Expert group joint opinion

Evaluation Procedure: Assessment of Study Field

Higher Education Institution: Transport and Telecommunication Institute

Study field: Information Technology, Computer Hardware, Electronics, Telecommunications, Computer Management, and Computer Science

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Summary of the Assessment of the Study Field and the Relevant Study Programmes

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The expert group found that TSI offers education programmes in the study field "Information Technology, Computer Hardware, Electronics, Telecommunications, Computer Management, and Computer Science" with a strong emphasis on academic excellence, industry collaboration, and research infrastructure.

The study field has clear aims and objectives aligned with the strategic development fields and the needs of the society and the national economy. TSI has partnerships with several universities and research institutions around the world, allowing for international collaboration and exchange programmes for students and faculty. TSI utilizes an e-environment that provides access to important information, and all students are required to undergo certification before completing their final project. TSI has implemented a quality management system based on the ISO9001:2015 standard, with publicly available documents outlining the general principles and objectives. The management of study programmes is carried out by the Study Direction Councils, which involve students in the design and annual assessment of study programmes. TSI is a financially stable private higher education institution that offers well-equipped facilities and resources for its study programmes, particularly in the field of engineering. TSI has managed to differentiate its revenue flows by attracting local and foreign students, developing new programmes, delivering specialized courses for industry, running joint projects with industry partners, managing patent portfolios, and actively participating in joint research projects. TSI's collaboration with UWE Bristol has strengthened study fields with new modern specialization sub-programmes, such as Data Analytics and Artificial Intelligence, Aviation Management, and Artificial Intelligence. The study field and programmes at the Transport and Telecommunication Institute (TSI) have commendable aims for research, including impactful applied research, internationally-recognized staff, and multi-disciplinary research clusters. TSI has a system for attracting qualified students from abroad and has established a comprehensive network of partner universities in Europe. The study field and study programmes at TSI have undergone a previous evaluation in 2013, with additional recommendations for the study programme "Robotics" during a licensing procedure. TSI has fully implemented most of the recommendations, including attracting foreign academic staff, strengthening admission requirements and providing opportunities for students to study separate modules/subjects and receive practical training.

However, the group also identified weaknesses, such as a limited level of ERASMUS activity, a significant overlap of course material between study programmes, a reliance on other sources of funding, a lack of support services available to students, and unclear information on the website and promotional materials the experts found that informal student and employer feedback seemed to work more efficiently than formal surveys, and the role of research work in increasing the Quality Management efficiency was undefined. There is room for improvement in providing access to online sources like Coursera and IEEE, and ensuring a balanced workload for academic staff with multiple courses and administrative roles. Research impact and visibility of TSI's academic staff are under expectations, with fair H-indexes and fair dissemination efforts. The integration of own research results in teaching is also questionable, and modernization of the curriculum and content is needed. TSI has strong connections with international and national partners, but student involvement in research projects and mobility opportunities is limited. TSI's efforts to attract foreign staff have been limited due to non-competitive salaries. While TSI has made progress in attracting foreign students, it still faces challenges in attracting students from non-post-Soviet states, limiting the diversity of the student body. Additionally, TSI's cooperation with the UK is limited to research supervision and may lead to miscommunication with prospective students seeking full academic programmes. TSI has partially implemented the recommendation to widen publishing in international journals with

high-impact factors, and the recommendation to stimulate scientific research activities in the field of robotics has been fully implemented. TSI has a fair outgoing student mobility rate but is implementing solutions to popularize blended intensive programmes (BIP) to address this issue.

In conclusion, the expert group's assessment found that the Transport and Telecommunication Institute (TSI) offers education programmes in the study field with a strong emphasis on academic excellence, industry collaboration, and research infrastructure. While there are weaknesses to address, such as limited student involvement in research projects and mobility opportunities, TSI has made progress in implementing previous recommendations and is financially stable, well-equipped, and has partnerships with universities and research institutions around the world. TSI needs to further improve research impact and visibility, modernize the curriculum, and attract a more diverse student body. Overall, TSI's strengths outweigh its weaknesses, and the institute has commendable aims for research and education in its fields of focus.

