has significant relevancy with the University mission and strengths, with EMÜ ranked as one of the top 100 universities in the world in the field of agriculture and forestry. The curriculum differentiates itself from similar study programmes in Europe. Typical production engineering curricula in European universities focus on mechanical engineering technology whereas this programme concentrates on agricultural machine-building and the use of the machinery. This direction is not taught at many other universities.

In respect of the curriculum of the M.Sc. Ergonomics, the current phase of curriculum development reflects internationally accepted core competencies, published by the International Ergonomics Association and bringing it in line with the Estonian Occupational Authority (SA Kutsekoda) occupational qualification standard (OQS) of Ergonomist, level 7, Initial Higher Education level, from 2017. From Academic Year 2018/2019 the student workload of the majority of core subjects were raised to 5 ECTS, to avoid fragmentation in the block mode system of teaching.

The EMÜ Institute of Technology works closely with professional associations and major sectoral employers in updating the programmes. In the past year, changes have been made to the module structure, built in the form of grouped courses. The programmes have widened some courses in order to adapt to industrial needs. The actions have already resulted in an increased number of applicants and the changes are expected to be reflected in full during the next few years.

The Curriculum Development Committee includes representatives of professionals and a doctoral student. Industry specialists are involved in the work of the Defence Board of the master’s thesis, in connection with the issue of the Diploma Mechanical Engineer level 7 for the M.Sc. Production Engineering.

Strengths

- Cooperation with the partner universities are perceived to work well.
- Some modules of the master's programmes are unique even from an international perspective.
- It is relatively easy to switch from one master to another, this is important from a student perspective.

Areas of improvement and recommendations

- A strengthened international cooperation is recommended to provide opportunities to increase awareness of research and education in the other

regions. This would give new influences that can complement and further strengthen the development at EMÜ and be mirrored in the curriculum logic and course contents.

Resources

Standards

- ✓ Resources (teaching and learning environments, teaching materials, teaching aids and equipment, premises, financial resources) support the achievement of objectives in the study programme.
- ✓ There is a sufficient supply of textbooks and other teaching aids and they are available.
- ✓ Adequacy of resources is ensured for changing circumstances (change in student numbers, etc.).
- ✓ Resource development is sustainable.

Comments

All 10 study laboratories and lecture halls have been modernised in 2014-2017, with support from EU Structural Funds, and pilot laboratories of vehicle diagnostics and internal combustion engines were refurbished in 2018. The renewed laboratories accept students working outside class hours when doing projects and to increase learning. The laboratories have the basic equipment needed but plans are needed for more advanced machines, for example CNC-lathes and CNC-mills for metal and machining research and education. This would both assist students to get the experience of industry production, while enabling staff to cooperate with industry to do research. There is now a need for a long-term plan for both maintenance and investment. The plan should harmonize with the development strategies for both research and teaching. Given limitations on funding, it is very important that, as much as possible, the same equipment be available for both research and education.

The University of Tartu is co-operating with EMÜ in aspects of the programme. In the case of a proposed project involving empirical study or ergonomic intervention, the application is submitted to the Research Ethics Committee of the University of Tartu committee. The Institute of Sport Sciences and Physiotherapy of the University of Tartu facilitate student access to specialist measuring equipment. Especially in the field of ergonomics, further investment in new hardware and software available for students would be appreciated.

The list of recommended literature is quite long for the courses, which could both be a strength and an area of improvement. An issue for the students could be that the recommended literature is too extensive where the students become overwhelmed with information available, hence making literature studies a heavy workload. As indicated during interviews with the students, it seems to be

relatively easy to find literature in either the library or in databases. Nevertheless, given that master's students in employment are time-poor, more specific direction on essential reading would be a welcome development. Some of the literature recommended in courses are from before year 2000.

The student counsellor is an important resource at a university. All students interviewed knew of and had met the student counsellor. It is important that the University keep informing the students about using this resource as an aid for them to be supported in their studies and career path.

Strengths

- The university recently invested in renewal and updating of laboratories and provides both basic and more advanced equipment.

Areas of improvement and recommendations

- A renewal of literature reading lists would be desirable, especially for inclusion of more up-to-date literature where it exists to supersede material published more than 20 years ago. Each course is recommended to review the recommended literature to shorten the reading lists.
- A plan for obtaining investment funds should be explored to extend the basic equipment to more advanced machines that would allow students to get the experience of industry production and for staff to be able to cooperate with industry to do research, for example CNC-lathes and CNC-mills.
- Vigilance in respect of student safety when working out-of-hours in laboratories should be renewed through occasional measures that prevent any creep in complacency over time.

Teaching and learning

Standards

- ✓ The process of teaching and learning supports learners' individual and social development.
- ✓ The process of teaching and learning is flexible, takes into account the specifics of the form of study and facilitates the achievement of planned learning outcomes.
- ✓ Teaching methods and tools used in teaching are modern, effective and support the development of digital culture.
- ✓ Practical and theoretical studies are interconnected.
- ✓ The organisation and the content of practical training support achievement of planned learning outcomes and meet the needs of the stakeholders.
- ✓ The process of teaching and learning supports learning mobility.
- ✓ Assessment of learning outcomes is appropriate, transparent and objective, and supports the development of learners.

Comments

The programmes have strengthened the aspects of e-Learning in education in order to address students' needs to work to finance their studies. E-Learning is used to address the flexibility that students already in employment require to a greater extent.

