EKKA

ESTONIAN QUALITY AGENCY
FOR HIGHER AND VOCATIONAL EDUCATION

Report on Quality Assessment of the Study Programme Group of Engineering, Manufacturing and Technology

Estonian University of Life Sciences

2022

Contents

1. Introduction

Quality assessment of study programme groups on first and second cycles of higher education

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 *Quality Assessment of Study Programme Groups in the First and Second Cycles of Higher Education* approved by EKKA Quality Assessment Council for Higher Education.

The aim of the expert panel was the evaluation of the Study Programme Group (**SPG**) of Engineering, Manufacturing and Technology at the Estonian University of Life Sciences (EMÜ).

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

The period of assessment was from December 2021 to March 2022. The Estonian Quality Agency for Higher and Vocational Education (EKKA) formed an international expert panel.

The expert panel consisted of the following members:

Markus Mueller	Chair of the panel. Professor of Electrical Generation Systems, School of Engineering, University of Edinburgh, United Kingdom
Per Ertbjerg	Associate Professor in Food Science, Department of Food and Environmental Sciences, University of Helsinki, Finland
Rain Kuldjärv	Center of Food and Fermentation Technologies, researcher, Estonia
Marino Menozzi	Professor in Human Factors, Chair of Consumer Behavior, ETH Zürich, Switzerland
Philipp Rudolf Von Rohr	Professor of Process Engineering, ETH Zürich, Switzerland
Dick Sandberg	Chaired Professor and Head of division of Wood Science and Engineering, Luleå University of Technology, Sweden
Sten Siro	Student; Tallinn University of Technology TalTech (MSc product development and production engineering); TalTech Student Union, Member of the Audit Committee. Warren Balti OÜ, mechatronics engineer, Estonia.

Assessment process

The preparation of the expert panel for the assessment visit began with an introductory seminar organised by EKKA. At its first meeting the distribution of tasks between the members of the panel was determined. The members of the team agreed the overall questions and areas to discuss with each group during the site visit and a detailed schedule for the site visit was prepared. Some additional information was provided before the panel meetings, and it was used to inform some of the discussions.

On 25 – 27 January 2022, meetings were held with representatives of the Estonian University of Life Sciences as well as external stakeholders. Four panel members (Ertbjerg, Siro, Kuldjärv & Sandberg) attended the meetings onsite and were able to visit the lab facilities used within the SPG. The three remaining panel members (Menozzi, Rudolf Von Rohr and Mueller) attended all meetings via Zoom. Each member of the panel was allocated to a study programme area and provided support in another area. Meetings were held with the Rector's team; Programme directors; support staff; teaching staff; students; alumni; and employers. Some meetings were in person, whilst others were hybrid or completely online.

After the visit, the panel held a meeting, during which the findings of the panel were discussed in detail and the structure of the final report was agreed. Findings of the team were compiled in a first draft of the assessment report and evaluation of the study programmes according to the five assessment areas.

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

When finalizing the assessment report, the panel took into consideration comments made by the university and made some adjustments in the final report. The panel submitted the final report to EKKA on 6th May 2022.

The current report is a public document and made available on EKKA website after EKKA Quality Assessment Council for Higher Education has made the assessment decision.

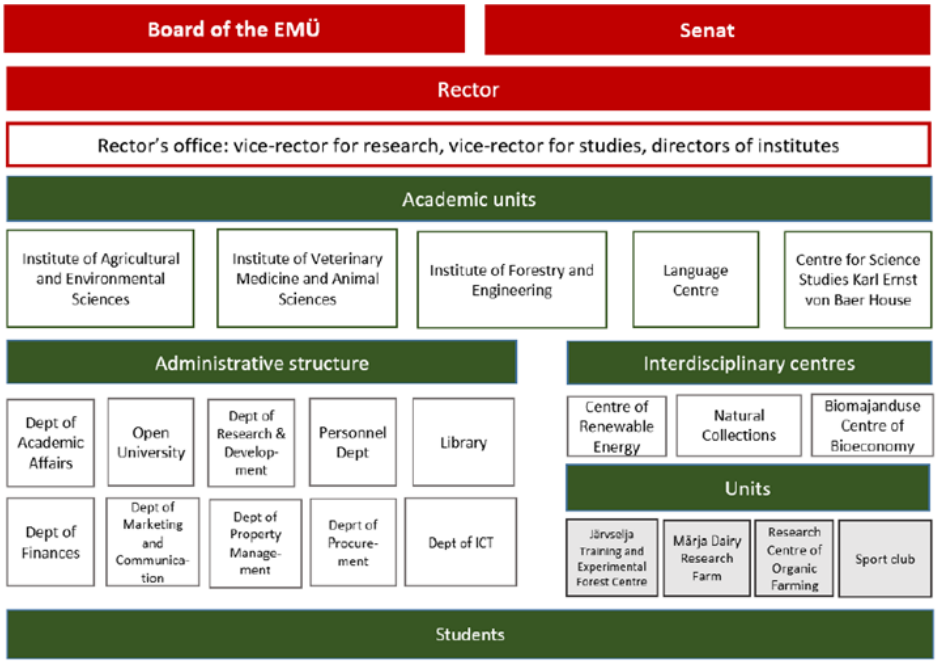
2. Overview of the study programme group of Engineering, Manufacturing and Technology at EMÜ

In the overview assessment we will refer to aspects of the Study Programme Structure, staff resource and students, with the most relevant aspects of the University Development Plan included as appropriate. Any recommendations and solutions provided in the assessment focus on local issues, but it is acknowledged that some issues require more national solutions involving coordination between all Estonian universities. Reference to more national issues is made where appropriate.

Since the last review in 2019 the structure of EMÜ has changed to that shown in Figure 1, with the changes commencing 1st January 2022. The new structure came about after extensive consultation over a 2-year period taking in views from all EMÜ staff, alumni and external stakeholders.

Five institutes have been merged into three: Institute of Agriculture & Environmental Sciences, Institute of Forestry and Engineering, and the Institute of Veterinary Medicine and Animal Sciences. EMÜ has retained its 6 focus areas, but now contained within the new 3 institutes. The Director of each institute is a member of the rectorate, and this the institutes will have more influence on the future strategy. It is anticipated that the new structure will lead to more critical mass in more research and teaching areas; more collaboration across groups within an institute and across institutes; more sharing of equipment and resources; and a levelling out of budgets between institutes. Since the new structure has only just been introduced it is impossible to comment on how effective it has been, but the panel recognise the logic behind the change. When staff were asked about it, the feeling was that the benefits will on the whole be positive. With the new structure, each Chair has a budget, which they have control over, enabling more flexibility in terms of resources and planning.

Figure 1: New Structure at EMÜ implemented on 1st January 2022 (Self-Assessment Report)



EMÜ strategy is implemented through the Development Plan, which focusses on the following areas: research and development, education, membership, society, and organisation. In these areas, a number of targets have been set for 2025, which are also indicators for the self-assessment.

Within Research & Development, the Institute Directors and Chairs have set a target of *High level internationally recognised research*. At present only one focus area – Agriculture and Forestry – is in the top 50 of World QS rankings, which is the highest ranking achieved by any Estonian university. According to the Self-Assessment Report **(SAR)** this ranking was achieved as a result of implementing the Development Plan. Overall EMÜ is ranked 800-1000 by the Times Higher Education. Internationally recognised research comes out from involvement in International Research projects; international collaboration; recruitment of international staff; high level of international mobility of staff; publications in international journals and presentations at international conferences; and finally research active staff with a PhD.

The Development Plan states that the goals and objectives are "to contribute to the sustainable use of natural resources, saving the environment, coping with climate change, preserving biodiversity, ensuring food security, producing safe and healthy food and the regional development of Estonia through a value-chain approach to bioeconomy". The SPG areas are clearly aligned with these objectives. Data provided in the SAR shows that since 2010 publications per member of staff have increased from 0.46 to approximately 1 in 2020. According to information in Appendix 5.5 some members of staff are exceeding this figure. Publications of the Chairs responsible for the implementation of the SPG curricula has more than doubled in 2020 compared to 2019, and before, rates were 5 times lower (figure 4 in SAR).

In terms of R&D income the accrued sum of the institutes under review is low: Institute of Technology (**IT**) – 40,000€; Institute of Veterinary Medicine and Animal Sciences (**IVMAS**) – 909,000€; and Institute of Forestry and Rural Engineering (**IFRE**) – 1,621,000€. Institute Chairs are engaged in large National and EU funded projects, and with the appointment of new Chairs and the new structure R&D funding will potentially increase. For the EMÜ as a whole the total R&D income in 2020 was 16,1M€ (figure 5, SAR), and if the number of equivalent staff is 366 (figure 4, SAR), the income per staff member is circa 40,000€. In an international top university average annual staff income is around 200k-300k€.

Table 1: Number of doctoral thesis defended in SPG related institutes (IT, IFRE, IVMAS)
(Self-Evaluation Report)

Table 4. Number of doctoral thesis defended in SPG-related institutes (IT, IFRE, IVMAS).

Year	EMÜ total	IT	IFRE	IVMAS
2018	9	1	2	1
2019	14	0	1	3
2020	17	3	2	3
2021	15+5*	2	1+1*	4+1*

* (expected)

In order to increase university ranking the panel recommend the recruitment of more PhDs, both home and international students. Staff time must be freed up to be involved in EU funding applications, with academic staff at all levels given the opportunity to engage in EU applications. At present the Development Plan states the target for funding awards per staff member is to be greater than or equal to the average of the 3 biggest universities in Estonia. According to global rankings EMÜ is pulling its weight with respect to other top Estonian Universities. As a panel we recommend that EMÜ look to other international universities in countries of a similar size and economy, e.g. Scandinavian countries, to set targets for R&D, in particular funding over the next 5 years, ramping up each year.

The Study Programme Group of Engineering, Production and Technology includes 8 curricula at the Estonian University of Life Sciences: two of those are Bachelor's level (**BSc**), two professional higher education (**PHE**) level and four Master's level (**MSc**) programmes.

Overall analysis of each programme is provided in section 4, but we will comment on general aspects that came out of the discussions and the Self-Assessment Report.

Table 2. Curricula belonging to the SPG of engineering, manufacturing and technology *(Self-Evaluation Report)*

Curriculum	Level of studies	Launched in	Responsible unit(s)
Technotronics	PHE	2007	Tartu College of Technology (TS)
Wood processing technology	PHE	2015	Institute of Forestry and Rural Engineering (IFRE)
Engineering	BSc	2002	Institute of Technology (IT)
Food technology	BSc	2010	Institute of Veterinary Medicine and Animal Sciences (IVMAS)
Energy application engineering	MSc	2005	Institute of Technology (IT)
Ergonomics	MSc	2005	Institute of Technology (IT)
Meat and dairy technology/ Food technology	MSc	2005/2018	Institute of Veterinary Medicine and Animal Sciences (IVMAS)
Production Engineering	MSc	2005	Institute of Technology (IT)

According to the SAR there is a shortage of labour in "energy, mechanical engineering, electronics, wood industry, food industry and many others". The SPG curricula have been designed and developed to meet the national needs of the industrial sector in Estonia, in partnership with industry. Employers have a number of roles within the SPG: as employer of some students; provider of internships; advisors on curriculum boards; provider of practical training; guest lecturers. The SPG is very closely linked with the industrial sector it is serving. Examples of the close interaction between SPG and industry is highlighted in the report in which EMÜ with DeLaval Eesti OÜ have developed a joint Farm Equipment Lab; and Demek CNC OÜ has equipped the CNC processing equipment laboratory with a numerically controlled milling machine.

Since 2013 there has been a steady decline in student numbers in the SPG, with numbers settling to 500-600 after 2018, as shown in Figure 2, providing some stability. Higher education in Estonia is free resulting in high numbers of applications, with potential students not always thinking about what is expected of the course, resulting in a high dropout rate. Dropout rate has been highlighted in previous reviews, and it is acknowledged that it is a national problem. EMÜ has acted upon this issue by developing new courses to provide students with a better understanding of university life and to manage expectations from courses. In order to address the issue at the admissions stage Food Technology now requires all applicants to provide a letter of motivation to attract more motivated candidates. The dropout rate and interruptions in the first semester for Food Technology have both improved in 2020/21 compared to 2019/20. This is clearly a positive step and needs to be continuously reviewed each year.

Applications, admissions, interruptions and graduations have been compiled into a single table from 2013 to 2021 using data from the previous and current assessments, shown in Table 3, which

highlights the continuing issue with student retention for a particular cohort. Within the professional higher education **(PHE)** and bachelor programmes the interruptions are a high proportion of the admissions, although in the Food Technology programme the interruptions are decreasing. In the MSc programmes the interruptions as a proportion of admissions are lower resulting in higher retention rates, but there is wide variation depending upon cohort and programme. It is interesting to note that in some MSc cohorts there are more graduations than admissions, which we expect is due to return of interrupted students. EMÜ should be commended for supporting interrupted students to return, and this was confirmed in discussions with MSc student cohorts.

Across all programmes the employment rate is very high with greater than 80% in employment, and with most working in the sector in which they studied. This provides evidence that the curricula meet the needs of the industrial sector. Discussions with alumni and employers confirmed this statement.

Figure 2. Change in the total number of students in 2013-2021 in University and study programme group *(Self-Evaluation Report)*

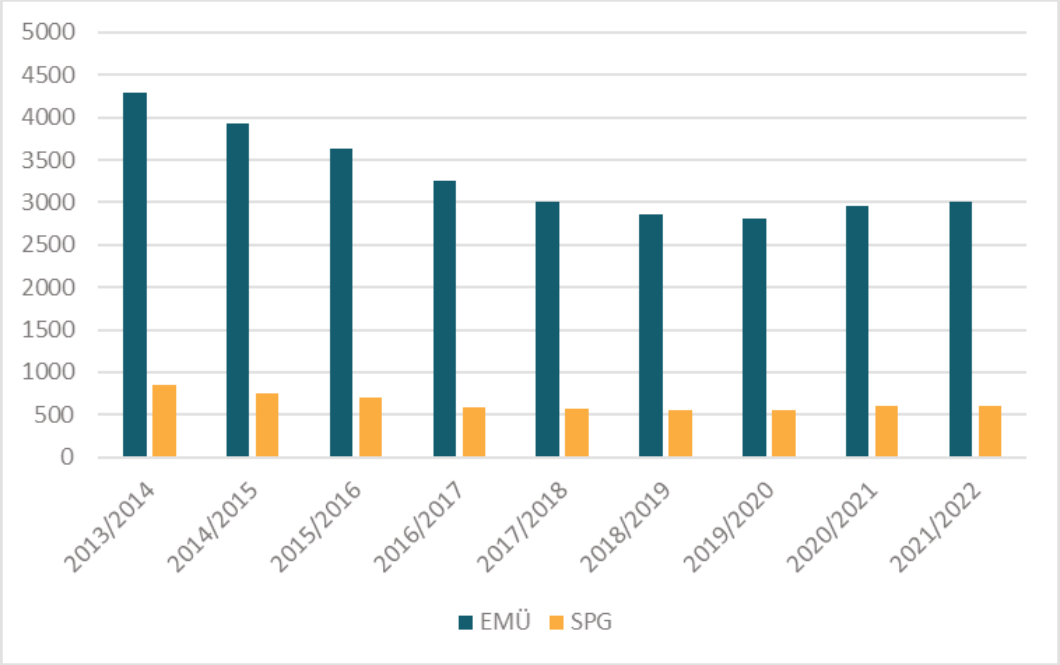


Table 3: Applications, Admissions, Interruptions, Graduates and Retention for all programmes from 2013 to 2021

Programme	Year	Applications	Admissions	Interruptions	Graduates	Retention
Prof HE, Techtronics	2013	108	36	27	12	
	2014	115	25	39	14	
	2015	111	26	21	14	
	2016	85	30	35	6	17%
	2017	94	24	21	13	52%
	2018	91	37	25	11	42%
	2019	74	36	16	6	20%
	2020	103	36	22	7	29%
	2021	99	34		3	8%