I - Assessment of the Study Field

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1.1 Management of the Study Field

Analysis

1.1.1.
The study field aims to prepare highly qualified specialists in the field of information technologies, computer science, electronics, telecommunications, and robotics with the fundamental knowledge and practical skills that would enable them to independently or in a team implement the development, operation, diagnostics, analysis, and optimization of computer systems, electronic and telecommunications systems, robotic/automated systems, as well as to prepare students for further studies in higher-level programmes, scientific activity, and further self-education (Self-assessment report (SAR), pp. 19). The tasks of the study field are also clearly defined, which include providing students with the fundamental knowledge and practical skills necessary for the profession, developing students' systematic and critical thinking, promoting self-education, developing and providing opportunities for students to realize themselves in research, innovation, and project activity, fostering cooperation between students, industry, academic and scientific environment, and providing students with a friendly, modern, multicultural, and encouraging environment for studies, research, and self-education (SAR, pp. 19).
The study field and the relevant study programmes comply with the main directions of the strategic development of the TSI and meet the needs and development trends of society and the national economy (e.g. RIS3). The aims of the study field are aligned with the strategic development directions set out in the TSI Strategy 2000-2025, which include international involvement, education, research and knowledge transfer, involvement of business and community, personnel, and the objectives to be achieved in each direction. The study programmes in the study field are subordinated to the objectives of the study field, forming a unified system framework, while reflecting the specificities of each study programme. The SAR report does not provide conclusive evidence regarding the field's recognition beyond the national borders.
The interconnection of the study programmes included in the study field is clear and logical. The SAR provides information about the mechanism for cooperation between teaching staff, which promotes the development and interconnection of study courses. The development of study courses is carried out on a regular basis, based on suggestions made by students, industry development trends, and the latest results of research, scientific activities, and innovations. During the implementation of study courses and scientific work, regular meetings of teaching staff are held to exchange experience on study course topics, results of scientific work, new developments in

research, etc. Discussions are used to develop and improve the content of studies, with mutual agreement on topics, emphases, responsibilities, and compliance with regulatory requirements. The knowledge acquired in other study courses is taken into account in the design or development of the content of the study courses, indicating it as a prerequisite. This ensures that the topics covered in the study programmes are continuously developed and updated in close cooperation with each other. For example, assoc. Prof. A.Krainyukov in cooperation with TERC engineer I.Laksa teaches the study courses Sensors for Robotic Devices, Metrology and Fundamentals of Electrical Measurements, Power Electronics Devices and Intelligent Robots. Another example, prof. A.Grakovskis in cooperation with TERC engineer I.Laksa lectures the study courses Electrical Circuit Theory and Electrical Machines in Robotics. This shows that the study programmes included in the study field are interconnected and developed in a logical manner.

1.1.2

TSI has identified and analyzed the strengths, weaknesses, opportunities, and threats of the study field and integrated them into development planning documents. The SAR provides information about the annual self-assessment of the study fields and programmes, which includes an evaluation of the SWOT analysis of the study field. The SWOT analysis is used to develop proposals for the improvement of the study field and its programmes. The SAR also provides information on how TSI expects to eliminate/improve weaknesses, prevent threats, avail themselves of the given opportunities, etc. For example, TSI plans to attract more representatives of the industry who are interested in academic activity, directly using the cooperation partner companies, to create a talent recognition strategy for attracting Master and Doctoral level students, and to attract foreign lecturers through ERASMUS+ exchange programme, EU-level projects. TSI should review and revise the information provided on its website and in promotional materials to ensure that it accurately reflects the nature of the educational programmes offered.

1.1.3

The management structure of the study field and the corresponding study programmes is oriented towards the development of the study field, and decision-making takes place efficiently. The SAR provides information about the structure of the management of the study field and the relevant study programmes, which involve the faculty responsible for the management of the study field, the institutions included in the TSI structure participating in the management of the TSI study fields, and the collegial bodies, such as the Faculty Council and the Senate, evaluating the efficiency of performance of the study programme directors and the heads of the study fields. The head of the study field is responsible for ensuring the review and evaluation of the study field and its development planning, external evaluation of the study field, as well as the promotion of cooperation between the directors of the study programmes implemented within the study field and the academic staff. The programmes included in the study field are managed by the directors of study programmes, who are responsible for managing the study process, development and updating of the study programme, development of documentation and methodological guidelines for the final exams, updating the study courses descriptions, preparation of the annual SAR of the study programmes, participating in the evaluation and comparison of the relevance of the scope and content of the course of study acquired in another programme or educational institution, and participating in advertising campaigns. The study programmes at TSI exhibit a significant overlap in the course material, which can pose challenges in introducing and distinguishing specializations effectively.