Despite the fact that most students are in employment, practical training through internships are becoming part of the programmes. The course TE.0935 Enterprise practice (8 ECTS) has been introduced in the M.Sc. Energy Application Engineering. In the M.Sc. Ergonomics programme students will have a 6-week traineeship (5 ECTS) in the summer after the first study year, from 2018/2019. The objectives and learning outcomes of the training are precisely defined, joining theory with practice. This also opens the possibility for international experience.

The University is at present upgrading the Studies Information System (ÕIS) and one of the developments embraces the elaboration of the feedback system in ÕIS.

Strengths

- The e-learning environment is a teaching method that both students and teachers are happy with, given the issue of most students already being in employment.

Areas of improvement and recommendations

- The Studies Information System (ÕIS) feed-back system must be revitalized and further developed. A culture of course meetings between students, teachers, and leaders of the educational programmes need to be developed to manage the results of course evaluations as an element in closing the feedback loop.
- Students must increasingly be motivated to make course evaluations that can help to develop the courses further.

Teaching staff

Standards

- ✓ There is teaching staff with adequate qualifications to achieve the objectives and planned learning outcomes of the study programme, and to ensure quality and sustainability of the teaching and learning.
- ✓ Overall student assessment on teaching skills of the teaching staff is positive.
- ✓ The teaching staff collaborate in the fields of teaching and research within the higher education institution and with partners outside of the higher education institution (practitioners in their fields, employers, and staff members at other Estonian or foreign higher education institutions).
- ✓ Recognised foreign and visiting members of the teaching staff and practitioners participate in teaching the study programme.
- ✓ The teaching staff is routinely engaged in professional and teaching-skills development.
- ✓ Assessment of the work by members of the teaching staff (including staff evaluation) takes into account the quality of their teaching as well as of their research, development and creative work, including development of their teaching skills, and their international mobility.

Comments

Lecturers are given the opportunity to take CPD-courses to focus on upgrading their teaching skills. Teachers have been given the opportunity to take part in the professional development courses at the Lifelong Learning Centre of the University of Tartu. Two lecturers have completed a course in Engineering Pedagogy at TalTech. There is also support for continuous professional development of the teaching staff by allowing them a free semester for research. Three staff members have availed of this in the period 2014-2017.

The University has a strategic plan for the establishment of 20 chairs in strategically selected areas. Recruitment for these posts is done internationally and appointments are made carefully. The strategic plan must permeate the entire organization, if it is to be fully effective. Therefore each department must also have a development plan. In these plans, the developments described in respect of scientific content, equipment and development of the academic staff etc. should be specific and measurable. The academic staff should have an individual development plan that is monitored and revised once a year. The plan should be discussed between the employee and management for the department. This vertical uniformity would ensure a coherent development of the entire organization, where staff development is put in the center.

The academic staff are generally satisfied with their work situation although some find that their teaching workload makes it difficult to find time for drafting applications for research grants. However they note that there is support from the University regarding the writing of applications for research grants. Furthermore, the academic personnel are satisfied with the opportunities

available for international study tours. However academic salaries are not competitive with that of civil servants and the private sector. Some staff feel undervalued in that they state that "it is within the competency of EMÜ to find resources to ensure the academic staff a competitive salary." All things considered the situation, in the larger perspective, is seen as positive and is an indicator of an active and ambitious organization.

Strengths

- The academic staff take a great responsibility for development within their groups and the Department.
- The academic staff are involved in the students' work and are aware of the study results, continuously following up on improvement areas.

Areas of improvement and recommendations

- The academic staff should intensify international cooperation in order to create awareness in research and teaching and bring new influences and new perspectives to EMÜ.
- Intensify the invitation of short time visits of international academic staff to subject groups in order to strengthen the competence and raise awareness of international research and teaching.

Students

Standards

- ✓ Student places are filled with motivated and capable students.
- ✓ The dropout rate is low; the proportion of students graduating within the standard period of study is large.
- ✓ Students are motivated to learn and their satisfaction with the content, form and methods of their studies is high.
- ✓ As part of their studies, students attend other Estonian and/or foreign higher education institutions as visiting or international students.
- ✓ Employment rate of alumni is high.
- ✓ Alumni and their employers are pleased with their professional preparation and social competencies.

Comments

The programmes have developed compressed courses ('block mode study') with included e-learning for master students working full time in addition to their studies. There is a low enrolment rate in regular studies as compared to the block mode study. The number of student candidates, who could pursue regular studies with the support from their homes, is going down. However dramatic improvements are predicted. For example in M.Sc. Energy Application

Engineering the number of graduates has shown a downward trend in recent years with only 6 graduates in 2018 but the University expect the number of graduates in 2019 will be 24.

In the interviews with the representatives from industry, it was found that the students have sought-after skills and are motivated to be further developed in the career after graduation. Surveys by the University show highly satisfactory graduate employability for all three master's programmes. The graduates of ergonomics are highly valued specialists in the labour market.

The master students are highly motivated in their studies with the majority of those interviewed indicating that the B.Sc. was not sufficient for career progression. Some found it important to provide their employer with evidence of the qualification and had returned to the University to formally finalise an unfinished degree programme.

Strengths

- Students can choose by their own areas for their master thesis and are given the opportunity to choose their supervisor for the master thesis.

Areas of improvement and recommendations

- Since a majority of the master students have working experience, they are well suited for contributing to course development and content. An additional way of gathering student feedback could be to have a group discussion consisting of students, lecturers, curriculum leader and others that have been involved in the course, where action plans for course development can be proposed with follow-up by graduates as industry representatives.