Programme	Year	Applications	Admissions	Interruptions	Graduates	Retention
Prof HE Wood Processing Technology	2013					
	2014					
	2015	64	21	2		
	2016	49	17	5		
	2017	41	17	7		
	2018	37	21	11		
	2019	43	19	9	4	19%
	2020	66	25	15	8	47%
	2021	60	24		8	47%
Programme	Year	Applications	Admissions	Interruptions	Graduates	Retention
BSc Engineering	2013	120	108	73	51	
	2014	275	78	86	34	
	2015	278	69	65	43	
	2016	200	60	93	48	44%
	2017	178	67	46	37	47%
	2018	189	81	59	27	39%
	2019	168	63	56	22	37%
	2020	187	84	47	16	24%
	2021	218	78		37	46%
Programme	Year	Applications	Admissions	Interruptions	Graduates	Retention
BSc Food Technology	2013	233	29	11	23	
	2014	257	25	16	26	
	2015	231	19	12	17	
	2016	228	24	18	16	55%
	2017	164	22	13	15	60%
	2018	140	24	13	15	79%
	2019	141	19	12	14	58%
	2020	77	24	5	13	59%
	2021	57	28		12	50%
Programme	Year	Applications	Admissions	Interruptions	Graduates	Retention
MSc Food Technology	2013	20	11	5	9	
	2014	16	13	9	6	
	2015	13	5	8	13	118%
	2016	16	13	3	7	54%
	2017	3	0	7	4	80%
	2018	16	13	2	5	38%
	2019	15	12	5	3	
	2020	22	15	4	3	23%
	2021	16	12		5	42%
Programme	Year	Applications	Admissions	Interruptions	Graduates	Retention
MSc Energy Application Engineering	2013	21	17	4	15	
	2014	26	19	8	10	
	2015	14	10	6	9	53%
	2016	16	7	12	15	79%
	2017	38	31	5	8	80%
	2018	29	26	12	6	86%
	2019	23	16	5	12	39%

	2020	19	11	12	11	42%
	2021	31	27		5	31%
Programme	Year	Applications	Admissions	Interruptions	Graduates	Retention
MSc Ergonomics	2013	17	16	3	11	
	2014	15	13	7	8	
	2015	13	6	5	8	50%
	2016	10	9	1	10	77%
	2017	5	4	2	3	50%
	2018	11	10	2	10	111%
	2019	10	7	3	7	175%
	2020	11	9	1	3	30%
	2021	14	11		7	100%
Programme	Year	Applications	Admissions	Interruptions	Graduates	Retention
MSc Production Engineering	2013	17	13	4	6	
	2014	14	5	5	11	
	2015	24	17	6	11	85%
	2016	38	26	12	3	60%
	2017	27	16	12	11	65%
	2018	30	22	3	12	46%
	2019	15	10	11	7	44%
	2020	19	11	6	7	32%
	2021	15	13		4	40%

Table 4 shows the number of credits transferred from other students attending from other Estonian universities and from abroad. Overall, the SPG contributes over 50% of the total ECTS transferred under the RPL programme. In the last two years the RPL (international) has reduced significantly due to the pandemic. Discussions with other universities in the Baltic & Scandinavian states are ongoing to develop joint Master programmes and other exchange programmes, which will improve student international mobility.

Table 4: The number of credits transferred in study program group under RPL procedure by semesters (A-autumn, S-spring) *(Self-Evaluation Report)*

	2018/2019 A	**2018/2019 S**	**2019/2020 A**	**2019/2020 S**	**2020/2021 A**	**2020/2021 S**
RPL (EE)	974	515	855	252	581	304
RPL (International)	12	129	15	27	6	6
EE*	225	263	231	302	299	234

*Compulsory courses from other Estonian universities (TN).

Student feedback is administered via the Study Information System (ÕIS), which is mandatory resulting in 100% submission rates. Overall, the average scores for all programmes in the SPG are greater than 4, demonstrating high student satisfaction, a dedicated teaching staff and the scores are aligned with the Development Plan.

Since 2016 the average student to staff ratio has been 8.9, much lower than competitor universities in Estonia. Such a good ratio enables the students to receive more support both pastoral and academic, resulting in high satisfaction.

In previous assessments the qualification of academic staff has been commented on in terms of numbers with a PhD. We believe that the staff are highly qualified to teach the course programmes, but if EMÜ wants to raise its international reputation and provide the students with a more research led intensive teaching programme, all teaching staff should have a PhD, as required by the University Development plan. Table 5 shows staff qualification for each curriculum, with all the MSc courses apart from Food Technology having a proportion of staff with a PhD > 70%. The BSc Engineering and PHE programmes have less than 50% staff with a PhD. Table 6 shows the number of staff with a PhD within the Chairs under review, and on average less than 50% of staff have a PhD within the Chairs. A target of 100% staff having PhDs by 2020 according to the last review has not been met. International recruitment will not completely solve the problem as it takes time and Estonian academic salaries are not competitive with other EU universities. A more realistic plan is required covering a 5-10 year time period, with various routes to increasing the number of staff with PhD contributing to teaching including: (1) International Recruitment; (2) International Guest Lecturers; (3) Partnership with other Estonian universities to share teaching staff with PhDs; (4) Standard PhD programme but part-time for existing staff; (5) PhD by publication in which existing staff collate a number of papers they have written and submit for a PhD (common approach in EU universities). The MSc programmes seem to be well covered by staff with PhDs, and so more focus is required to increase staff with PhDs on the BSc and PHE programmes. Since the PHE programmes are more vocational, it may be that not all staff need to have a PhD or set a target of 70% for PHE programmes. We think EMÜ need to be more realistic with this target, and also to set targets according to the teaching programme requirements.

Table 5: Qualification of lecturers responsible for courses taught in the SPG (as of September 2021) *(Self-Evaluation Report)*

Curriculum	Level of studies	No of courses	Qualification of persons, responsible for the courses		
			With a PhD	PhD students	MSc
Ergonomics	MSc	24	79.2%	8.3%	12.5%
Production Engineering	MSc	32	75.0%	12.5%	12.5%
Energy Application Engineering	MSc	26	76.9%	11.5%	11.5%
Food Technology	MSc	31	61.3%	19.4%	19.4%
Engineering	BSc	53	43.4%	34.0%	22.6%
Food Technology	BSc	44	61.4%	20.5%	18.2%
Wood Processing Technology	PHE	64	45.3%	1.6%	53.1%
Technotronics	PHE	75	44.0%	34.7%	21.3%

Table 6: Number of staff members full time equivalents and number of staff with a doctoral degree in the Chairs under review *(Self-Evaluation Report)*

Chair	Year	No of staff		
		full time equivalent	with a PhD	%
The Chair of Rural Building	2018	20	8	40.00%
and Water Management (MIMV)	2019	21.15	6	28.37%
	2020	16.19	5	30.88%
The Chair of Forest Management	2018	18.1	13	71.82%
Planning and Wood	2019	23.7	14	59.07%
Processing Technologies (MIMP)	2020	20.3	13	64.04%
The Chair of Energy	2018	11.8	5	42.37%
Application Engineering (TIEQ)	2019	11.2	6	53.57%
	2020	14.05	6	42.70%
The Chair of Biosystems	2018	19.65	9	45.80%
Engineering (TIBT)	2019	21.75	10	45.98%
	2020	20.65	10	48.43%
The Chair of Food Sciences	2018	17.7	7	39.55%
and Technology (VLTQ)	2019	29.3	7	23.89%
	2020	31.3	7	22.36%

The University undertakes staff surveys every 2-3 years to assess various aspects of working life. In the most recent survey in 2020 the overall satisfaction rate was 4.65 compared to 4.5 in 2011 and 2017 (Figure 2 in the Self Evaluation Report). An example of feedback being put into practice is the introduction of a new motivation and recognition system launched on 1st January 2022. In discussions with staff it was clear that staff are happy with their roles and the support they receive from Chairs as well as senior management within the Rectorate, as borne out by the survey. An open-door policy is pursued by all senior managers, which is appreciated by staff.

3. Main changes on the basis of recommendations of the last quality assessment of the study programme group of Engineering, Manufacturing and Technology at EMÜ

The comments made at the last review and progress made are summarised below.

Addressing high dropout rates: This is still an issue and will take a number of years to solve. It is both a local and a national problem. Locally some progress has been made through the introduction of courses to better prepare and manage expectations of incoming students. Food Technology has introduced a Motivation Letter requirement at the application stage to ensure more motivated students apply. Any local changes will take time to have an impact. The main reason for dropping out is economical – the need to pay for living expenses as there is no financial support for students from national government. There needs to be some sort of hybrid funding of students so that they can dedicate the time required to undertake the degree programme in the time allocated. Both employers and universities recognise this and are flexible, which is acknowledged by the students and employers. It is time for government, employers and universities to work together to develop a package of financial support in order to address this problem once and for all.

Developing enhanced learning outcomes to ensure graduate attributes of initiative, critical thinking and creativity: According to the current SAR the learning outcomes have been revised to align more with the course objectives, and a review of the sample courses in the Appendix confirms this statement. In the last review it was stated that there was little differentiation in the learning domains between PHE and BSc learning outcomes. Since 2019/2020 Bachelors degrees are also awarded to PHE graduates according to the Higher Education Act. Inspection of the sample courses in the Appendix confirm that similar language is used for both PHE and BSc learning outcomes, which is expected since both receive a Bachelor degree. However, as highlighted by the previous panel, the learning outcomes of a Bachelor degree should indicate that a student is able "to formulate problems in the field of study and to analyse and evaluate different solutions; showing initiative in initiating projects; critical thinking; and creativity", but these aspects are missing from the current learning outcomes for both PHE and BSc programmes.

It is difficult to fully comment on this recommendation without having seen the previous self-assessment report and curriculum outlines. Even though similar language is still used, there is a subtle difference between PHE and BSc. PHE learning outcomes are very much focussed on the practical application of the knowledge gained, and preparation for work in industry. Within the BSc programmes, practical application of knowledge is also an overarching learning outcome, but there is also more emphasis on analysis and critical evaluation, and preparation for continuing studies at Master level. The last review panel in 2019 recommended that "a mapping exercise be carried out to identify and address any gaps that currently exist between student achievement and learning outcomes at PHE and BSc level and those prescribed in Annex of Government of Estonia Regulation 178". There is no evidence in the Self-Assessment document that such a mapping exercise has been undertaken, but according to comments from EMU, this mapping exercise was undertaken according to the new Statute of Curriculum entered into force 2018 and was input for approving curriculum changes.

Based on the learning outcomes in the current SAR there does appear to be more differentiation in ambition between the PHE and BSc so that graduates do have "attributes of initiative, critical thinking

and creativity", but it is not clear if this has arisen due to the mapping exercise recommended by the last review panel.

Research-led teaching, inter-university collaboration: Compared to the last review there has been some improvement in the number of staff qualified to PhD level. Table 7 below reproduced from the last review report shows the proportion of core staff at doctoral level and should be compared to Table 5 above. The PHE programmes have reduced slightly; BSc Engineering has gone up slightly to 43%; Food Technology in both BSc and MSc has seen significant increases; Energy Application Engineering has also seen a significant increase from 45% to 77%; Ergonomics and Production Engineering are down slightly.

Table 7: Proportion of Core Staff at Doctoral Level Delivering Programmes (review report 2019)

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

The last review commended EMÜ for its cooperation with Tallinn University of Technology (TalTech). Since the last review a curriculum for a joint international MSc in Ergonomics has been developed with the University of Latvia and Vilnius Gediminas Technical University, approval pending from respective ministries. An exchange programme between Technotronics and Wood Processing with Lahti University in Finland was established in 2018. Energy Applications Engineering has very good links with Grenoble University in France, from which guest lecturers contribute to taught courses. Unfortunately, the pandemic has affected the implementation of these partnerships, and we would encourage persevering and expanding these international cooperations to increase research led teaching.

Development of benchmarked University-wide norms in respect of student workload distribution: It is not clear from the self-assessment report that any changes have been made with respect to this recommendation.

Interconnection of theory and practice: In the last review the panel commented on the balance between theory and practice across the different programmes. In a previous assessment made in 2015, the team noted "employers consider the graduates from PHE programmes as being fit for the labour market. For academic bachelors however a master degree seems to be the pre-requisite." This statement is still true today. Students enrolled on Technotronics and Wood Processing are very pleased about the high level of practical training, and according to the employers this training sets EMÜ students apart from other Estonian universities, that have all but abandoned practical aspects. With regards to graduates from Bachelor courses, the attitude from employers is that EMÜ provides Bachelor students with a foundation in the basic fundamentals, so that the company can then train the students in specific roles. Employers and students do accept that a MSc is required for more

management type roles within industry. In discussions with alumni from Energy Applications, Engineering, Technotronics and Wood Processing the interconnection between theory and practical application to real life problems would have helped with their understanding of the fundamentals, but also in their industrial roles. Industrial guest lecturers could help fill the gap to connect theory and practice, and certainly all the alumni and employers we met are keen to contribute. The right balance of theory and practice needs further development, perhaps through more consultation with alumni and employers.

Staff workload model and structured human resources development framework: In the last appraisal a recommendation was made to introduce a framework for assessing workload to distribute teaching, research and admin in a transparent manner. This was to avoid high teaching loads, which might prevent staff from undertaking research and, hence, gaining a PhD. In the last review a comment was made which alluded to a new staff structure, which has now been implemented. Since 2020 the University now has the following academic positions: professor, research fellow, lecturer and teacher. Discussions with staff are positive about the new structure – it is more flexible than the old structure enabling staff to choose a path that is appropriate for them depending upon circumstances. Through the appraisal system it is possible to review the position and pursue a different path if it is appropriate. As far as we can tell an institution workload model has not been introduced, rather workload is discussed between the staff member and the relevant Chair.

From discussions with staff the typical teaching load of a Professor is 200 hours, and 400 hours for a lecturer. If a staff member wishes to study for a PhD, then the workload might be reduced by 100 hours, but this is negotiated with the Chair according to current resources etc. Overall, the new staff structure is a move towards a human resources framework that is able to meet the needs of the staff. In discussions with staff, they were very supportive of the new structure and staff feel supported by their respective Chair. From 2022/23 new PhD students will have the position of junior research fellow, and according to the University Senate Regulation on Academic Staff Positions (27.02.2020) their teaching load may not exceed 10%. However, it is not clear if this applies to existing teaching staff who start a PhD. As more staff are recruited, more could be done to share the teaching load for those existing staff undertaking a PhD.

Graduate students as a bridge between a student-centred university and a supportive industry: In the last review a recommendation was to make better use of students who work in industry to involve them more in decision making bodies within the university. From the Self-Assessment document students are involved in curriculum committees, but there tends to be only one student member – more should be included. As a panel we think more could be done in this area, and not just in involving students, but also alumni. Many alumni that we spoke to are very keen to be more involved in supporting teaching and its development, but very few had been approached. More mature students working in industry, particularly from MSc programmes, and alumni could also be used as mentors or buddies for younger students in 1st and 2nd year to support them, which may help with reducing interruptions and the dropout rate.

Selectively internationalise the University's programmes: The two previous assessments recommended the introduction of more English taught courses in order to attract more international students, as part of the EMÜ's strategy for improving global rankings. Since the last review, progress has been made with the curriculum for an International Masters in Ergonomics with universities in Latvia and Lithuania awaiting approval from respective government departments. The Chair in Energy Applications Engineering is developing a Renewable Energy module taught in English to attract more international students. In Technotronics and Wood Processing a course exchange in Robotics has been establish with a university in Finland. Teaching in English is not an issue for most students, and

certainly the students we met had an excellent command of the English language. The students did not have an issue with being taught in English, since most of the best textbooks are in English. Issues were raised by some students and employers about maintaining some teaching in Estonian to ensure that graduates working in industry could communicate technical matters to other workers on the shop-floor or customers whose English is not so good. This issue was also raised by the previous panel, and we agree that EMÜ should continue to selectively internationalise programmes, perhaps focussing more on Master programmes.

Programme Action Plans need to be 'smarter': It is not obvious to the current panel that the previous panel's recommendation "to update the Action Plans in a manner that is Specific, Measurable and Timed" have actually been implemented.

4. Summary of general findings and recommendations at the study programme group level

Since the last review the world has experienced a global pandemic requiring a very different way of working and educating. EMÜ was well placed to deal with the pandemic due to its flexibility in teaching methods such as block teaching and use of online resources because a large proportion of the students are in full-time employment. Staff from Academic Affairs, IT and Counselling all made a significant contribution in supporting the SPG as well as providing general support to all staff and students. Teaching and technical support staff showed a great deal of dedication and creativity in continuing to provide education to the students, e.g. the use of take away home kits to ensure the students were able to continue with practical training.

EMÜ has responded to recommendations from the previous review as well as they could have done under the circumstances. The University consults widely with external and internal stakeholders before implementing any changes. After such a consultation a new university structure was introduced on 1st January 2022 in which 5 institutes have been rationalised to three, and a more logical staff structure was also introduced at the same time. Initial thoughts from staff are positive on both changes, in particular the flexibility of the staff structure. There could have been more time between this and the last review to allow some of the changes to have an affect.