1.1.4

A system has been set up and procedures developed for the admission of students, for the recognition of the study period, professional experience, prior formal and non-formal education, and for the assessment of students' achievements and learning outcomes. The admission rules for the specific academic year are published on the TSI website in Latvian and English and are available to everyone. The admission rules have been developed and admission proceeds in accordance with

external laws and regulations, such as the Law on Higher Education Institutions, Cabinet Regulation No. 846 of 10 October 2006 “Regulations Regarding the Requirements, Criteria and Procedures for Admission to Study Programmes” (hereinafter - CR No. 846). The admission terms and procedure for citizens and non-citizens of the Republic of Latvia as well as foreigners holding a permanent residence permit in Latvia are determined in accordance with the general procedure and Paragraph 7 of CR No. 846. The admission requirements for foreign applicants have been agreed upon, including a test in English, Physics, and Mathematics. The Admission Department offers prospective students consultations on the admission process, including admission requirements, contesting admission results, rights, and obligations of the applicants. The heads of the study programmes provide consultations on admission requirements, entrance examinations, and their specifics, ensuring that applicants are fully informed and prepared for admission to TSI. TSI ensures fair recognition of previous education and professional experience so that applicants can apply for studies at later stages. Therefore, based on the information provided, it can be concluded that the system and procedures for the admission of students, recognition of prior education and professional experience, and assessment of students' achievements and learning outcomes are logical and effective, and the involved stakeholders are informed about the system.

1.1.5

The methods, principles, and procedures for assessing the achievements of students have been developed and are clearly defined. The report provides information about the criteria, conditions, and procedures for the evaluation of students' results, which enable reassurance of the achievement of the intended learning outcomes. The assessment methods and criteria of learning outcomes are included in the course description and are available to students in the e-learning system. The assessment criteria and methods for final examinations are included in the Methodological Guidelines for Writing Graduation Theses as well as in the Regulations for the Award of Academic Bachelor's and Master's Degrees and Regulations for the Award of Professional Bachelor's Degree, Professional Master's Degree, and Professional Qualifications. The criteria for evaluating the study results of the doctoral programme are described in the Regulations on Doctoral Studies, and the procedure for awarding the Doctoral Degree - in the Regulations on the Procedure and Criteria for Awarding the Scientific Doctoral Degree (Doctoral Dissertation). Learning outcomes achieved in prior education or professional experience are recognized in accordance with the TSI Regulations on the Evaluation and Recognition of Prior Learning and Professional Experience. The SAR also provides information about the assessment methodology developed by the lecturers of each course, which indicates the percentage of the total mark that each assessment criterion represents. The lecturers use assignments that give the student the opportunity to test themselves and receive feedback. A large number of lecturers use an assessment method based on performance assessment rubrics or rating scales. This approach ensures that students understand at the outset how a particular piece of work will be assessed and also allows the lecturer to increase the effectiveness of the assessment, as the student receives not only a mark but also feedback on each criterion. The same approach to assessing learning outcomes is also used in distance learning. The methods used in the study programme contribute to the achievement of the objectives and learning outcomes of the courses and the programme, ensure student-centred learning, encourage students to take an active part in shaping the learning process and ensure that students' performance is appropriately assessed.

The relevance of assessment methods and procedures for achieving the aims of study programmes and the needs of students is analyzed. The SAR provides information about the assessment methods and criteria of learning outcomes, which are included in the course description and available to students in the e-learning system provided during the visits. The lecturers inform students about the knowledge assessment criteria and methods during the first class. The assessment methods used in the study programme contribute to achieving the objectives and learning outcomes of the courses and the programme, ensure student-centred learning, encourage students to take an active part in

shaping the learning process, and ensure that students' performance is appropriately assessed. The choice of assessment methods depends on the learning outcomes that a lecturer is planning to achieve. The applied methods are geared to the development of the student's abilities, specifically, to learning, creative use of knowledge, cooperation, self-evaluation, offering of alternative solutions to problems, critical thinking and making responsible decisions. The assessment methodology developed by the lecturer of each course indicates the percentage of each assessment criterion in the composition of the total mark. Learning outcomes achieved in prior education or professional experience are recognized in accordance with the TSI Regulations on the Evaluation and Recognition of Prior Learning and Professional Experience. Although TSI's study programmes feature various specializations designed to cater to the diverse interests of students, the quality and successful implementation of these specializations remain uncertain due to the limited number of students enrolled. This raises concerns about whether the specializations are effectively meeting students' needs and expectations and highlights the need for further evaluation and potential improvements. The substantial overlap in course material across various study programmes at TSI poses challenges in effectively introducing and differentiating specializations. The limited level of ERASMUS activity at TSI highlights an area needing improvement and increased attention. A need exists to enhance student engagement and implement unified criteria in surveys across courses at TSI. A considerable number of students at TSI work alongside their studies to finance their education, which may negatively affect their academic performance. The study programme Robotics is currently only offered at the undergraduate level.

1.1.6

TSI has established the principles of academic integrity and mechanisms for their observance, effective anti-plagiarism tools that promote the development of the internal culture of TSI, are applied, and the stakeholders involved are informed about it. TSI has developed the Code of Ethics, which defines the basic principles of ethics and conduct for administrative, scientific, and research staff, as well as students, creating a favourable, respectful, and responsible working environment at TSI. The Code of Ethics includes core principles and standards of conduct to be complied with by students and employees in their attitude to the Institute, their work, and in relations with their colleagues, clients, and business partners. The TSI Code of Ethics defines basic ethical principles for students, including honesty, justice, responsibility, loyalty, respect, and collegiality. TSI has also established the Ethical Commission, which assesses complaints regarding a failure to comply with the core principles of professional ethics and conduct. TSI introduces students to the principles of academic integrity and adherence thereto during their studies and any sanctions for non-compliance with these principles from the beginning of the study process in the first introductory lecture. TSI also introduces their employees to the Code of Ethics, and employees confirm becoming acquainted with the Code with their signature. The Code of Ethics of TSI is available to all students, employees, as well as the public on the TSI webpage. This financial vulnerability underscores the importance of diversifying income streams to ensure a more stable and robust financial foundation for the institution.

TSI acts in accordance with the principles and rules of good faith and responsible conduct described in the TSI Plagiarism Control Regulations. The regulations set out the procedures for identifying plagiarism in the papers of TSI students, including self-plagiarism, and the criteria for the identification of violation and the applicable sanctions. TSI uses Turnitin®, the world's leading tool for correcting papers and preventing plagiarism, which is integrated into the TSI e-learning system Moodle and provides a full service for submitting, correcting, determining the originality (plagiarism) of content, and returning submitted papers. TSI also checks other papers for plagiarism, including all study course papers, written examinations of study courses, and specific tests of study courses.

Conclusions on this set of criteria, by specifying strengths and weaknesses

TSI offers education programmes in the study field, with a strong emphasis on academic excellence, industry collaboration, and research infrastructure. Taught by faculty members and supported by a research environment, TSI ensures that students receive a comprehensive education. However, experts found areas for further improvement which will be analyzed in more detail within the scope of this opinion.

Strengths:
1. The study field has clear aims and objectives that are aligned with the scope of activities of TSI, the strategic development fields, as well as the development needs of the society and the national economy.
2. The institute has partnerships with several universities and research institutions around the world, allowing for international collaboration and exchange programmes for students and faculty.
3. The study field attracts representatives of the industry who are interested in academic activity, directly using the cooperation partner companies, to strengthen the composition of the academic staff in the areas of the study programmes. The study field integrates these areas of work, creating continuity between them. This approach strengthens the innovation capacity of the national economy by establishing mutually beneficial partnerships between academic and non-academic stakeholders.
4. Management of TSI study conducts an annual self-assessment of all study fields and programmes, which includes the SWOT analysis. The SWOT analysis is used to develop proposals for the improvement of the Field of Study and its programmes.
5. TSI utilizes an e-environment that provides access to important information, such as programme requirements, lists of tasks and deadlines, as well as assessments. This approach makes information easily accessible and conveniently visible, which promotes better understanding and reduces unnecessary confusion and ambiguity.
6. All students are required to undergo certification before completing their final project. This means that projects are initially evaluated, which helps to ensure that the quality of the work is high. Certification provides an opportunity for students to receive feedback from their supervisors, peers, and other relevant stakeholders. This feedback can help students improve the quality of their work, identify areas where they need to focus, and ultimately produce a higher-quality final project.

Weaknesses:
1. While TSI offers a range of specializations within its study programmes to accommodate students' diverse interests and career aspirations, the limited number of students participating in these specialized tracks raises concerns about their quality and effectiveness. The small student population within these specializations could make it challenging to gauge whether the courses are appropriately designed, structured, and delivered to meet the needs of the students, as well as the industry demands. With a limited number of students, it could also be challenging to measure the success of these specializations in terms of student satisfaction, academic performance, and employment outcomes. Consequently, this could hinder the institution's ability to make data-driven decisions to refine and improve the curriculum, teaching methods, and support systems in place for these specialized tracks.
2. There is a significant overlap of course material between study programmes at TSI, which can create challenges in effectively introducing and distinguishing specializations. When a large portion of the curriculum is similar across various study programmes, it could become difficult for students to identify and appreciate the unique aspects and benefits of each specialization. This can also lead to confusion about the specific focus, objectives, and outcomes of each specialized track, making it harder for students to make informed decisions about their educational and career paths.
3. There is a limited level of ERASMUS activity, which is an area that requires attention and improvement. ERASMUS is a valuable programme that allows students to gain international