In this section we provide general strengths, improvement and recommendations, with more detailed points made in Sections 2,3 & 5.

General Strengths

- Dedicated and motivated staff at all levels – management, academic and support.
- Highly employable graduate students, with most working in their sectors of interest.
- Relevant curricula servicing the national need for engineers, technologists and ergonomists in Estonia.
- Flexible academic staff structure enabling staff to choose an appropriate pathway according to their circumstances.
- Dynamic and supportive leadership from Rector to Institute Directors and Chairs.
- Very good links with industry, both local and national, who actively engage with the SPG, through teaching, practical training, internships, and in advisory roles.

General Areas for Improvement & Recommendations

- **Reduce interruptions and dropout rates**: This is a national problem in higher education in Estonia, but a number of local initiatives can also help. New courses have been introduced during the first year to better prepare students for their studies. Monitoring of these courses and how they are received by students is important for sharing of best practice across the SPG. Food Technology has introduced a Motivation Letter at the application stage – we recommend that this is introduced across the SPG and monitored across the SPG. Other initiatives worth considering include the introduction of a buddy/mentor system for first and second year students on PHE or BSc courses, using alumni and older students from the same programme. Local initiatives provide pastoral and academic support, but to solve the root of the problem better financial support for students is required. It is time for government, employers and universities to work together to develop a package of financial support in order to address this problem once and for all.
- **Continue Internationalisation of Selected Courses**: Some progress has been made but this aspect has been hindered by the pandemic. The level of English language amongst the students is certainly not a barrier to further internationalisation of courses. However, the university does have a responsibility to maintain the use of the Estonian language, not just for cultural reasons, but also for practical and economic reasons. Scientists and engineers need to be able to explain technical aspects to workers and clients who do not have a good command of English. At present the focus of internationalisation has been on the Master courses, and we recommend that this continue. MSc graduates are more likely to work in management positions, and thus deal with international clients and partners. For the BSc and PHE programmes we would recommend maintaining teaching predominantly in Estonian, with English used when appropriate, e.g. Courses on new technologies, in which the resources are not available in the Estonian language.
- **Increase number of staff with PhDs**: Related to research led teaching and inter-university collaboration. This is an ongoing challenge, with significantly more improvement required in some programmes, such as the BSc and PHE. We recommend the development of a formal staff support plan for PhD submission over the next 5-10 years, which might include alternative routes as outlined on p11; appropriate time allocation (preferably 50/50 PhD/Teaching); set a target of staff numbers moving onto a PhD each year, and the number will depend upon being able to share teaching resources across each programme. We recommend focussing on early – mid career lecturers, and in particular, target those who already have research publications to go down the PhD by Publication route.
- **Develop a staff workload model**: This was a recommendation from the last review and is not clear form the current Self-Evaluation Report how much progress has been made (see comments in Section 3). Workload is negotiated between staff and the Chairs. A more formal workload model would allow Chairs and staff to distribute workload more evenly as part of the support provided to those staff working for a PhD.
- **Interconnection of Theory and Practice**: Employers and alumni are complimentary of the quality of practical training received. However, students felt that there could be more industrial or practical examples to show how theory is implemented in practice. This is an opportunity to invite more guest lectures from alumni and employers or to introduce more project-based learning. The Covid pandemic has not helped with practical training within companies. The mechanisms for connecting theory into practice are in place and we recommend that as the pandemic recedes these are implemented to ensure students are given every opportunity to be fully assessed on the implementation of theory into practice.

- **More engagement with alumni**: All the alumni that we met were full of praise for their education at EMÜ, and were keen to contribute, but many stated that they had not been approached even after they had offered. The alumni are an excellent resource for the SPG providing a link with industry; providing guest teaching opportunities; and also mentoring of students to help them through their degree programme.
- **Development of benchmarked University-wide norms in respect of student workload distribution**: This was a recommendation from the previous report (see comments in Section 3). Within all curricula of the SPG modules have varying ECTS associated with them, making it difficult for students to manage time, and also manage expectations. In EU universities all modules typically have the same number of credits, so that student allocate equal time and priority to each module. It is also easier for students to transfer credits between institutions improving student mobility. More equal credits across modules will also make it easier to manage staff workload. There is some equalisation in modules in the Food Technology MSc – 3 out of 6 modules have 35 ECTS each.

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

5.1.1. Technotronics (PHE)

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.

Technotronics is a professional higher education programme with a length of four years. Graduates get the initial higher education qualification of mechatronics engineer. Students can choose between two branches of specialization – either electronics or mechanics. The programme was created together with three other institutions: Tallinn University of Technology (TalTech), University of Tartu, and Võru Vocational Education Centre. Now co-operation with TalTech and Võru Vocational Education Centre has come to an end and it continues with the University of Tartu only. Currently the programme is being constantly monitored and changed to keep it in line with what are the predicted needs of the labour market in the coming 10 years.

The curriculum is constantly changing in response to feedback from students gathered after every semester and based on that changes are made. However, during the discussion the employers said

felt that the students do not have the necessary skills, materials and knowledge of fundamental equations for solving real life problems. An engineer has to be able to figure out solutions to their problems by using everything that they have learned previously in their career.

EMÜ Technotronics is very similar to Mechatronics that is taught at TalTech. What differentiates Technotronics from TalTech Mechatronics is that the developers of the programme, teachers and students all value practical experience very highly. The high quality of practical training is where EMÜ truly stands out. There are well equipped laboratories and a lot of lab-based teaching. It is very good indeed that students can use the labs outside of study hours to work on what they want and continue learning. The students themselves highlight access to the labs at all hours and the quality of practical training as the best aspects of the course.

All the subjects in Technotronics are officially taught in Estonian. If an international student wishes to take the course staff are happy to teach in English. However, this information is not widely publicised, and a prospective international student does not know this, making it very difficult to attract international students. There is also a lack of information about which language curricula are taught in on the EMÜ English webpage.

Strength

- High quality practical training which is appreciated by students

Opportunities for further improvement

- The panel recommends more problem-based teaching and guidance of students on how to apply fundamentals to real life problems.
- It is advisable to provide more information on the EMÜ English webpage for international students about learning opportunities in English

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.

Evidence and analysis

The Technology building was renovated in 2011. When visiting the facilities the panel members saw that all the laboratories were clean and maintained well. A lot of the machines were very recent and up to date with what the current labour market uses. During discussions with students we heard that they feel the CNC machines need to be upgraded. It was agreed that old machines can be used to teach the basics, but newer machines are needed to truly get students ready for their careers.

Some classes are also taught at the University of Tartu. Since these facilities were not shown to the panel and they do not belong to EMÜ the panel cannot comment on those.

The library is well stocked with books and study materials required for the programme, but the bigger collection of books is in the e-library. Students also have access to the Microsoft Office suite and to many different engineering programmes, providing the students with a good base to go into the industry and learn more professional programmes specific to the sector in which they are working.

Funding to renew equipment is included in the Action Plan with the Self-Assessment Document. The teaching staff mentioned that one of the first things they would do with extra money is buy new machinery. It seems this funding problem has not been solved in the last three years and is still an issue. While the current lab equipment is good it might not be good enough in five years. So, funding to update laboratory equipment should be maintained as a priority with future budgets. There is an opportunity to work with the employers to fund or provide access to machinery for training.

Strengths

- Access to a wide range of Engineering software
- E-library
- Well-equipped labs

Opportunity for further improvement

- All CNC milling machines except one model provided by Demek CNC OÜ are no longer state of the art. A sustainable funding model is required to keep machines up to date, and thus ensure the students continue to receive a high quality of practical training.

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.

Evidence and analysis

Teaching during the COVID period had two sides. On the one side there were classes where students were provided with an electronics kit to do their laboratory work from home, and on the other side there were classes where students had to do their CNC laboratories in simulations because access to labs was not permitted, even in small groups. Providing take-home kits demonstrates the capabilities, dedication and flexibility of the teaching and admin staff involved. There was very positive feedback from the students on the learning and teaching support provided during the Covid period.

There seems to be a big focus on practical studies which is good and differentiates the EMÜ Technotronics programme from other similar schools in Estonia, but that does not mean that

theoretical studies should be neglected. As well as teaching the university should also promote research and for that theoretical knowledge is needed. While theoretical studies may not be most important in PHE fields that does not mean that it should not be taught, especially when this PHE programme gives out BSc degrees to students. Employers have commended the university on its practical training, but at the same time have commented on the lack of problem-solving skills, which require fundamental knowledge and understanding of the application of theoretical studies.

One area of concern seems to be in students' mathematical ability. There is now a course that helps students achieve the university level in mathematics, but teachers are still worried about the level of knowledge their students have. On the positive side, staff have the opportunity to really inspire students and show how maths is applied in real life engineering problems. There needs to be some discussion between universities and high schools on how maths is taught in school to better prepare students for engineering programmes.

Strength

- Ability of staff to adapt teaching and learning techniques according to Covid restrictions.

Opportunities for further improvement

- Continue to improve mathematics teaching.
- More connection between theoretical and practical studies.

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.

Evidence and analysis

EMÜ set a goal for all teachers to have a PhD degree, but in Technotronics less than 50% of teaching staff have a PhD. Teachers seem to have a high workload in the university, so they are hesitant to start their PhD studies, let alone finish PhD studies within 4 years. The lack of a PhD qualification may explain the issue of weakness in theoretical studies.

A strength of the academic staff in EMÜ is that they seem to always be available to speak and consult with students. They have an open-door policy. The student staff ratio is low in EMÜ, but even so it is still good that students receive a more personal approach.

This willingness to listen and consider what students think also reflects in how the programmes are modified and improved from year to year. Students told the panel that they see and hear how a subject changes for the better every year because of feedback from previous students.

Strength

- Teachers are open to introduce changes into their subjects based on student and alumni feedback.

Area of concern and recommendations

- Increase the number of staff with PhDs, if the target of 100% is deemed appropriate for PHE programmes. Staff interested in increasing their qualifications should be given more time to work on research.

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.

Evidence and analysis

Majority of the students who are currently studying in EMÜ are very motivated and happy about the quality of the studies. However, there is a problem with high dropout rates at EMÜ. It is easy to say that these numbers are high because education in Estonia is free, and students are just testing if they like university studies at all.

EMÜ has either not figured out what are the main reasons for dropping out or they do not want to make big changes to combat the drop-out rates. If we are to assume that the main reason for dropping out is that students are not well enough informed and just want to try out the university then fixing the problem should be easy. If you just raise the entrance requirements, then the weaker students who drop out in the first semester cannot get in to begin with. This could also raise the prestige of the university within Estonia, so that it would not be the last choice for students. Even some teachers are concerned that the entrance requirements are too low. The university has started working on the problem by adding to the information found on their website and by initiating an orientation week for Estonian students. While these are good first steps EMÜ could be doing more. An example would be to have a one-on-one talk with students who want to study there to make clear the expectation of

studying at university. This has also been discussed within the administration, but it has not been put in motion.

It should be noted that if students do not drop out then their future studies are well supported within the university. They have access to counselling from a psychologist and many of the teachers have an open-door policy. This makes it easy for students to get help with both academic and personal problems and their study related issues.

Feedback from the labour market revels that EMÜ students are valuable assets in the workplace, in particular the students' practical experience is appreciated.

One thing that came out from talking to the students is that when asked why they study in EMÜ the most common reason is location. In the future it could be that the reason is that EMÜ is the best university in Estonia to study these programmes, but currently the main selling point is that people from around Tartu do not want to travel far from their home. While this might be good for Southern-Estonia that their talent does not move away from the region. Overall, it is not a good sign on how the university is viewed by high school students who are looking to receive higher education. It should not be the job of the University to attract workforce to the region but rather it is a task for the labour market to figure out.

The second main reason for choosing EMÜ to study Technotronics is for the high quality of the practical aspect of studies and that is a lot better than just "location".

Strengths

- Students are here for practical studies and that is also what the university is aiming for.
- Students are highly valued by employers.
- Students feel well supported academically and pastorally.

Area of concern and recommendations

- The high dropout rate is a major concern. The university has taken steps by adding more information to the website and organizing orientation week, but EMÜ should keep on working on this issue. A good next step could be interviews between students and program leaders.

Opportunities for further improvement

- One-on-one interviews to get accepted into the university.
- Raise entrance requirements for Technotronics.

5.1.2. Wood Processing Technology (PHE)

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.

Evidence and analysis

Wood Processing Technology is a 4-year Professional higher education study program, with general objective to "Prepare specialists to work and develop entrepreneurship and businesses in the field of wood processing and furniture production, who are able to apply innovative and environmentally sustainable technologies". The study program is from an industrial view very broad, including the whole forest value chain for the mechanical wood industry from forest to products such as furniture, timber houses, semi-finished wood products, and market aspects, i.e. several sub-industries with their own specific requirement are in focus. To realize such a program in a way so the students reach a relevant academic depth, specialist knowledge, practical skills useful in the wood industry, is a challenge. The EMÜ Institute of Forestry and Engineering has, however, managed well in that task: 1) clear learning objectives, a carefully designed and structured curriculum that is well documented in detail, 2) the development of the program is well anchored by the academic personnel, industry, and student representatives (A curriculum committee comprising of the representatives of academic staff, students and employers meets regularly, at least once in academic year), and 3) the study program includes a practical training module, which gives a relevant link between learning outcomes and industrial practise. Both industry and student representatives see practical training module as very rewarding and important for the program's uniqueness and success. A continuous development of the program is ongoing. The need from industry of students graduated from the program is about 10 times as large than today.

There are, however, some overall fields of concern/possibilities for improvement in the program: 1) to cover such broad field (many different industry sectors) in a single program is hard to do with success, 2) conditions for being able to reach and keep a proper level of the laboratory resources needed in both education and research, 3) exchange with universities abroad is nearly zero; a low number of students taking the chance to go abroad for studies, and 4) the overall academic level and research activities within the core group of university persons that manage and teach within the program areas in focus, i.e. wood technology. These issues will be described in more detail under the respective area in the present evaluation report.

Strengths

There is close cooperation with the representatives of employers (incl. alumni) and students characterised by the spirit of trust. The support from industry representatives, i.e. the Estonian Forest and Wood Industries Association, and the Estonian Furniture Industry Association is evidence of this.

- The curriculum has a strong link to practice and comprises a high proportion of practical training and traineeships, which is appreciated by host companies as well as the students.
- The curriculum is designed in close cooperation and with input from to the academic personnel, industry representatives, students, employers, and alumni.
- The courses and modules cover many, but not all, fields of the value chain in focus, and support the overall objective and the learning outcome of the program within these fields. The students are offered opportunities to receive comprehensive knowledge of the forest products industry, a necessary requirement for their continued professional career.

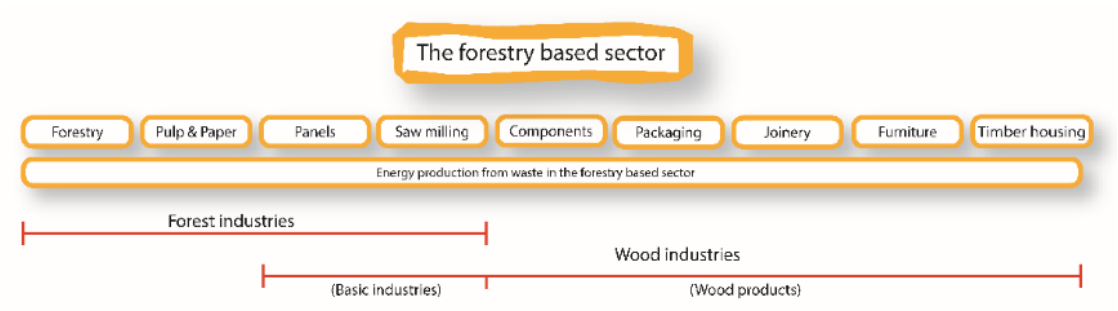
Areas of concern and recommendations

- It seems that the study program tries to cover too broad a field of the forest products value chain, which may complicate and weaken the integration of more fundamentals in the work: 1) to establish and maintain a good academic level of teaching personnel and in the teaching itself, but also teaching capacity in more practical subjects,
  2) to allocate economical resources for courses, study material and laboratories for the focus areas of the program, 3) to avoid overlap between courses, 4) to convey to the students the focus of the program and what the education leads to, and 5) to be able to examine students with a deep knowledge in a specialisation specific field (as stated in the general objective of the program).