experience, develop cultural awareness, and expand their networks. By not promoting ERASMUS activities effectively, the institution could be limiting the opportunities available to its students and potentially missing out on opportunities for collaboration with other institutions.
4. There is a necessity to bolster student engagement and advocate for the adoption of consistent criteria in surveys across courses. While the faculty considers individual suggestions, the lack of a unified survey system can make it difficult to assess and compare the performance of courses and faculty members.
5. Only 5% of its income is generated through projects. This means that there is a significant reliance on other sources of funding, which can create budgetary instability and limit the institution's ability to invest in its programmes and facilities.
6. Many students are employees alongside their studies to secure funding for their studies, which can have a negative impact on their academic performance. Working while studying can lead to fatigue, stress, and limited time for studying and completing assignments, which can ultimately impact a student's grades and academic performance.
7. Inaccurate or unclear information on the website and promotional materials could potentially mislead prospective students and cause confusion about the nature of the programmes offered. This may result in missed opportunities to attract students who are interested in the specific type of education TSI provides, as well as potentially damaging the institution's reputation among potential partners and other stakeholders.

1.2. Efficiency of the Internal Quality Assurance System

Analysis

1.2.1
TSI has implemented ISO9001:2015 Quality Management System which is certified at the institution. There were roughly 2300 HEIs in the world in 2022 (https://www.manilatimes.net/2022/05/12/campus-press/world-ranking-and-iso-certification/1843324) that have this ISO9001 certificate which sets out the requirements for a quality management system allowing the institution to demonstrate its ability to consistently provide education and related services that meet customer and applicable statutory and regulatory requirements. This aims to enhance students, employers and staff satisfaction through the effective application of the system, including processes for improvement of the system (https://www.iso.org/standard/46486.html). ISO9001 defines a set of regulatory documents and procedures required for ensuring the educational quality of the study process and the high level of skills and knowledge of the graduates. The documents ‘TSI Strategy 2020-2025’ and ‘Quality Handbook D-QM v.5.’ and ‘TSI Quality Policy’ outlines the general principles for the quality policy and managerial principles as well as strategic objectives and target groups – students, employers and partners. Therefore these documents assure conformity to the students and employers, i.e., society's needs and requirements. The TSI Strategy 2020-2025 and Quality Handbook and Quality Policy are publicly available on the TSI internet site (https://tsi.lv/about-us/official-documents/). During the TSI site visit and meetings with the students, experts noticed that not all the students were aware of the availability of these documents and their content. Therefore yearly QMS introduction seminars would be advised to organize.
TSI Quality Handbook sets composition and indices of quality management processes and the processes fall into three groups: Educational service cycle processes; Human, material and information resource management processes; General management processes implemented by the Rectorate to ensure continuous improvement of quality and efficiency of the management system. The processes are described in detail in the TSI Quality Handbook. The list of quality management system documents includes P11-P34 processes related to relevant detailed guidance documents. The Quality Policy document and TSI Quality Handbook specify Internal and External Quality Audit

procedures, which guarantee the implementation of the quality policy of TSI. The internal quality audit and assurance includes continuous monitoring of all specialist training processes and analysis of potential deviations and implementation of the principle of continuous improvement of the quality management system of education services and specialist training. The external quality audit and assurance includes the periodic monitoring provided by the well-known international certification organization TUV Rheinland and regular internal audits of the TSI quality management system.
The document 'Development Plan of the Field of Study "Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management and Computer Science" 2021-2026' is based on the TSI Quality Policy and TSI Strategy 2020-2025 and the Development Plan specifies the development areas of the study field and the specific activities that will be carried out. The essential is to mention that activities in this document are presented together with the expected and measurable results, which make it possible to assess the progress of the activities and to take respective steps if needed.
The guiding documents are available to the academic staff and students in the Normative Document Database (in LOTUS) and on the TSI website (https://tsi.lv/about-us/official-documents/).
The found deficiencies and the taken corrective measures during the internal quality audit are recorded in the Register of Nonconformities. Based on the results of the audits, the activities of the Council of the Study Field are improved and the content of study course materials is adjusted(SAR p.38).
Experts noticed in the meetings with the students and staff that informal communication between the students and teachers is also active and helps sometimes even more efficiently to react and correct some problems in the study process, for instance, to add some lecture topic into a course or to modify some practical exercise to gain more up to date knowledge.
The periodic surveys of students, employers and alumni take place in accordance with the document 'Regulation on Surveys of Students, Alumni and Employers' once per year, which should be considered a little bit slow feedback system and student surveys should be an organized after each semester twice per year to reach faster to develop corrective work plans.

1.2.2
TSI has introduced a set of documents to specify the requirements for development and reviewing the study programmes: Regulation on Management of Study Directions and Study Programmes and Regulation on Management of Study Courses.
The management of the design and implementation of Study Programmes is carried out by the Study Direction Councils (SDC) which is organized by the Dean of the Faculty and Head of the Study Field. TSI students are involved in designing study programmes, annual assessments and programme improvement by acting in the Study Direction Council, Faculty Council, Senate Commissions, and Senate via filling out the survey.
The questionnaires and the surveying process is regulated in detail in the document 'Regulations for Organizing Surveys of Students, Graduates and Employers'. The document also determines the responsible persons for each surveying step and respective actions according to the analysis and results of the survey. The whole process of implementation and efficiency of the study programme is monitored and supervised by the director of the study programme by assessing the study process.
There is a significant overlap of course material between study programmes "Management of Information Systems", and "Computer Science" at TSI, which can create challenges in effectively introducing and distinguishing specializations. It is understandable if the theoretical part of common courses and topics overlaps as the programmes are all focused on different ICT topics but on the other hand, the practical part, examples and homework should focus on the specific aspects and applications of each specialization. Therefore it would be advised to specify clearly and in sequence each programme specifics through the practical part of the courses and define respective programme characteristic skills acquired by these practical tasks.

The design, approval and implementation of the study programme are divided into 7 steps. All the steps are described in detail in the Quality Handbook and Quality Policy documents and in the current SAR (p39-40). All the respective steps and activities needed for the improvement of the study field are approved by the Senate of the Institute. The contribution of research work towards enhancing the efficiency of Quality Management is not clearly established.
It is essential to mention that an annual SAR which is prepared by the Programme Directors and the Head of the Study Field for the study programmes and study field is discussed and approved by the Senate. The annual SAR contains results of regular surveys, the procedures of which are described in the document Regulations for Organizing Surveys of Students, Graduates and Employers. The experts noticed during the visit that all the students, graduates and employers met were aware of and participated in filling out these surveys though the general percentage of filling the surveys by the students is rather low (in the range of one-third of students as reported on the TSI management meeting. It could not be noted how the Student Council is involved in the improvement of these surveys. On the other hand, the graduates and employers were very active and interested in giving regular and operative feedback to the academic staff during the study process. The essentiality and smoothness of the informal communication were stressed from the side of all the stakeholders - TSI management and students, teaching personnel and employers. This kind of informal and effective communication got positive credit from all. This fact leads to the idea to enhance the current TSI feedback system through formal annual surveys with the positive aspects of the informal feedback and more involvement of the students in improving the questionnaire's feedback system.
As an example of how a new programme was developed and implemented in TSI the new study programme “Robotics” development and introduction process is described in the SAR, which conforms fully to the regulations stated in the TSI documents (Plan for the development of the study field, Regulation on Management of Study Directions and Study Programmes and Regulation on Management of Study Courses) and State regulations. The adequacy of the development and implementation of the new programme is proven by the success of the programme from the side of the admission number and students' and employers' satisfaction expressed during the visit discussions.

1.2.3
The Quality Management System of TSI for Student Complaints and Proposals is based on the customer orientation principle and is oriented to improve the whole management and teaching process at TSI. Students have information on their right to submit complaints and suggestions to address problems in the TSI study process. The TSI Quality Management System ensures competent and neutral analysis of student complaints and is needed to involve independent experts in the review process.
Procedures for submitting and considering complaints and proposals are described in detail in the document Regulations for the Admission and Examination of Student Complaints and Proposals, which is available on the TSI internet page (https://tsi.lv/about-us/official-documents/). The document states requirements for filing and reviewing appeals and additional procedures are prescribed in the document Rules of Study Procedure.
According to the internal procedure, students may submit complaints and recommendations to the TSI Study Department, which ensures that complaints and recommendations are registered and forwarded to the responsible department and official in accordance with the document Procedure for the Acceptance and Examination of Requests.
The essential fact is that complaints and recommendations received by the Study Department are registered in the Register of Applications in the section of Complaints and Recommendations. The result of the complaint and decision is submitted later into the same register. The decision about the complaint and decision is taken within 7 business days and the students will get the respective feedback.

Continuous improvement of quality management is achieved through periodic analysis of the registered complaints and recommendations by the Quality Department staff. The complaints indicating significant deficiencies in the quality assurance system are recorded in the register of non-conformities. The development and implementation of corrective actions in the teaching process and study programmes are organized by the Head of the Study Programme and the Director of the Study Field.
All the freshman students are introduced to the document related to the Student Complaints and Proposals submission and processing rules during the Welcome Week and the availability of the documents on the TSI internet pages. Links to the respective materials with explanations and documents are permanently available to students in the e-learning environment.
The experts noticed during the interviews of the students and graduates that all the students were aware of the procedures and how to submit the complaints and respective documents. It is essential to mention that no substantial complaints were noticed by the experts and smooth communication between the students and teachers and Heads of the Study Programmes were noticed.
The TSI Quality Management System for Student Complaints and Proposals works well which is proven by the students and teaching during the onsite discussions. Despite that, the students mentioned an informal and more personal way for proposals they are using too in communicating with the teachers which is sometimes even faster and more effective.