One way to handle this generic problem in the field of wood technology and processing education is selectable specializations in the end of the education (year 3-4), preferable also including larger project-based courses or course parts in close cooperation with industry. Such projects may also be linked with the final graduation-thesis project (which is small; 15 ECTS).

In the first years, the students should get the possibilities to have an overview of the forest products industry as whole, and also some specialisation in related areas such as forestry, basics in environmental aspects, economy, and needed general basic science courses, engineering tools including a relevant theoretical base.

Which specializations that should be included in the study program must be a task for university in close dialog with industry representatives. The diagram below can be a help in structure the industry.



Opportunities for further improvement

- The objective of the study program highlights environmental aspects and related possibilities for the wood industry and its products. This aspect should be even more pronounced in the education and in the marketing of the program to attract new students. Courses should be developed so the student will know and be able to use tools/concept for handle the environmental aspects in the industry such as Life-cycle assessment (LCA), circularity and reuse concepts, Environmental Products Declarations (EPDs) for products, etc.
- It is recommended, that the graduation-thesis project is extended to 30 ECTS, being even more as industrial cooperation projects, and that other examination forms than graduation-thesis projects are avoided. A graduation-thesis project including up to 2 students will develop the students towards "self-propelled" engineers and give the students the opportunity to show their capacity in using their knowledge built up during years of studies.
- Sustainability expresses the idea of recycling, reusing etc. In future production, sustainability will play a major role. It should (must) be included in all subjects and all courses. How this is included in courses is not clear in the curriculum, which can be improved.

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.

Evidence and analysis

Recently, a large-scale renovation of the study environment was finished and financed from the University budget; the laboratories are well updated but mostly of standard character for educational use. Security and safety issues seem to be at a good level following Estonian regulations. The new organisation on Institute level has facilitated cooperation and jointly use of laboratory facilities and other resources to train the students. Equipment has been considerably updated since the evaluation 2019, and further investment in facilities and equipment is on-going. Organisation of the laboratories with responsible person etc. was in good order, and the laboratory personnel are motivated to maintain and develop the resources, as well as supporting the students. The students are satisfied that there are no essential deficiencies in the resources available to them, and the open-minded attitude from university in general and from laboratory personnel in specific to using the labs 24 hours was especially appreciated.

During Covid, the IT support has been mainly focussed on the on-line educations system, which may be a reason why update of other equipment has been left behind.

The Wood Processing Technology program is also using experimental facilities on other places belonging to the university and outside university (Järvselja Training and Experimental Forest Centre, Võru County Vocational Training Centre (VKHK), Competence Centre for Wood Processing and

Furniture Manufacturing), which gives students the opportunity to practice on state-of-the-art equipment related to specific processes used in the wood industry.

A modern well-equipped library located on campus supports students and staff. Some textbooks used in courses provided in class sets (e.g. Saarman), and on-line textbooks getting more and more used by the students and available at the library. Library staff provides courses in literature search etc for students.

There is a need for more research-oriented equipment, and facilities and equipment beyond the present industrial range of treatments to be able to build research in the wood-technology field and to offer the students more innovative process technology studies, as well as materials science study. The thermal-modification lab is one good example of such equipment that already exist at the university. Basic equipment for the use in both education and research are jointly shared between the labs at the EMÜ Institute of Forestry and Engineering, and all study programs have access to these facilities.

Strengths

- Good support from university and institute to build state-of-the-art laboratory facilities for educational use.
- Positive open-door attitude towards the student to use laboratory facilities for different projects.
- Laboratory personnel are motivated to maintain and develop the resources.
- A general will on all levels of the university to be able to offer the students an education where theoretical book studies and practical training in labs goes hand in hand.

Area of concern and recommendations

- A permanent financing system for laboratories including new acquisition of equipment, buildings, maintenance of equipment and buildings, technical staff, etc. is not clear. A depreciation fund has been set up at the university to upgrade equipment, but it economic strength of it seem not enough. In the long run, financing laboratory activities based mainly on external project funding will not be a successful path. Several technical and agricultural universities in Europe have, based on economical reasoning, closed their laboratory facilities and considerably reduced their technical staff, with a major negative impact on the quality on both research and education. It is recommended that the top management at the university develops a long-term strategy to prevent such a negative scenario.

Opportunities for further improvement

- To further develop existing and new study programmes with a theoretical base in combination with practical training, both in labs and at industry; combined with Lifelong Learning concepts offering alumni and other to return to university for shorter periods, on distance learning, in specialised courses etc., will make EMÜ education unique. Experimental facilities for development of innovative process technology will attract industry to place part of their development activities at the university for the benefit of both education, research and industrial cooperation. However, the university is responsible for offering the research capacity with enough research-oriented staff.
- Teaching literature seems, at least in the wood-technology fields, to be old, mainly written in Estonian. “Recommended literature” being partly expensive international books that students in most cases, for economic reasons, will not buy. Some courses seem not to have any written study material. It is recommended to start a long-term project to update wood technology

literature for free-of-charge distribution in digital form to the students. Such a project can advantageously be run on a Baltic-Scandinavian arena where conditions in the industry and the need of such literature are similar. Opportunities for co-financing should be possible. Study literature should be developed with advantage of bilingualism (Estonian - English).

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.

Evidence and analysis

The teachers express a great commitment to teaching and to the students' progress; various forms of teaching are applied where distance learning has, for natural reasons, been particularly frequently used in recent years. The teaching is adapted to a certain extent to the individual students' specific conditions in terms of their beside-studies work situation etc. The students show great enthusiasm for the teaching and their studies. Foreign lecturers have been invited for teaching, but this could be done to a greater extent; co-supervisors of graduation thesis come from outside the University when relevant. Practitioners from different companies give lectures for the students. All teachers are involved in the project "From lecturer-to-lecturer", i.e. lecturers visit each other's lectures and give feedback on the teaching methods used. Problem-based teaching, problem solving is applied in courses. E-learning is supporting face-to-face learning. Study trips (forest and industry) with students are done on a regular basis. Different forms of examination are applied and adapted to different types of course content and the students express that the assessment is transparent, objective and supports the individual student's development. In the last evaluation report (2019) it was criticism about feedback to students. Improvement on this issue has been in focus since then, and today students provide feedback on courses through Study Information System and teachers follow the feedback given to their courses. Students express that both formal and informal feedback are satisfactory.

The study plan is adapted to support students to be one semester abroad and students are encouraged to get involved in international exchange, but there is little use of the opportunities due to the supply situation for many of the students (working in parallel with their studies). Exact numbers of mobility of the students are not presented. Industry representatives clearly expressed their great support for student going abroad and getting international experience. The promotion to increase the number of foreign students joining the whole or part of the Wood Processing Technology program at EMÜ is too weak; at least the web-page must be completely in English.

The students express a good balance between theoretical courses and practical tasks, where the theoretical parts are a good base for the more practical parts. The practical training module at industry is well prepared and is appreciated by the students and the industry. Practical sections of the courses have excellent workshops for training. Overlap exist between courses, but the students do not see that as a big problem. Some students are involved in research projects as a part of their studies; the desire is expressed that such activities can be expanded, but there is a lack of suitable research projects.

Strengths

- The students show great enthusiasm for the teaching and their studies, and the teacher-student relationship is very good creating a positive atmosphere and a creative learning environment.
- Teaching environment is modern using modern tools, software, workshops etc. and variety of teaching methods are used; teaching is implemented with enthusiasm.
- Good improvement since last evaluation (2019) on giving feedback to students, and how to work with feedback on the curriculum, courses and the learning process.

Area of concern and recommendations

- Student mobility is not working well: neither do the students at the Wood Processing Technology program at EMÜ go abroad for part of their study time, nor do foreign students join the program. An increased mobility may improve/internationalise the study environment, influence the teaching, and give international experience to the students, something that the industrial representatives strongly advocate as they act mainly in an international market.

  It is a difficulty when most students work full-time. For various reasons, it can be difficult to be absent from work for a longer period of time to study abroad. How to encourage the students is not an easy task in such a situation, but one way could be to “encourage” the companies and their association to accept mobility periods to a higher degree.

  Building long-term collaborations with various foreign universities for student, teaching and research collaborations is also a good model for facilitating mobility.

  The visibility of the education for foreign students should be improved (e.g. on the university website, on conferences, study visits), as well as the opportunities offered within the program should be presented in a better way.

Opportunities for further improvement

- As mentioned in the 2019 evaluation report, it is recommended that the interconnection of the teaching of theoretical principals and their related practical studies should be continuously reviewed to optimise achievement of learning outcomes. In the Wood Processing Technology programme it is not a good idea to have too broad a base of theoretical studies; the theoretical course-base must be selected with precision and care to support the progress of the students.
- The curriculum gives the students the possibility to make an “exam” instead of an examination project (preferrable connected to the industry) and write and defend an examination thesis. The alternative examination “exam” is not clear and it is, however, not by the evaluation committee a recommended examination form due to the industry need of engineers with the strong ability to lead projects and write reports. This is confirmed in the discussion with industry representatives.

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.

Evidence and analysis

The Wood Processing Technology program is broad in the sense of all the different subjects to be covered and to reach the objectives and designed learning outcomes. Therefore, there is a need of academic as well as practical skills in the teaching and development of the program. Teachers are generally skilled and motivated, which also is an impression shared by the students. Assessment of the work by members of the teaching staff show in general good high ranking, but the international mobility among some of the teachers is low.

When analysing the group of teachers related to wood technology (i.e. persons that have graduated (MSc, PhD), have their mainly research today – within the recent 5 years, and/or have their practical skill in the field of the wood technology area, i.e. mainly wood material science, wood physic, wood machining, etc.)

- There is one Professor of Wood Technology, teaching 1% of the courses (related to 225 ECTS) and close to retirement, or retired.
- There are 3 senior Wood technology teachers (PhD) teaching 8% of the course volume, whereof one of the three persons is not employed at the university.
- 52% of the course volume are lectured by person without a PhD; they are mostly teaching in Wood Technology related subjects.

In 2021, there are 48 members of academic staff responsible for the courses of the curriculum (about 100 students). Their average age is today 50 years. All responsible lecturers have either a Master's degree (42%) or a doctoral degree (52%), and the goal is that all lecturers must have a doctoral degree. 25% of the responsible lecturers are women. During the interviews, it has become clear that the number of lecturers could be higher to allow better inter-changeability. The teaching staff in the Chair of Forest Management and Wood Processing has also an effective long-term cooperation with different wood processing enterprises. Combining research and teaching seems to be a problem for the teaching staff on personal level, and because of lack of external financed research projects.

Strengths

- A good balance between academic staff and practitioners in the teaching group.
- Teachers are generally skilled and motivated, which is also an impression shared by the students.
- A generally good age distribution and a fairly good gender balance of among the teaching staff.

Areas of concern and recommendations

- A Wood Processing Technology program shall be domiciled within a research group focussing on wood-technology research, i.e. the management of the program and the "main" teaching staff should have deep knowledge level in the core subject of the study program and the conditions for the industry in focus. The teaching should be based on persons with a PhD in subjects related to the focus areas of the study program and teaching should be combined with research, but of course more practical skills are also needed in the education.

  There are too few academic staff who are employed by the University, holding a PhD and fully devoted to the programme, especially within the Wood Technology subject. Many teachers are practitioners from outside the University without a PhD, which is also needed in the program.

  It is a clear risk that a high-quality education cannot be met in the field of wood technology, neither on short term, nor on long term.

  It is strongly recommended, that a plan be drawn up and financial resources allocated for implementing the plan with the aim of strengthening the subject of Wood Technology at EMÜ. The plan should focus on how the current research group can be further developed and established internationally - primarily based on the young persons who currently work at EMÜ in the Wood Technology subject, and how the progression of teachers within the subjects, in the long term, can be ensured.

Opportunities for further improvement

- Develop the international cooperation within the wood-technology sphere in research as well as in teaching and student exchange
- Research the possibilities to develop exchange programmes on all levels (teaching, research and student level); the possibilities should be good within Baltic-Scandinavian area.

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.

Evidence and analysis

Students that continue the program are very motivated and are satisfied with the content and teaching method within the program. Specialists in the forest products industry are in huge demand on the labour market and the students have no problem getting a job. The demand from industry of students graduated from the program is about 10 times greater than current graduate supply today, and the industry representatives are highly supportive for improving the program and to increase number of students. The mean student intake has been a bit more than 20 students annually, but unfortunately the drop-out rate remains high (the exact number is not clear). There are various reasons for students interrupting their studies such as motivation when they enter the program, misconceptions about the speciality, financial problems, and employment in industry.

Student exchanges with other foreign universities have been successful, but Covid has prevented such activities in recent years. Student mobility is in general low.

Alumni interviewed had a very positive experience of the program and confirmed how well the program prepared them for their career in industry. They especially pointed out the general basis they achieved about the wood industry and different processing aspects, and the importance of the practical skill learned within the program. In the past three years, a total of 20 graduates have left the University and entered the labour market. Of these, 65% have a job in their speciality.

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

Strengths

- Flexible study process supports all students, in particular those who have to work and hence cannot attend regular classes.
- Alumni are highly motivated and satisfied with the program and judge it as a good base for a career in the wood industry.

Area of concern and recommendations

- Measures to reduce drop-out should be intensified. For example, various forms of entrance exams can be introduced. Reasons for drop-out should be penetrated in more detail as there is no consensus on this (in university, among alumni, industry represents etc.).

Opportunity for further improvement

- Develop the contacts with alumni working in the wood industry further, which will support the development of the program, increases cooperation with industry in both research and teaching, support the students to find trainee and future jobs, etc.

5.1.3. Engineering (B.Sc.)

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.

Evidence and analysis

The bachelor program under the name Engineering attracts a reasonable number of students and fulfils a need for the local industry. It is in fact the basis for the Master curricula in Production Engineering, Energy Application Engineering, and Ergonomics. The curriculum is been rearranged in a way that the courses can be given in block mode. The Self-Evaluation Report states the curriculum has been 'modernized', but no explanation is provided as to how. In our opinion the curriculum could be described as being more flexible. As an example we mention the possibility by students to decide whether one writes a report as bachelor thesis or one makes an exam. The start of the specialization has been clearly defined and it has been shifted. This is positive especially for the planning of a mobility semester. On the other hand, the number of ECTS have changed for some courses. This change is not reproducible. Some courses have been renamed but we do not see that the content has changed, although the number of ECTS have been changed.

The result of the internal evaluation of the curriculum is not known at the time of the assessment. However, we see this internal evaluation very positive and motivate to finish and draw the right conclusions

It is a positive move to strengthen the basics in the first year and reduce the ECTS for the specialization by 18 ECTS. A general course in entrepreneurship is very attractive for all curricula.

The feedback from student questionnaires has been taken into consideration and discussed in the curriculum group. Most students have chosen this study place and this curriculum because they live close to the university or they have a job in the neighbourhood.

In the curriculum board there is one industrial representative. An industrial advisory board is suggested to give a broader view from industry and focus on the local needs.

It is recommended to compare the actual curriculum with national and international curricula and learn from the developers of those curricula what changes are needed to introduce new material in production engineering, energy and ergonomics in the Estonian context, in particular rural life and agriculture. To increase mobility closer collaboration with other universities on the curriculum development would be helpful.

The study programme allows for sufficient practical courses. The practical part is well supported with the relevant equipment, but students commented that the CNC machine could be updated to reflect the equipment used in industry.

In the self-evaluation report the measure to evaluate the change in the curriculum is not defined. Here we miss clear goals and criteria like dropout-rate decrease or percentage of mobility of students.

Strengths

- The curriculum is strongly focussed on the following master curricula in three areas with its specialisations in production engineering, ergonomics and energy application engineering.
- A clear cut between very basic courses and specialisation is helpful concerning the specialisation courses. These courses can rely on a sound basic knowledge.

Areas of concern and recommendations

- The curriculum should not be adapted/changed too frequently. It needs some time to find out the weak parts. Therefore, we suggest not to make big changes within the next 4 to 5 years.
- The practical experiments, tools and equipment are almost perfect (except CNC machine). However, the challenge is to maintain it in good shape and to over regular periods of time. A clear strategy for financing new equipment is not available, and thus needs to be considered. A possible solution could be through the involvement of industry, which could lend or gives access to up to date machines and equipment.

Opportunity for further improvement

- The study plan does not take account that students have to work in industry, for financial reasons. Larger credits or stipends with low interest rates could help to improve the personal situation of the students and provide them the chance to do extraordinary studies and to lower the dropout rate.