1.2.4
TSI administration periodically collects the following information and data: the number of applications received and matriculated students in the 1st year and senior years by study programme, the language of instruction and home country. Based on the admission results, the data are analyzed and changes are made in the marketing activities of the study programmes. The total number of students and their status (active, inactive), by the language of instruction, study programme, study level, study form and types; the number of graduates; dropouts are reviewed at meetings of academic staff and employers and presented in yearly SAR.
Analysis of the results of questionnaires on the satisfaction of students and graduates with the implementation of the study programme (content, quality of lecturers' work, objectivity of the evaluation system, availability of the information, career opportunities); analysis of the employability is discussed at the meetings of the academic staff and included in SAR. Student performance indicators are monitored at the faculty level according to the session results and these data are collected once per semester. These statistics are used to specify the problems and need for possible corrections in the study course content.
The procedure for organizing the surveys is described in the document 'Rules for Organizing Surveys for Students, Graduates and Employers'. The students' survey in electronic format with further analysis of the survey data is organized in TSI once per year at the beginning of the spring semester. The survey focuses on the student's satisfaction with the studies and programme and with the study courses' content and balances with the lectures and practices and course works. In this sense, the previous assessment comments were taken into account where students wanted more practice.
Special attention is given to foreign students, especially at the beginning of their studies conducting a survey to find out the satisfaction of the foreign students matriculated in the 1st year with the services of the agents used and the work of the TSI admission commission.
A survey to receive the employers' opinions on the preparation of TSI graduates is organized at least once every two years and the results are reviewed during the Rectorate, Faculty Council, and Study Field Council meetings and presented in the annual SAR. Thus, the study programme with the study courses is updated every year according to the students' and employers' feedback.
It is still questioning the role of the Student Council in conducting, analyzing and improving the annual surveys to get even more adequate and operative results. Students receive information only during a specially organized general meeting. On the other hand, the automatic system for

registering the participation of the students from the lectures and sending reminders by the programme management immediately after noticing a student disappearance or low participation from the study process. There is still some confusion with the dropout rate calculation as many students study more than the nominal study programme duration, which is understandable on one hand as most of the students work in parallel but the calculation should be regulated for the statistics and efficiency assessment.

1.2.5
TSI website (https://tsi.lv) contains a lot of information about the Institute, programmes and regulatory documents in Latvian and English. There is the name of the programme, degree/qualification that will be obtained, programme content as in credit points, type and form of studies, study language, programme director and respective contact information, admission requirements, programme annotation, learning outcomes, career areas, study courses, tuition fee, graduate references. Experts noticed during the visit that students were satisfied with the information available on the institution's website as well as in the e-learning platform. More information about the programmes in the Latvian and English languages is given on the site https://tsi.lv/lv/study_programmes/. There is also Erasmus+ and guest lectures information available for the students and what should be essential separate information for the alumni (alumni event, alumni association and options for participating in the TSI life).
The study programme information on the website of TSI is managed by the Director of each study programme. The information consistency is monitored by the Academic Quality Department. The Department is responsible for updating the information in the official registers (VIIS (State Educational Information System) and E-platform) and the information is up-to-date. The Research Administration Department administers and updates the information in the National Information System on Scientific Activities (sciencelatvia.lv).

Conclusions on this set of criteria, by specifying strengths and weaknesses

TSI has implemented and run ISO9001:2015 Quality Management System which is certified at the institution.
Experts noticed in the meetings with the students and staff that informal communication between the students and teachers is also active in parallel with the QMS-defined feedback system and helps sometimes even more efficiently to react and correct some problems in the study process, for instance, to add some lecture topic into a course or to modify some practical exercise to gain more up to date knowledge. There is a significant overlap of course material between study programmes "Management of Information Systems", and "Computer Science". The practical part, examples and homework of each course should focus on each specialisation's specific aspects and applications. Therefore it would be advised to specify clearly each programme's specifics through the practical part of the courses. Informal student and employer feedback seems to be working more efficiently and formal surveys are filling only one-third of the students therefore some actions should be taken to increase the number of students giving feedback, maybe combining somehow the formal and informal feedback systems. There is still some confusion with the dropout rate calculation as many students study more than the nominal study programme duration, which is understandable on one hand as most of the students work in parallel but the analysis should be regulated for the statistics and efficiency assessment.