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.

Evidence and analysis

The resources were not a big issue in the discussion with the teachers (on all levels). There is sufficient support to reach the goals for the learning outcome except in the area of computers. The textbooks were sufficient. Resources are also sufficient according to the discussions with the students.

Recently, a large-scale renovation of the study environment was finished and financed from the University budget; the laboratories are well updated but mostly of standard character for educational use.

A modern well-equipped library located on campus supports students and staff. Class sets of books and on-line textbooks were available for the students. Library staff provides courses in literature search etc. for students.

Area of concern and recommendations

- A strategy needs to be in-place for updating PCs on a regular basis to ensure students and staff have access to the most recent technology and can also run new versions of industry standard software. PCs are typically replaced every 3-4 years, and so we recommend that funds are allocated for this within the Programme budget.

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.

Evidence and analysis

The teachers use modern teaching methods like video classes (teams, zoom) partly initiated by the fact that students stayed at home because of the Covid-19 virus problems.

The weekly working hours of many students with the job aside the studies ranges according to discussions between 60 and 70 hours (job and studies). The balance between work and other important activities (sport etc) is one sided; it contributes to the big dropout rates and is not supportive for the innovation and learning process. Other activities like sports, music, etc. are also necessary to create an academic environment which finally helps to improve the ranking of the university and the mobility.

The practical studies are well taught and highly appreciated by students and they are interconnected with the theoretical studies. The stakeholders warmly spoke about the engineers having joined this curriculum and finished with a degree. It is also mentioned that social competences and practical training can most probably better been learned when students work in industry. The practical educational part is well done.

The teaching and learning process does support learning mobility as evidenced by some graduates moving onto the three follow-up master curricula (Energy Application Engineering, Production Engineering, and Ergonomics, although they do not have large numbers). In 2021 in Energy Application Engineering 27 admitted and 5 graduates, in Ergonomics 11 admitted and 7 graduates, in Production Engineering 13 admitted, 4 graduates. New courses have been introduced in 2020/21 such as "Industrial Ergonomics", "Human Centred Product Design", and "Energy Applications and Internet of Things", which may increase learning mobility into the Master's programmes. As with other

programmes international mobility is non-existent due to work commitments in industry, and also the lack of courses taught in English.

Strengths

- The feedback of students on the courses is taken serious and courses are adapted. This is very positive in view of improvement of the teaching process.
- It was unanimously confirmed in the interview that teachers and lecturers can easily be contacted for advice and help. This open-minded discussion culture contributes to the social competence engineers need to have in later industrial environment.

Opportunities for further improvement

- More problem-based courses and more teamwork in the studies is recommended; it exists already today but should be extended. Specific courses such as Lean and daily improvement work, management and project leading courses are to be included.
- Develop the contact with alumni, regional companies further, involve them more in students contacts, projects work, guest lectures, industry visits, etc. The alumni as well as industry representatives at the hearing supported such activities. Improve the programme web-page.

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.

Evidence and analysis

According to Figure 18 in the Self Evaluation Report 50% of teaching staff have a PhD, 24% are studying for a PhD and 26% are educated to Master's level. Given that all staff have at least a Masters, provides evidence that staff have adequate qualifications to achieve the objectives. From the staff data in the Appendix, 11 of the staff with PhDs are under 49, which is good for the future, and out of the remainder 3 are 70 or over. Taking into account retirals the programme will increase the number of PhDs, but only just above 50%. There needs to be more recruitment of staff under 40, preferably with a PhD, in order to ensure sustainability.

In order to support existing staff to study and complete PhDs, staff workload needs to be addressed so that those studying for a PhD can spend more time on their research, which in turn will feed into teaching.

A challenge faced in the recruitment of staff is in offering competitive salaries. In discussions with staff it was stated that an academic salary is not comparable to salaries in industry, or even compared to other universities. It is strongly recommended to increase the salaries to comparable values as in industry to get best suited teachers, lecturers and professors. This is the enabler for improving the strategic goal to climb in international ranking.

In discussions with the students and alumni, the overall impression is that they are happy with the quality of the teaching. There were no complaints.

According to the Self-Evaluation Report one international guest lecturer is highlighted, and the programme director accepts that more overseas guest lecturers could be invited to teach. Industrial partners have engaged in the programme through lectures, and also as co-supervisors in Bachelor projects. This is an excellent way of exposing the students to real-world industrial engineering challenges.

Teaching staff attend training sessions such as voice training, presentation skills, working in multi-cultural environments. Staff also engage in seminars such as From Colleague to Colleague, in order to share best practise – this is very worthwhile and all staff should be encouraged to attend such a seminar. In other universities a "buddy" system is in place, in which staff attend colleagues' lectures and provide feedback.

It is positive that international lecturers are integrated more frequent in the courses,

Student feedback is well integrated and helps to support the ongoing curriculum discussion.

Strength

- Academic staff is very motivated to teach with best methods.

Areas of concern and recommendations

- We fully support the policy of encouraging existing teaching staff to study for a PhD. However, given the high staff loading, do lecturers have enough time for the research, do they have time to publish, to go to conferences, etc? Maybe a sabbatical leave can help to improve this situation. The problem has been recognized and addressed also in the self-evaluation.
- The salary is far below comparable salaries (from discussion with staff) in industry and with jobs at other universities also not very attractive. It is strongly recommended to increase the salaries to comparable values as in industry to get best suited teachers, lecturers, and professors. This is the enabler for improving the strategic goal to climb in international ranking.
- For professors there is no retirement age. The age distribution of the teaching personnel shows that 50% of staff are 50 and over; 25% of staff are 60 and over; and there are 3 staff over 70. It is advised to look for best academic staff and to attract experienced international teaching staff.

Opportunity for further improvement

- To improve the teaching with practitioners, more industrial people with a research background should be motivated to teach speciality courses.

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.

Evidence and analysis

In student and alumni meetings it is clear that the students who do not drop out are highly motivated and capable. In previous reviews Maths and Physics have been cited as challenging for some students, as there is a mis-match between high school and university. Engineering acknowledges this issue and has introduced additional maths support classes to those students who do not perform well in a placement test and are considering the same in physics.

Almost all students leaving the university find a job, mostly in industry or continuing on a Master course. The interviewed students had basically no complaints about their studies. We got the feeling that students are not very demanding and not very critical.

Applications to Engineering are high, ranging 168 –278 between 2013 and 2021, with admissions ranging from 60 to 108. However, the dropout rate is high, typically greater than 50%. Data is provided in Table 3 in this report. High drop rate is a problem across all programmes, and Engineering acknowledges it in the Self-Evaluation Report. Several meaningful measures have been introduced after last evaluation in 2019, such as counselling, individual learning, support with maths and physics, orientation courses in the first semester. The RPL program enables students to return after interrupting their studies. There is a shortage of engineers in Estonia, and thus industry provides attractive alternative opportunities for students, contributing to the drop out rate.

In discussions with students, they commented on how easy it is to be admitted to the university, and that a lot of those admitted were not fully committed to the course because their expectations were not met, or they found the work too demanding, in particular maths and physics. It was their opinion that this contributed to high drop out rates. An entrance exam was suggested as a way of attracting only highly motivated students.

In terms of mobility the students are encouraged to study abroad through ERASMUS, but uptake is low due to work and family commitments. The Programme has introduced a so-called “mobility window” in the new version of the curriculum, which allow students to form a package of courses which can easily be transferred to another university. However, this still does not solve the problem of work commitments. It has only been introduced and so more time is required to see how effective it is. On graduation some students move from the Bachelor to the follow up Master curricula – Energy Application Engineering, Ergonomics and Production Engineering – leading to some internal mobility. In 2021 in Energy Applications Engineering 27 students were admitted, and 5 graduated; Ergonomics

admitted 11 and graduated 7; and Production Engineering admitted 13, graduating 4. More details on admissions and graduations can be found in Table 3 of this report.

Strength

- The students are very motivated. The education as bachelor in engineering is highly appreciated by industry. Alumni find good jobs in industry or go for a master program.

Areas of concern and recommendations

- The main area of concern regarding students is the high dropout rate, which is typically greater than 50%. It is acknowledged by the programme, and some initiatives have been introduced. Some other recommendations include:
    - Most students know well what they want when they enter the university because they are already involved in industrial work, and thus have a narrow viewpoint, so they do not fully appreciate the expectations of the course – perhaps the introduction of admission talks and an entrance test may help to motivate students and reduce the dropouts.
    - Introduce a personal tutor system during the first 4 semesters, so that the students receive both academic and pastoral support in a small group. Such a system allows the students and staff to build up a good relationship, and staff will be able to identify students who require more support reducing the chance of dropping out.
- Students do not use extensively the mobility program. According to the students the main reason is their financial situation and that they already work in industry and study at the same time. Perhaps one way around this is for the university and employers to work together to find international placements in the employer's international partners or customers.

5.1.4. Food Technology (B.Sc., M.Sc.)

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.

Evidence and analysis

The development of the BSc and MSc curricula builds on the goals and indicators set in the Development Plans of the University, the Institute of Veterinary Medicine and Animal Sciences and the Chair of Food Science and Technology 2018-2025. The curricula are updated in the light of the

principles of sustainable development, the Green Deal and the “farm to fork” strategy. From meeting with the teachers, it was pointed out that there is a good collaboration between Veterinary Medicine and Food Technology, both in relation to shared teaching collaboration and having common research projects.

The study programme includes practical training related to the planned learning outcomes. Thus, the BSc programme has 12 ECTS mandatory practical training, and in the MSc has 8 ECTS practical training either from the Meat Technology, the Dairy Technology or the Plant-origin Food Technology speciality module. This amount of practical training is sufficient.

There is evidence of responding to student and employer feedback, e.g., by including the course *From idea to business plan* (4 ECTS) in the BSc curriculum and *Valorisation of agri-food by-products* (8 ECTS) in MSc curriculum, and by increasing the focus on plant-based technology in both programmes. In addition, the development of the curricula is based on general analyses (incl. labour market and feasibility analysis), occupational qualification standards, suggestions from the previous assessments and strives for the best quality. The process of opening and developing the curriculum is described in the Statutes of the Curriculum. The University introduced a new internal curriculum evaluation system in 2021.

Traditionally, there is a clear focus on raw-material based technologies, having meat, dairy and plant-based specialisations in MSc programme, and this is also what the industry is recommending responding to the need in the society. In the last three years, a number of changes have been made to both Bachelor’s and the Master's curriculum in Food technology.

To the Bachelor's curriculum in Food technology:

- The competition for admission stands at 5.64, 3.08 and 2.28 students per study place in the previous three academic years, respectively.
- From the 2020 admission a letter of motivation in the admission conditions was introduced.
- Students complete internships at a food company at the end of both the first and second year, in the amount of 5 and 7 ECTS, respectively.
- Sub-modules were introduced in the curriculum in 2019/2020, including a sub-module in entrepreneurship and a sub-module in environmental management and bioeconomy covering the learning outcomes in these fields.

To the Master's curriculum in Food technology:

- The objectives and learning outcomes of the curriculum were reviewed and aligned with the learning outcomes described in the Standard of Higher Education.
- In 2020 the specialty module of bakery and confectionery technology was replaced by the specialty module in plant-origin food technology. This has stepped up the motivation of students to study and increased the potential to fill study places.
- Master's studies were transferred to the block mode study form in 2018.

In both programmes two English-language modules in Food Science have been launched: one for the autumn semester (44 ECTS) and the other for the spring semester (39 ECTS). In the reporting period 2019-2021, 49 foreign students participated in studies through these modules.

Strengths

- There is good evidence of responding to student and employer feedback, indicating that the feed-back system is functioning well.

- Covering “farm to fork” (*talust taldrikule*) with good collaboration between Veterinary Medicine and Food Technology.
- Several research projects have been developed and research has been initiated on the valorisation of by-products of food processing.
- There is a clear focus on raw-material based technologies, having meat, dairy and plant-based specialisations in MSc programme.
- In the MSc programme the extension of the specialty module in bakery and confectionery technology to the plant-origin food technology module.

Opportunities for further improvement

- The action plan of the self-evaluation report states: “Involve partners from other institutes, universities and labour market in the implementation of the curriculum”. We strongly encourage to have increased focus on cooperation with international Universities and companies. This would give new opportunities for high level scientific research and increase the revenue from projects.
- Students are satisfied with the amount of practical training (or would want even more). However, it would be beneficial to increase the awareness of the students about benefits of being involved in high level scientific research related to their study programme.
- Although there are research subjects in the Food Technology BSc curriculum (VL.1230-VL.1235) and students are involved in research projects, we would suggest having more overall seminars where all currently running high level scientific research is presented to students and opportunities for participation are highlighted. Interviews with BSc students revealed that the information about scientific research and involvement options has not reached to everybody.

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.

Evidence and analysis

The food technology laboratory complex has recently finalized an extensive renovation and is today equipped with all the necessary equipment and devices. The tour of the labs indicated that the combined laboratories are well suited for high level scientific research and for the students to learn analytical methods needed in industry, although there is a need to increase the diversity of state-of the-art equipment for teaching and research. The facilities are suitable for having joint projects with food industries, which will also help to increase the external funding level. Renovation of the chemistry laboratories is currently being planned, which is expected to be updated in the 2022/2023. Also, there

is a plan of refurbishing the auditoriums, common rooms and lecturers' offices. Our visit to the library confirmed that the university library provides adequate support with respect to specialty articles and databases. These resources include original study materials prepared and published in Estonian, and databases such as Scopus and Web or Science to obtain scientific material in English.

Classrooms are equipped with the necessary technical means for teaching, including distance learning (e.g., audio-video equipment). From the interview with the support staff and teachers we understood that the technical support for the needed IT-solutions is very good, which is important in the current situation with distance learning due to the pandemic. IT-solutions were provided very quickly and there are many solutions available, e.g., Zoom, Teams, BigBlueButton, Moodle.

Co-operation between different structural units, including the joint use of EMÜ laboratories, and the involvement of other units such as Polli Horticultural Research Centre and BioCC OÜ in conducting studies has increased in recent years. Study materials are available to students through Study information System, Moodle, at the EMÜ library (including various databases) and in the Chair on the spot.

Strengths

- Food Science and Food Technology Laboratory Complex is up to date and suitable for high level scientific research.
- Technical support for the IT solutions needed is very good, being available and with a short response time. Also, different trainings are constantly provided.

Opportunity for further improvement

- There is a need to increase the diversity of state-of the-art equipment for teaching and research, but with special focus on in-depth food analysis would be a good supplement. Increased funding from national and international research projects should be obtained preferably in collaboration with industry.

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.

Evidence and analysis

Teaching methods and tools used in teaching are modern and effective, e.g. problem-based learning, digital learning, diversification of training opportunities. The interviews with the teachers and with

support staff showed that there is good collaboration between these two sides: staff is supportive, and teachers are interested in constant improving of technical teaching skills. This was also confirmed by additional material provided by the University, e.g., examples form recorded video lectures. E-learning possibilities are sufficient (different programmes are available, e.g. Zoom, Teams, BigBlueButton), used by the teachers and well supported by the staff.

Courses are updated or replaced according to feedback from different parties. Previous assessment report mentioned that "students did not always appreciate the relevance of some modules delivered in the early stages of the programme" and made a recommendation "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.". During the interviews with alumni and current students we found out that the university has used the feedback provided by different parties and "problematic" courses have been renewed or replaced.

Practical and theoretical studies seemed to be interconnected as it was highlighted in different interviews. Theoretical classes were often followed by practical classes and new infrastructure was well suitable for this approach – classes equipped with computers and other modern tools were next to laboratories. Also, tours to different companies are provided for students – this supports learning and also provides possibility to find contacts for internship.

Practical training in industry is a strong component of both study programmes and was strongly highlighted by students. However, there is a trend that after mandatory internship students are employed by the company and in some cases, this affects further studying and can end with dropout. The university should emphasise the importance of BSc and MSc degree to both sides – students and companies. Interviews with employers and partners outside the university revealed that although employers would like to hire students with BSc or MSc there is a lack of workforce in the sector and therefore degree is not so relevant (although especially the MSc degree was well valued and preferred by the companies). This problem should be highlighted in the national level by both parties – the university and the employers.

Self-evaluation report highlights that the focus is shifting more and more on enhancing science-based learning. This has increased also the number of students graduating with a Bachelor's thesis – in the past three years, 36% of graduates have defended a Bachelor's thesis. BSc students currently still have an opportunity to choose between writing a thesis or taking a written exam. Promotion of even more science-based learning and reporting skill would be beneficial, which could be done by making writing of Bachelor's thesis mandatory.

The number of courses delivered in English has increased with the objective of increasing the attractiveness of the programmes to overseas exchange students. There was a clear understanding from different parties (interviews with top management, directors, teachers) that this trend should be continued in the future. Internationalization in the university level is positive and needs to be supported in every level. It creates new international collaboration opportunities, new projects and collaboration between students and scientists from different cultures – has wider influence overall.

Previous assessment report highlighted that the managerial skills of graduates need to be improved to be competitive. This recommendation has been addressed as new courses have been added to the curricula, e.g., MS.0813 *From idea to business plan*, PK.1707 *Environmental protection and management*.

Strengths

- A range of teaching methods are used, and e-learning skills and possibilities are up to date, which is extremely important in current pandemic situation.
- Practical training is sufficiently provided both by the university laboratories and also by the companies. There is a strong base for interdisciplinarity as practical training in the university laboratories prepares students to work in the companies. For instance, process simulation and lab-scale equipment are similar to processes and equipment used by industry.
- Number of English courses is increasing and there are positive attitudes towards teaching in English by different parties, e.g. teachers, students, management.

Area of concern and recommendations

- From discussion with employers and alumni it became evident that due to the lack of workforce in the sector some students are hired full time before finishing BSc or MSc studies. This problem should be addressed by the University at national level in cooperation with employers who also understand and value the university degree.

Opportunities for further improvement

- Only few students are involved in scientific research leading to publications. We suggest demonstrating more different research projects and encourage students to participate in them. More information about different research opportunities and participation options should be provided to students already from the first semester.
- Science-based learning and reporting skills could be improved by making writing of Bachelor's thesis mandatory.

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.

Evidence and analysis

The university is conducting the satisfaction survey among teaching staff and comparing the results with the previous job satisfaction surveys. Last survey was conducted in 2020 and results presented

in self-evaluation report showed increase in overall satisfaction with the quality of working life in the EMÜ.

According to the organization of academic career path and the Development Plan of the University, all lecturers should have a doctoral degree. This ambitious plan had positive feedback from the teachers during the interviews and there were evidences that it had motivated teachers to obtain a PhD degree, although according to the self-evaluation report only 18 out of 33 teachers at BSc and 12 out of 18 at MSc have a PhD. Teachers were very positive about the new academic structure and the new motivation and recognition system enforced from 1 January 2022. They highlighted this as giving clear overview of possibilities of academic career in EMÜ.

New rules of procedure for conducting appraisal interviews at the University can be also highlighted as a positive change, because during the interviews teachers seemed to be pleased and positive about the current situation and they felt that their opinion matters.

Also, the “open door” policy was a very positively accepted approach. Teachers found that they can communicate with different parties and their opinion is considered to a large extent.

Interviews with teachers and the self-evaluation report also highlight that there is sufficient possibilities and resources for self-improvement, and these options are actively used.

Student's feedback concerning the engagement of the teaching staff in providing good teaching and supervision was very positive. Students were most satisfied with the friendly and positive approach of teachers. Interviews with both BSc and MSc programme alumni showed that teachers who have not been positively reviewed by the students have improved their teaching skills or the subject has been replaced.

The main problem reflecting from the self-evaluation report and also from discussion with teaching staff seems to be finding a good balance between teaching and scientific research as the research activity of some teaching staff, as evaluated by number of publications, is low by international standards. This should be addressed in more details by directors of the institutes responsible for programmes - teaching staff should have clear publications goals that helps to keep scientific research level and teaching workload should allow to do research.

From discussions with teaching staff it became evident that there is positive attitude towards internationalisation and teaching more in English. This would increase number of international students and create new opportunities with international collaboration. Self-evaluation report and discussion with teaching staff also revealed that there are some resources for mobility and if used, the experience has been very positive. More internationalisation and teaching in English would help to increase international mobility also for EMÜ teaching staff as more connection and collaboration would be created.

The interviews revealed that the salary level was still found as rather unattractive compared to the industry level in the national level (also mentioned in “Areas of improvement and recommendations” in last assessment report). However, teachers found other positive aspects regarding working in EMÜ, and there were examples of people coming from the private sector back to teaching at the University.

Strengths

- Positive overall atmosphere between different parties – teachers, students, management, support staff.

- New academic structure and recognition system, which was enforced from 1 January 2022 at EMÜ, has been found as a very clear and positive change by all parties.
- New structure seems to have a positive effect on the number of lectures with PhD –there is a clear motivation for staff to obtain a PhD degree.
- Feedback from students to teaching staff is overall positive and feedback has been used to improve curricula.
- There is a positive attitude among teaching staff toward teaching in English and internationalisation is also positively valued.

Areas of concern and recommendations

- Although the number of lecturers having a PhD is increasing, the proportion remains too low. It is recommended to increase the research capacity by encouraging teaching staff to apply for national and international research projects and ensure that a PhD is a pre-requisite for all future academic appointments.
- The number of publications is low by international standards. This should be addressed in more details by directors of the institutes responsible for programmes. Although the publication requirements are set, there is evidence that teaching workload does not help to achieve the publication goals.

Opportunity for further improvement

- Mobility of academic staff should be increased. This would create more possibilities for international collaboration, new projects and increased funding. The university could introduce motivation system to increase the mobility of staff.

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.

Evidence and analysis

Students' satisfaction with the content, form and methods of their studies is high. Interviews with students and also with alumni showed a very positive attitude towards the curricula, teaching and support staff and resources. Students were motivated to study and finish their study programme.

Interviews revealed that if alumni were able to mention some subjects that should be improved or removed from the curricula then current students did not have these examples, because the shortcomings were already removed by the university according to the feedback of students. During

the interviews, current students at BSc and MSc level were not able to highlight any problematic subject. There is a high overall satisfaction with the curricula.

Dropout is still continuous source of concern as also referred by the University in the self-evaluation report. Additionally, in June 2021 the number of students on academic leave was 12 in the BSc and 8 in MSc. Dropout is addressed with different methods: the admission of motivated applicants and a flexible learning process by offering individual learning, personalized approach and counselling, as well as allowing the students the possibility to retake the course and/or participate in the studies during the academic leave, orientation week is organised for the freshmen. Self-evaluation report also states clearly that reducing the number of dropouts must not take place at the expense of the quality of the graduates' education – this is an important aspect when the dropout rate is addressed. Interviews showed that there is understanding of the problem and different measures are used to reduce it. A recent improvement has been that students need to write a motivation letter in the admission process to the BSc studies, and this was seen as a positive approach by staff and students, although it is still too early to make a conclusion on the overall effect. However, there is an understanding that the high dropout rate is not only a concern of the university, but this needs to be addressed by the Ministry of Education and Research of Estonia and secondary schools (cooperation is needed on different levels of education and it is not only the university's problem).

The number of students in MSc programme is too low. Although the number of admissions was 12, 15 and 12 in 2019-2021, then number of graduates was 3, 3 and 5 respectively. Interviews with MSc students also revealed that taking into account also the division between speciality modules, there were examples where there is one MSc student per speciality module each year. Considering resources needed to provide MSc level teaching on one specialty module, the number of students must increase to be sustainable. Cooperation with national and international universities are needed to increase the number of MSc students and collaboration with industry is needed to provide possibilities to motivate to start and finish MSc studies (industry values the MSc degree). One positive change to promote MSc studies has already been introduced: Master's studies were transferred to the block mode study form in 2018, but there has not been clear increase in numbers yet. Therefore, this area needs to be addressed further.

Students also felt confident that the curricula provided by the EMÜ are valued by the employers and prepares them for future. Interviews with employers also revealed that the demand for specialists in food technology at the labour market is high, even higher than universities can provide.

The number of students on both BSc and MSc going on exchange programmes abroad appears to be low, however, not clearly indicated. The self-evaluation report states that two students on the BSc programme are planning to participate in students exchange this year. Interviews with students revealed that students were not "excited" to go abroad due to obstacles as work and family.

Strengths

- Students' overall satisfaction with teachers, resources and curricula is very high.
- Students and employers are overall satisfied with the level of knowledge and skill obtained by BSc and MSc programmes.
- The career opportunities in the food industry look very good.

Area of concern and recommendations

- The number of students in MSc programme is too low. Cooperation with national and international universities are needed to increase the number of MSc students, and as the industry values the MSc degree stronger collaboration with industry is needed to provide

possibilities to motivate to start and finish MSc studies. Reducing the dropout rate and the effect of the block mode study form introduced in 2018 needs to be addressed further.

Opportunities for further improvement

- International mobility of students should be increased. There should be motivation system for students to study abroad. Current situation shows that there are enough financial possibilities, rather it is the question of student's motivation. More in-depth analyses needs to be done by the University to understand what would motivate students to increase international mobility.
- Assure that the information students are seeking concerning admission to studies are clearly presenting the content of the study programmes. Students should realize in application process that the food technology university studies include higher level of natural sciences (it is not culinary art education). Clarifying this information to students in the application process could potentially decrease later dropout.
- Research opportunities should be introduced more and in earlier stage of studies to increase the number of students participating in scientific research. This is also important to have new people entering to academic career model instead of going to industry.

5.1.6. Ergonomics (M.Sc.)

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.

Evidence and analysis

The programme Ergonomics (M.Sc.) offers the core competences listed by the International Ergonomics Association (IEA) for a specialisation in Human Factors and Ergonomics. Therefore, the course provides a level of education making graduates fit for performing in their professional environment, which is also confirmed by the issued level 7 graduation certificate of the Estonian Qualifications Framework. Further support that the course meets practice requirements comes from statements of the alumni working as ergonomists in practice. One of the alumni has been accredited as Eur.Erg. by the Centre for Registration for European Ergonomists, the only body endorsed by the IEA for the certification of Ergonomists in Europe. The study programme includes practical training, an important part of which has been carried out in cooperation with companies. During the time between 2016 and 2022, a total of 24 master thesis were completed in cooperation with companies.

The course content includes aspects of physical and cognitive Ergonomics as well. Ergonomics is also taught in the engineering study. The module TE.0965 Industrial Ergonomics is taught in 2.3. Engineering and aims to teach know-how and skills for solving ergonomics issues typical in production. According to the course curriculum listed in the appendix, the programme includes an important amount of practice, for example such as in the course TE.0971 "Design of work environment" or in the course TE.0973 "Cognitive Ergonomics" with as much as 30% of laboratory work (self-evaluation report page 250). So, the balance between research and practice is good, which was also confirmed in the interview with the alumni.

The development of the course is managed by a curriculum committee, which consists out of lecturers, alumni and one student. Before its implementation, the committee reviews inputs to the course coming from students and alumni, the latter are in part also employers. Alumni reported a tight link of the course developers with practice. This enables to sense the requirement of practice and adapt the course content within short delays.

A joint curriculum with Latvia and Lithuania for a master in Ergonomics and Human Factors Engineering has been developed and is at a stage of being finalized. The joint curriculum is intended to contribute to student's international mobility.

According to the self-evaluation report (page 177) the language of instruction is Estonian, with English and German required for achieving the learning outcomes. Ergonomics is a scientific discipline and a profession (IEA). Ergonomics science integrates practice and as such, the command of the local language is a necessity. However, from the point of view of the internationalization of a university, English is the language of choice. At master level, teaching in English is helpful for the students as the master study also prepares students for their scientific career. All interview partners were very skilled in English and we have not noticed any aversion to have English courses in the programmes. Students and teaching staff remarked that modern textbooks are in English and for some topics, only English textbooks are available. Therefore, it should not be a major problem to introduce English as a language in teaching whenever possible.

Strength

- Optimal balance of research and practice.

Opportunities for further improvement

- Include (or improve visibility) of "hot topics" in Ergonomics, such as Human-Robot-Collaboration and Human-Cyber-Physical Systems.
- As suggested in the self-evaluation report (page 94), "the university should also enter into agreements with foreign companies to facilitate student's summer internships outside Estonia …". As a pre-stage task aiming to achieve such agreements it could be worth thinking about starting an initiative at the level of the programme and explore interests of foreign companies for organizing international internships. In seeking international connections, the programme could ask local companies acting globally to help out with their international relations.

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.

Evidence and analysis

Training in Ergonomics requires technical equipment and instruments based on paper & pencil, both of which are used in the lab and in the field as well. Portable and inexpensive technical equipment is sufficiently available and can be replaced with support of the depreciation fund of the university (self-evaluation report, page 95). The study has its own laboratories (Ergonomics, Risk Management, and Ergodesign) and runs an Electric Lighting Laboratory in collaboration with the chair of Energy Application Engineering. Also, students can use resources of the institute of sports sciences and physiotherapy at the nearby University of Tartu.

Some elaborated devices and methods used for training are also developed by initiative of lecturers and professionals from the Estonian Ergonomics Society. Self-developed devices and methods are of interest to many training courses around the world and should be published whenever possible, such as was done for the electromyography device developed by the senior lecturer of the programme.

According to the self-evaluation report (page 95), the course suffers from a shortage in numbers of Windows computers. Windows PCs are necessary for running freeware tools (programmes for lighting design and for body movement analysis) used in training. As not all students own a Windows PC, the shortage causes delays in completing assignments or internships („independent work“) based on the freeware tools mentioned above. The shortage is an issue requiring an immediate solution. Besides providing additional Windows PC, it is worth investigating, whether the freeware could be run on virtual machines for other platforms, such as „Parallels Desktop“, or whether analogous software is available which runs on other (Mac iOs) platforms.

An important resource for a scientific based education is journals. The university provides access to the scientific journals relevant to Ergonomics (self-evaluation report, page 95).

Strengths

- Staff engaged to develop elaborate equipment and experimental methods of their own. An excellent example is the development of an electromyography recorder.
- Equipment suitable to be used in the lab as well as in the field.
- Very spacious laboratories compared to the quantity of students on the course.

Area of concern and recommendations

- We recommend solving the IT issue regarding the availability of machines and/or software for student works within a short delay. The issue arises from a lack of enough machines with Windows operating system or software running on other platforms, which could be given to

the students for completing their assignments, so they can complete their semester projects etc. in time. Lack of machines and software delays their work beyond deadlines, besides, also causing conflicts with the succeeding semester class.

Opportunity for further improvement

- Publishing self-developed devices and methods in international journals fosters contacts with the international community.

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.

Evidence and analysis

According to the self-evaluation report, there is enough study material (e-textbooks, self-check tests, educational videos) which is adequate for an independent study, which means students may study at flexible times and independent from the teaching staff. The material also includes videotaped tutorials and guidelines for internships. Two important benefits arise from the independent study. First, contact hours may be used more effectively, e.g. for addressing individual issues. Second, the independent study helps students to cope with the difficulties of working for a living in parallel to the study. From the discussions in interviews, we may conclude that the double load caused by studying and working in parallel is one of the major issues when studying, and is, at least in part, also responsible for the dropouts.

Practical training is achieved through internships and master thesis, both of which are often performed in companies. Following the English summaries of the master thesis listed on the website of the institute, practical oriented work is in line with the planned learning outcome, and there is a strong interaction of theory and practice.

Students rate the courses with good to high marks (average 4.2 – 4.3 in 2021. on a scale ranging from 0 to 5) considering aspects of conformity of the course content to the course name, their expectations, the clarity of study tasks and the teacher's competence as well as the necessity of the course for their future life.

In general, all courses are completed within EMÜ although support mechanisms for mobility are in place at the level of the university. Various reasons account for the lack of mobility, such as obligations due to one's occupation, family life, age of students and a lack of finance. It is expected that the joint

curriculum prepared in cooperation with the Lithuanian and Latvian university could help boost students' mobility within the Baltics.

Students complete their study with a graduation thesis on a broad spectrum of topics in Ergonomics. In general, the graduation thesis offers a good opportunity to gain practical experience in the field while cooperating with companies. All master thesis of 2022 are in Estonian with a summary in English. Considering that the master thesis is kind of a business card for international students and institutions, an additional effort to write the thesis in English would have a major impact on the international visibility of the Ergonomics study at EMÜ. From what we have learned in the interviews, the language should not be a major issue hindering the completion a written thesis in English.

Strengths

- Study material enables independent study.
- Efficient use of contact hours.
- Strong link to practice.

Area of concern and recommendations

- All master thesis of 2022 are in Estonian with a summary in English. The master thesis is kind of a "business card" showing activities and achievements of the programme to the international community, in particular to students abroad who are investigating possibilities for an exchange university, for instance at EMÜ. We strongly recommend English as a language for master thesis.

Opportunity for further improvement

- Explore ways to boost mobility by linking to international networks for promoting education in Ergonomics. There are several initiatives in place for the promotion and the exchange of education in Ergonomics and Occupational Health Sciences on an international level as for instance the ENETOSH network (www.enetosh.net) or the global HFE education map (https://iea.cc/global-hf-e-education-map/). Such initiatives could be a starting point for establishing a broad international mobility programme and explore possibilities of further finances for supporting mobility.

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.

Evidence and analysis

In the group of the 12 lecturers involved in teaching, ten have a PhD degree. The CVs of the teaching staff involved in the Ergonomics study testify an adequate qualification of the staff to achieve the objectives and planned learning outcomes of the programme. Overall students give positive ratings on teaching skills of the staff. Cases of negative feedback are handled including the director of academic affairs.

According to section "2.5.1. Curriculum and curriculum development" of the self-evaluation report the teaching staff collaborates with the higher education institution. Following discussion in interviews with alumni and employers, the staff is highly engaged in strong collaborations with the practitioners and employers in their field.

„We are happy!" was the concluding remark of the interviewed group involved in the Ergonomics programme. To ensure an up-do-date education, the teaching staff is required to conduct scientific work and the researchers are required to teach. Therefore, the teaching load varies depending on the position of the teaching staff and for a lecturer it could be as high as 80% of the working time. In additional to teaching, lecturers are responsible for the preparation and publication of textbooks and other study material. According to the self-evaluation report, this responsibility requires more support, indicating that the load in lecturers could be a threat for their scientific duties, although the scientific duty could be as low as 20% of working time.

In order to foster their teaching skills, some of the teachers participate on their own initiative in training courses and one teacher took part in Coursera courses according to the Self-Evaluation Report.

Foreign guest lecturers presenting their research or newer measurement technologies enriched the program and possibly also contributed to relieve some load to the teaching staff as their lectures are given to the whole student body in the field of Ergonomics. There is some potential for increasing the benefit by increasing the number of invited guest lecturers. Organising such lectures as video meetings should not have a major impact on financial costs. Similarly, it is worth investigating, whether it is possible to create synergies with exchange of teaching (e.g., remotely) with other universities to address additional topics of ergonomics.

Strengths

- Highly motivated teaching staff.
- Almost all members of the teaching staff have a PhD, which meets the university target.

Area of concern and recommendations

- Workload of lecturers is high. More staff should be recruited. The programme could also try to engage overseas lecturer presenting their research or newer measurement technologies could contributed to relieve some load.

Opportunities for further improvement

- Increase frequency of guest lectures with international recognised foreign lecturers.
- Organise exchange lectures with lectures of other universities to include additional topics of Ergonomics and benefit from synergies reducing workload in 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.

Evidence and analysis

In general, students follow an occupation in parallel to their study, which is a critical load. However, according to the self-evaluation report (page 102) and following statements made by interviewed students, students are highly motivated. They see the Ergonomic study as a good opportunity to make a positive change in their occupational career. The employment rates for students of this programme are good, which is also due to the needs of the local market requiring high level educated ergonomists. Following the statements of alumni, which are also employers of graduated students of this programme, students are very well prepared to tackle the demands of practice. We noticed an impressive enthusiasm of interviewed alumni for the programme mainly, but not only, because the education in Ergonomics opened interesting perspectives for their future job.

As shown in Table 5, drop-out rates first increased in 2018/19 after the block mode teaching was introduced; in 2020, the drop-out rate has fallen. This positive development is in line with the high motivation of the students. As according to statements of the alumni the market for ergonomists professional is growing rapidly in Estonia, positive career perspectives might also have contributed to the fall in drop-out rates in the Ergonomics study. Students are eager to complete their study in time, which explains the high proportion of students graduating within the standard period of the study.

As previously reported, the international mobility of the students is low. According to the interviewed students, financial burdens, occupational duties and family life are among most important reasons for the low mobility. It is worth noting that on average students are older compared to students on other programmes. Occupational duties and family life might play a more important role in older than in younger students.

Strengths

- Highly motivated students, probably the most motivated ones among the students met during this evaluation process.
- Enthusiastic alumni who are engaged in supporting the programme.
- Good job perspectives for graduates in Ergonomics.
- Low drop-out rates.

Area of concern and recommendations

- Financial issues are hindering international mobility. As per nature, Ergonomics is strongly linked to practice. Therefore, opportunities could be explored to tackle the financial issue with local employers. By our own experience, an engagement of the employers results in a significant payback of investment for the employers.

5.1.7. Energy Application Engineering (M.Sc.)

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.

Evidence and analysis

The curriculum is aligned with the Statutes of the University and the needs of the labour market. The programme has been guided by the OSKA report, which monitors the labour market and future skills. Alumni, students and employers are consulted as part of the Programme review, as evidenced by the Master's Curriculum Committee – 5 university staff, 1 external member and 1 student member, which meets 3 times a month during the semester. Membership of this committee is biased towards EMÜ staff – in discussions with employers and alumni, they were very keen to be involved, but were never approached. In order to really benefit from external input, we recommend increasing the external members to include more employers and alumni.

The programme provides a good foundation in the fundamental principles of electrical power engineering as applied to energy. Current modules are aligned with Estonian industry – power generation, agriculture and forestry. This is very evident in one course – Electrical Drives, which covers the use of electrical motors in agriculture. Some students feel that such courses need updating to include more current challenges in the electrification of transport and energy, e.g. design of electrical drives for electric vehicles; electrical generators for wind turbines. New courses such as Smart Grids, Renewable Energy, and Nanomaterials for Energy Applications are being introduced, demonstrating the alignment of the course to more current real challenges and new advances in materials.

Not all panel members were able to visit the labs for Energy Applications Engineering, but the practical aspect was discussed with students and employers. Both sets felt that practical labs could be updated in line with comments on the taught modules. Employers, students and alumni accepted that the practical element of the programme provided a good foundation, but once in industry additional practical training was required. It was recommended that there is more industrial input to the practical

review of the programme. It was noted that there has been investment in the establishment of a new renewable energy lab, which may answer some of the practical training issues.

In the self-evaluation report it is stated that "Professor Andres Annuk is a member of the Occupational Qualification Council of Energy, Mining and Chemistry Industry representative from the Rectors Council. He is a member of the evaluation commission under the Estonian Society for Electrical Power Engineering (ESEPE). Director of the Institute of Technology Margus Arak is a member of the Estonian Association of Engineers board. Researcher PhD Alo Allik was a member of the Electrical Engineers board." Representation on such professional boards ensures that the programme is aligned with professional standards.

Strengths

- Good leadership with a strategy for developing the programme, aligning it with advances in the energy sector, and recruiting staff with expertise in relevant specialist areas such as Smart Grids and Renewable Energy.
- The programme is aligned with professional standards as recommended by professional engineering institutions.

Opportunities for further improvement

- Increase the number of external members in curriculum review committee, in particular from alumni. From discussions with both employers and alumni it was felt that not enough was being made of this very valuable resource in informing the development of the programme.
- Update practical aspects of the modules to align with industrial practices – bring in engineers from industry to teach and develop labs, but also to provide more real-life aspect to the teaching content.

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.

Evidence and analysis

According to the self-assessment document resources do not seem to be an issue.

There are labs in industrial automation, electrical drives, microprocessor and control systems, thermal engineering, nanomaterials labs, lighting technology lab and a renewable energy lab. The lighting technology lab was renovated in 2018. A new member of staff - Dr. Sergio Pires Pimentel - will lead the Renewable Energy lab. All labs are shared between MSc and PhDs, with new equipment being mainly sourced from research projects. Sharing of labs ensures that the MSc students are exposed to research.

There is enough space for expansion of students, even if the student numbers were to double.

Students have access to labs from other programmes, e.g. a scanning electron microscope in Forestry. In addition, students can access overseas labs through successful EU applications, e.g. The Parrot program between Estonia and France, specifically University of Montperlier.

Most of the important texts are in English and available to the students. If anything, the students suggested there was more of a problem with relevant textbooks in Estonian.

Strengths

- The quality and variety of the lab resources available is a major strength ensuring that the practical outcomes of the programme are achieved.
- Sharing of lab resources within the programme and with other programmes ensures that students have access to the most up to date equipment.
- Participation in international programmes giving access to specialised lab equipment and also exposing the students to different research cultures.

Opportunities for further improvement

- Although the labs are well resourced, some students claimed that more fundamental equipment such as transformers and instrumentation was outdated and from the Soviet-era. It was accepted that such equipment is able to perform the required function, but perhaps there should be a plan for updating of some equipment.
- In discussions with the students, they acknowledged the availability of modern electrical drives and servo drive systems but stated that not all academic staff were able to demonstrate the equipment. As stated in the self-assessment document Action Plan under resources, more staff training is required.
- Students, alumni and employers all stated that further training in use of some specialist equipment was required once in industry. We support the Action Plan to involve more experts from industry in practical work development.

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.

Evidence and analysis

Over the last 2 years of the pandemic staff have used e-learning to deliver course material online. Many courses are delivered as blocks rather than spread over a semester. The combination of e-learning with block teaching is very flexible and suited to many students who work and cannot attend the university for regular classes. Staff integrate e-learning and block teaching with contact study methods such as flipped classroom, online study groups, and problem-based learning. With only e-learning teaching, practical demonstrations are provided online, but this is no substitute for actually performing the experiment in the lab. Overall, the programme is able to provide a flexible educational environment according to circumstances to allow the students to develop and the study process takes into consideration the fact that a lot of students have to work whilst studying.

The study process receives full support from the IT department. In a meeting with support staff, the IT member attending was commended by his colleagues for their role in ensuring all programmes were able to deliver the outcomes through e-learning.

An important change to the programme made in 2020-21 is in the Master's thesis, which allows the students more time for reflection, an important part of undertaking a research project; it reduces the pressure on the students and allows the students to get more involved in the research activities within the Chair. It is hoped that the change will increase the number of theses submitted and hence reduce the drop-out rate.

The programme does encourage mobility through the RPL procedure and also through the introduction of English taught courses. At present there is only one course taught in English. One example is provided of the RPL procedure involving an Austrian student transferring credits and completing the course at EMÜ. The Chair plans to encourage home students to take advantage of ERASMUS opportunities, but in discussion with the students there will be very small numbers of students exploring such opportunities due to family and work commitments. It is therefore likely that most of the exchanges will be into Estonia, but more English courses are required to attract international students.

As part of the practical training the student take part in a traineeship, which the students find very useful and positive. In order to ensure outcomes are met, a tripartite agreement is made between University, student and company.

As a result of the pandemic the assessment process has been largely online. Since there are small numbers of students, staff have been able to set different questions for students to prevent copying, and some staff have considered oral exams. This is only possible with small numbers of students.

Strengths

- Flexible study process supports all students, in particular those who have to work and hence cannot attend regular classes.
- Good support from the IT department in setting up e-learning and Moodle courses.
- A good example of best practice and innovation in Teaching and Learning is in the change in the MSc dissertation format, enabling the student to contribute to research. The new format is more flexible and reduces pressure on students, making it more likely that the student will submit and hence not drop out.
- Changes to the MSc thesis demonstrates willingness to make change to enhance the learning process for students.

Opportunities for further improvement

- Introduce more English taught courses.
- Continue to develop e-learning and block teaching.
- Further develop online practical teaching so that it is not just a demonstration and the student participates more – some programmes like Technotronics have sent out kits for students to work with.

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.

Evidence and analysis

According to the University 5-year Development plan all academic staff should have a PhD. Based on the data in Appendix 4.6 in the self-assessment document, there are 14 teachers associated with the Chair, and only 9 of them have a PhD, 64% of staff. However, Table 5 indicates that almost 77% of the staff responsible for giving the courses have a PhD and Table 6 shows that from 2018 to 2020 less than 50% of staff have a PhD. There appears to be a lack of consistency in the information presented on staff with PhDs.

Based on discussions with the academic staff, the Chair is very supportive. Prof Rauwel holds regular meetings with staff, e.g., seminars on writing research papers; weekly discussions on PhD projects.

Staff workload is agreed between the Chair and the member of staff, and typically it is 400 hours a year on teaching for a lecturer, with about 100-hour reduction if the staff member is studying for a PhD. Given the pressures on staff this is not enough time and explains why more staff are not motivated to pursue a PhD.

Master programmes should be research led providing students with an opportunity to engage in research. From the self-assessment report staff in Energy Applications Engineering are engaged in EU projects, which is of benefit to the MSc programme.

The new Chair appointed in 2020 was appointed to increase international recruitment of staff and increase the number of English courses. Since her appointment Dr. Sergio Pires Pimentel from Brazil

has been recruited, and more recruitment is planned in the future in strategic areas such as energy storage and hydrogen. Evidence of international collaboration in both teaching and research is provided through strong links with University of Grenoble in France and universities in Latvia.

Table 33 in the self-assessment report provides a realistic set of targets for international recruitment, mobility and the introduction of English courses.

As well as international guest lecturers, representatives from industry teach and participate in the MSc Defense Board.

The students are happy with the teaching. There was a comment on the difference in teaching style between younger and older staff, with the latter adopting a more traditional approach of learning by memory rather than understanding.

Out of the 15 staff listed in Appendix 4.6, 10 staff have one or more publications in the period 2018-2021, with 4 staff having more than 10 publications. Profs Kokin, Annuk and Rauwel are active in EU projects, with Prof Rauwel having applied for EU projects as coordinator. However, this only represents 3 of the 15 staff as being active in external research projects. In order to feed more research into teaching, which is particularly important at Master's level, more staff need to engage in external research projects.

On the whole, the staff are highly qualified ensuring quality of teaching delivery and sustainability. Staff are approachable and adopt an open-door policy for students.

Strengths

- Highly motivated and qualified academic staff, providing very good support to students.
- Pro-active leadership from the Chair providing support for the staff and students.
- Strong links with international partners and companies providing input to the teaching programme, in particular universities in France, Latvia and Egypt.
- The Chair has a realistic plan for increasing internationalisation, mobility and English teaching.

Area of concern and recommendations

- The only area of concern is in the balance of teaching workload and time to study for a PhD. If the university is serious about all staff having a PhD, staff teaching workload should be reduced by more than 100 hours as is the current situation. We recommend that staff enrolled on a PhD should be able to spend 50% time on teaching, 50% time on PhD, and this should be contracted. A strategy in place to allow 2-3 staff at a time to do this, with teaching loads shared by other staff or by bringing in other guest lecturers to cover would provide a more formal plan to meet the university target. At present the university has this target, but there does not appear to be a formal plan and it is left to each Chair to sort out.

Opportunities for further improvement

- Bring in more international guest lecturers.
- Recruit more researchers with an international profile.
- Support more staff to apply for external research funding and include early career staff in large EU grant applications.

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.

Evidence and analysis

The panel was very impressed by the quality, dedication and motivation of the students we met. It is clear that those students who do not drop out are very good, and fully engage with the work programme.

There are a number of observations regarding students that are of concern and provide evidence that the standard "The dropout rate is low; the proportion of students graduating within the standard period of study is large" is not being met. Table 3 in this report summarises these observations.

- Student numbers graduating are low and fluctuate every year making it difficult to plan ahead. According to the data presented in the self-evaluation report, the number of graduations in the Master's varied from 17 in 2011 to 5 in 2021.
- The drop-out rate has fluctuated between 12 and 40%.
- In terms of admissions, the self-assessment report shows very low number of applications – in the range 19 to 33, with admissions running at 60-70% of applications.
- Data in the self assessment report shows very high interruption numbers – we would estimate almost 50% of the total Master's cohort.
- Although the review is about the MSc programme it is worth commenting on the lack of PhDs graduating in the last 10 years – only 4 according to the self-assessment report.

Reasons for high drop-out rate and interruptions were explored in discussions with the staff, students, alumni and employers. All made similar comments:

- A lot of students have to work as they receive no income during their studies, and this clearly has an impact on time available and motivation, more so at the BSc level. Master students and their employers understood the educational benefits of the MSc degree and their careers, but work pressures play a role in interruptions.
- Students drop out for family reasons due to childcare.
- Military service was also proposed as a reason to drop out.
- Finally, expectation of the course and what is required. This is probably more an issue for the BSc – students apply from School with no real idea of what the programme is about and how much work is required. Entrance requirements particularly in Maths and Physics are very low, and it is these subject that the students struggle with in their first year. In a few meetings with students the following phrase was used: "it is easy to get in, but difficult to stay in" - it should be the reverse.

These observations cover 2010 to 2020, before the new Chair was appointed. It is clear from the discussion with staff and the Chair, as well as the self-assessment report, that the Chair is dedicated to addressing this issue. The change in dissertation is a good example – the new format reduces pressure on the students, making it more likely that the student will submit and hence graduate. The new format was only introduced in 2021, and it will be interesting to see what the impact is.

The staff felt that the feeling of community within an MSc meant that the students supported each other, so that the drop out is lower than other programmes.

The students acknowledge that the programme has been designed to be flexible to accommodate their requirement to work at the same time. Also, from discussion with students the university works will students who have interrupted, enabling them to return and finish their studies. No data is provided to support this, but it was stated in student discussions.

Despite the drop out and interruption issues, the students are highly employable with 79% of graduates employed in the energy sector in Estonia.

Alumni are, on the whole, happy with the programme, specifically the practical aspect of the course. There were comments about varying style of older members of staff compared to younger members, but all staff were approachable and willing to provide support. Alumni stated that the cohort would support each other to learn together, reflecting the comment made by a staff member about the community feeling in a Masters.

The employers all recognised the quality of training the students received, in particular the balance between theoretical and practical training. The employers recognise the benefit of a MSc in terms of professional development, and hence are flexible allowing students time to attend university. A point was made that EMÜ could be more flexible to help motivate students to complete their course. Some additional training is always required once in industry, but the employers recognise the quality of the fundamental engineering education that students receive.

The students are not very mobile, with no exchanges either within Estonia or abroad. The pressures on students to work during their studies, makes it very difficult to go abroad. There was some discussion that some large employers who partner with international firms could provide support with international mobility. The lack of English taught courses reduces the number of Erasmus students coming to Estonia. There are some examples, but the numbers are very low. The standard related to mobility is not met – it is a complex issue, which will be difficult for the university to solve.

Strengths

- High graduate employment rate.
- Students are highly motivated and dedicated to the course.
- Good sense of community within the student cohort enabling self-learning within the group.
- Employers are happy with the fundamental education that students receive in electrical power engineering.

Areas of concern and recommendations

- High drop-out rate and number of interruptions – this is a national problem, and local fixes will only have a minor impact. Locally, we recommend working more closely with employers to reduce pressure on students and provide more flexibility regarding Course attendance. A buddy/mentor system could be introduced involving 2nd year MSc students mentoring 1st

years, and alumni mentoring both. At a national level all Estonian universities need to lobby government to provide funding for student subsistence to reduce the need to work full time.

- The lack of international mobility of EMÜ students is of some concern. This has been exacerbated by Covid, but the MSc students themselves are unwilling to take on ERASMUS etc. due to family and work commitments. The programme is doing all it can to put the pieces in place to encourage students with mobility, through international contacts, introduction of English courses, and ERASMUS. However, there is a wider problem – lack of student financial support meaning they have to work. In order to increase international mobility of home students more has to be done on the social and personal level, perhaps working with the employer to encourage the opportunity whilst keeping the position open and continuing to pay, or to provide scholarships. This is a national issue, and all universities in Estonia need to work together to solve it. Until this happens international mobility will continue to be an issue.
- International mobility of students coming to Estonia is still too low, due to the lack of English taught courses. Recommend teaching the whole of the MSc in English, and thus accelerating the plan proposed in the self-assessment document. The students speak excellent English and when questioned about the prospect of English taught courses, they were very open. It was stated that most of the best textbooks are in English anyway. Employers supported this also, but only for the Master programme, not for the Bachelors. It is important to be able to communicate technical issues in Estonian with non-English speaking workers within industry.

Opportunities for further improvement

- Wider participation of alumni in the MSc programme – in the alumni meeting none of those present had had any contact with the MSc programme. They were all prepared to participate in guest lectures and provide practical training; act as mentors to current students, which could help reduce drop- out rates and interruption.
- Make student applicants more aware of the expectations of the MSc programme through wider school and public engagement.
- Use the MSc programme and research activity within the Chair to make the public more aware of the societal impact of energy engineering.
- In the Curriculum review committee, there is only student member – we would increase this to two, one from each year of the Masters. We would also include alumni members, who are very keen to contribute. This would encourage more feedback from the student community and help the teaching staff to understand the issues faced by students.

5.1.8. Production Engineering (M.Sc.)

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.

Evidence and analysis

The study programme was reviewed in 2020 with the appointment of a Curriculum Development Committee, which included 5 staff, one student and one employer. Development of the programme does therefore take account of feedback from students and employers. However, the feedback does seem limited – the single employer is focussed on robotics, yet the core area of the curriculum are listed as manufacturing engineering, bioenergetics engineering, agricultural engineering, and automotive engineering. In future development of the curriculum wider feedback from employers is required to truly reflect the curriculum.

The structure and content of the modules does meet the objectives of the learning outcomes. Overall, the programme of modules is coherent. In the SER on page 136 it is stated that the Chair has collaborated with 7 universities from European countries in the development of the PE curriculum. It is claimed to have a wider range of basic courses compared to European universities, which tend to focus on mechanical engineering technology. However, the modules at EMU represent more of a sub-set of mechanical engineering, rather than a subset of production engineering. Some modules are clearly associated with Production Engineering, for example Manufacturing Engineering, Technological Devices and Materials, and perhaps Robotics. If the student chooses Manufacturing Engineering as the speciality module, then the student has covered typical modules for production engineering. However, based on the titles of the sub-modules in Bioenergetics, Automotive or Agricultural, none of these other options appear to cover production engineering. We do accept that the modules and course structure meet the learning outcomes, but is Production Engineering really the correct title for the MSc?

The practical part is an internship in industry which is been defined by the university. The students must write a report and get 8 ECTS credits. Although most of the students are already working in industry this requirement remains. We believe it would better to invest more time in hard core science courses and in mathematics, because the students experience the practical element as part of their jobs.

According to the SER on p135 the curriculum has been adapted to reduce the workload of staff due to an increase in admissions, but according to Table 5 on p135 of the SER admissions have not changed since 2019, and in fact are very low – 10 per year. The curriculum must be developed to get the best learning outcome and to fulfil the goals of the direction.

Feedback of all involved groups has been included in the discussion on the improvement of the study program. The development fulfils the standards of higher education set in Estonia.

The wish to involve more international lecturers is positive, same counts for the concept of closely combine teaching and research.

Sustainability expresses the idea of recycling, reusing also. In future production sustainability will play a major role. It must be included in all subjects and all courses. This is missing.

Sustainability expresses the idea of recycling, reusing also. In future production sustainability will play a major role. it must be included in all subjects and all courses. This is missing.

Strengths

- International comparison of the study program with universities in 7 other European countries.
- Curriculum meets the expectations of employers.

Area of concern and recommendations

- We are concerned about the small numbers on the course given that there is a shortage of engineers in Estonia. Compared to the other engineering-based MSc, Energy Applications Engineering, the number of applications and admissions are lower. Perhaps the low applications and admissions are due to some confusion about the nature of the course, as it is neither production engineering nor mechanical engineering. As mentioned in the analysis we feel that the curriculum has more Mechanical Engineering aspects than Production Engineering. Given that there is a shortage of mechanical engineers in Estonia we feel that the curriculum should be re-branded to truly reflect the curriculum content – it could be branded as Engineering MSc with the final qualification according to the specialist module chosen, e.g. Engineering MSc (Agricultural) or Engineering MSc (Manufacturing). In this way it is clear what the student is expecting and also more clear for employers.

Opportunities for further improvement

- It is advised to create an industrial advisory board to regularly discuss the curriculum and other issues like labour situation, topics for Master thesis also. One industrial person in the development group seems to be not enough. The industrial advisory board could give a broader view and support the curriculum development.
- The curriculum language of instruction is Estonian and students must have the option to write their thesis in Estonian. However, to increase the number of international students we recommend converting more courses to English.
- The specialist core modules all have an impact on the environment. More on sustainability aspects should be included in the curriculum.

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.

Evidence and analysis

The laboratories of EMÜ have been recently renovated to give them a new and clean look. Most of the equipment is up to date and fits the studies well. Demek CNC OÜ has equipped the CNC processing equipment laboratory with a numerically controlled milling machine. The old CNC bench is suitable for initial training, and in cooperation with companies, the latest machine tools are introduced to the students.

The university needs to take a look at both of these arguments and make a decision and communicate that to the students too. The modernization of the machines mainly concerns the control part, in modern words the digitalization.

Some laboratories had brand new machines because they are collaborating with industry leaders and have borrowed the machines.

Teaching material and textbooks are available for all students. The materials are also sufficient if student numbers increase.

Strengths

- Renovated laboratories (especially in the area of bioengineering)
- Some brand-new machines

Opportunity for further improvement

- Digitalization needs up to date computers, here the university must have a plan to renew the hardware.

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.

Evidence and analysis

The teaching and learning process is nicely adapted to the subject with practical and theoretical studies well connected. The teaching methods are appropriate, and the learning outcome is fulfilled. The standards are fulfilled, but reliable and effective results cannot be concluded from statistics because of the low student numbers.

The process of teaching and learning supports the social and individual development through sub modules in Engineering Ethics and Enterprise Practice. However, given that Production Engineering is about logistics and management, more courses could be provided to contribute to student's development, such as project management, time management, presentation skills.

The teaching methods are using digital methods, which have been even more of a necessity due to Covid-19. The use of more e-learning is a very positive approach.

The achievement of the learning outcome is supported with the feedback from teaching staff and students. j. More information could be provided on this aspect.

Teaching methods support the outcome effectively. The practical training motivates students. It is well combined with the theoretical part. The Master thesis examples listed in the SET are from the area of Bioengineering. The employment of production engineers is mostly (>70%) in related industries. Given the various speciality modules it would be interesting firstly to know how many students take each speciality module, and then which of these industrial sectors the students are finally employed.

The curriculum does encourage mobility, mainly through practical internships in industry. The pandemic has impacted all other forms of mobility for the last 2 years. No information was provided on mobility pre-pandemic, and so it is difficult to comment on how effective the curriculum is used to enable student mobility. It is anticipated that like other programmes international mobility will be low because students have work and family commitments.

Strength

- Students and lecturers were fast in applying new learning methods, mainly triggered by Covid 19.

Opportunity for further improvement

- Work with employers to increase opportunities for mobility by finding positions in international partner companies or international customers.

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.

Evidence and analysis

According to Table 6 in the SER, 75% of the teaching staff have a PhD, 12.5% are studying for a PhD and the remainder are qualified to MSc level. Based on this evidence the teaching staff have the adequate qualifications to deliver the MSc course. Out 18 staff 12 are younger than 50, and of these 8 have a PhD. The age profile is well balanced, but there needs to be a strategy in place for retirals, with 4 staff in the range 60 to 80.

The teachers and lecturers have on average an H-index factor of 2 and the professors and associate professors from 1 to 23. These numbers clearly indicate that the teaching persons have normally a

very limited or no recognition in research. In the last 4 years 6 new persons have been appointed; one full professor with an h-factor of 23 and all others below 3.

A brief look at the CVs of staff does show that it is mainly senior Professors who have current research projects, supervise PhD students, and are publishing papers, typically 3-4 a year. Younger early career staff seem to be struggling with research, perhaps due to workload. Most of the current or past research projects have a focus on Agriculture, which ties in with the speciality modules in Bioenergetics, Agriculture and Automotive, but not so much in Production Engineering. International and national practitioners are involved in teaching.

The lecturers learn from the course evaluation with questionnaires and change things if this is urgently claimed. It is very much appreciated that lecturers take the student assessment (via questionnaire serious). It is difficult to keep the questionnaire anonymous because of the low number of students.

According to the data in section 5.6 of the SER only 5 of the 18 staff attended additional professional and teaching skills courses in the period 2018-2021.

Collaboration on all issues (research, teaching, national/international) is very positive. Staff workload seems to be dominated by the teaching with research a lower priority.

Strengths

- Highly motivated and qualified academic staff, providing very good support to students.
- 75%, 13.5 staff have a PhD, with 8 of those staff 50 years of age and younger.

Areas of concern and recommendations

- Three staff members are 69 and over, which is beyond the retirement age. A recruitment strategy needs to be in place to replace retirals. Should anything happen to any of these staff, then the workload will fall upon other staff, increasing their teaching load even more.
- We would encourage a review of the workload of early career staff to support them in building up research, leading to more publications, and opportunities to feed research into teaching. Sabbatical leave is one way of achieving this, and in particular encouraging young staff to take sabbatical time abroad.

Opportunities for further improvement

- Results of the student evaluation of the lecturers could be made public, this gives competition among lecturers and will thereby improve the teaching.
- More staff should be encouraged to attend professional development courses.

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.

Evidence and analysis

Student admissions are very low, and retention rates for the last 3 years are less than 50% (see table 3 in this report). Those students who do remain on the course are motivated and capable. However, there is some concern over the low numbers of students being admitted and the high drop out rate. However, when we look in the action plan, this issue is not treated with the necessary care. Measures like decreasing dropout rate helps but further activities are needed to come up with a sustainable number of students in the first place.

We recognize that the drop out rate includes student who failed the exam. They can redo the exam. It is more interesting to learn the percentage of students who entered the university and left it (with a title and passed final exam) compared to the number of students who entered the university only.

The students who remain on the course are very motivated, but all of them suffer under the big workload (job around 80% beside studies). They acknowledge the feedback on the recommendations based on the questionnaires. The teachers are approachable and understand the needs of the students. According to the SER the Chair consults with students who have dropped out, using RPL to recognise the skills and knowledge gained during interruption. As with other programmes the main reason for a high drop-out rate for financial reasons, and the student have to work. In order to assist students financially there is now an opportunity to apply for a scholarship.

The practical part is very welcome and students like it. It provides the basis for subjects with more of a research focus such as biotechnology. A master's programme should cover advanced subjects related to current research, so teaching staff are encouraged to include their research interests in the teaching.

It is obvious that all mentioned master thesis topics (page 140 Self-Evaluation) are concerned with more or less bio-related topics. In this area two professors (Rauwel and Kikas) have a strong background in research.

No data is provided on student mobility in the SER, other than that it is encouraged through ERASMUS+, Nordplus and NOVA-BOVA. Mobility, both within and outwith Estonia, has no doubt been affected by Covid, but no pre-Covid data is provided and so it is difficult to comment on this aspect. In the future mobility can be improved, both out of and into Estonia through more widespread teaching of courses in English. Students should also be encouraged to attend other Estonian universities.

Alumni who have successfully completed the course are satisfied with the training and support provided in the programme. In discussions with the employers, they are happy with professional preparation, which is reflected in the high employment rate of graduates.

On page 139 of the SER it is stated that "a number of people seeking to obtain the Master's degree come to the university to study when they are already working in their speciality. This confirms that the content of the curriculum is in accordance with the needs of the labour market." We rather get the impression that the students just want to get a Master's degree and deepen their knowledge.

One final comment, not really covered by the standards, but is related to motivation and well being. Due to the financial situation students take on employment as well as full-time studies – this represents a significant workload. In the SER there is very little information on work-life balance between studies, job and free activities (sports, music etc). With so much of a focus on working it easy to become saturated leading to burn-out, and this hinders creativity, innovation and free thinking.

Strengths

- Focussed and motivated students.
- The employment rate of graduates is high.
- Satisfaction by alumni about the professional preparation is high.

Areas of concern and recommendations

- We are concerned by the high workload of students, because many students are in full-time employment. Young people need other avenues to express themselves through sport, culture etc. We acknowledge the need to work for financial reasons, but we recommend that the university review this situation and work with students and employers to provide time for such opportunities. For example, in the UK, all universities allow Wednesday afternoons for extra curricular activities.
- We are concerned about the low numbers of students admitted to the course. From a financial point of view it is not very attractive to have such low numbers of students. In the years 2018-2021, 31 graduated in production engineering. We recommend a review of why admissions and applications are so low at the moment, given that there is a shortage of engineers in Estonia. In addition, we recommend a potential re-branding of the MSc programme and improved marketing to attract more applications. High dropout rate is a major concern but is also an issue for all programmes in the SPG. We recommend that all programmes in the SPG share experiences and best practice. More could be done to work with employers to reduce work pressure – the employers need to understand that they will benefit more if students complete the Masters. Other options include a "buddy" system in which 2nd year students support 1st year students – this also builds a community; and a tutorial system, in which staff are allocated small groups of students to support them with their academic and pastoral needs.

Opportunities for further improvement

- Better marketing to attract more applications.
- Work with students and employers to increase mobility.