Strengths
1. TSI has implemented the ISO9001:2015 Quality Management System and the institution is certified according to ISO9001.
2. Quality Handbook is developed and periodically updated and the TSI Quality Policy document is

introduced and both of the documents are publicly available on the TSI website.
3. Full set of Quality management documents is developed at TSI and the list of all the documents is compiled and available in the TSI electronic document system (SAR Annex 2. TSI internal regulation list).
4. ISO9001 system assumes periodic internal audits performed by the Quality Department of TSI.
5. The academic staff is aware of the system and respective documents. It follows the rules set in the documents conducting the study, developing new courses, analyzing the study process and collecting feedback from the students and employers.

Weaknesses
1. Student council is weakly involved in developing and running the surveys.
2. The Quality Handbook sets the general rules for collecting the feedback data and running the surveys for the study process stakeholders but a clearly structured strategy for reducing the student dropout rate and increasing the admission is unavailable.
3. The role of research work in increasing Quality Management efficiency is undefined.

Assessment of the requirement [1]

1 R1 - Pursuant to Section 5, Paragraph 2.1 of the Law on Higher Education Institutions, the higher education institution/ college shall ensure continuous improvement, development, and efficient performance of the study field whilst implementing its internal quality assurance system:

Assessment of compliance: Fully compliant

Justified in Quality Handbook and Quality Policy documents and specified in more detail in SAR (p.36-38). In addition the ISO 9001:2015 standard implemented at TSI and periodically audited by the external organization sets the requirements for continuous improvement of the study field quality system and assurance of the efficient performance for the system.

2 1.1 - The higher education institution/ college has established a policy and procedures for assuring the quality of higher education.

Assessment of compliance: Fully compliant

Justified in Quality Handbook and Quality Policy documents

3 1.2 - A mechanism for the development and internal approval of the study programmes of the higher education institution/ college, as well as the supervision of their performance and periodic inspection thereof has been developed.

Assessment of compliance: Fully compliant

Justified in Quality Handbook and Quality Policy and Regulation on Management of Study Directions and Study Programmes and Regulations for Organizing Surveys of Students, Graduates and Employers documents.
here is a significant overlap of course material between study programmes "Management of Information Systems","Computer Science". The practical part, examples and homeworks of each course should focus on the specific aspects and applications of each specialization. Therefore it would be advised to specify clearly each programme specifics through the practical part of the courses.

4 1.3 - The criteria, conditions, and procedures for the evaluation of students' results, which enable reassurance of the achievement of the intended learning outcomes, have been developed and published.

Assessment of compliance: Fully compliant

Justified in Quality Handbook and Policy and Regulation on Management of Study Directions and Study Programme documents

5 1.4 - Internal procedures and mechanisms for assuring the qualifications of the academic staff and the work quality have been developed.

Assessment of compliance: Fully compliant

Justified in Quality Handbook and Regulation on Management of Study Directions and Study Programmes documents

6 1.5 - The higher education institution/ college ensures the collection and analysis of the information on the study achievements of the students, employment of the graduates, satisfaction of the students with the study programme, efficiency of the work of the academic staff, the study funds available and the disbursements thereof, as well as the key performance indicators of the higher education institution/ college.

Assessment of compliance: Fully compliant

Justified in Quality Handbook and Regulation on Management of Study Directions and Study Programmes and Regulations for Organizing Surveys of Students, Graduates and Employers. It is advised to make student surveys twice a year at the end of each semester.

7 1.6 - The higher education institution/ college ensures continuous improvement, development, and efficient performance of the study field whilst implementing its quality assurance systems.

Assessment of compliance: Fully compliant

Justified in Quality Handbook and Regulation on Management of Study Direction documents

1.3. Resources and Provision of the Study Field

Analysis

1.3.1.

TSI is a higher education institution with private capital, which operates as a joint stock company. Financial stability is one of the key focuses and therefore TSI has implemented governance, budgeting principles and controls across the organization.

TSI managed to differentiate revenue flows by attracting local and foreign students, developing new programmes, developing and delivering specialized courses for industry (https://tsi.lv/business/employee-training/), running joint projects with industry partners, managing patent portfolios and actively participating in joint research projects. Up to 95-98% of the total revenue comes from own-driven activities and the rest 2-5% (vary between years) from projects with Latvian and European fundings (based on SAR 2.3.1 section of study field).

The largest part of revenue comes from students' tuition fees making this a key risk and at the same time an opportunity for further growth. Latvia continuously experiences a decrease in new students, and this has an impact also on TSI. Besides the overall decrease in students, the global pandemic in recent years had another negative impact on attracting new students. TSI has managed this challenge by optimizing investment programmes and making bachelor and master programmes more attractive for potential students (i.e. new double degree programmes with the University of the West of England (Bristol, Great Britain; hereinafter - UWE Bristol) and academic Computer science master degree programme for people without a bachelor degree in computer science). As a result of these activities, TSI managed to keep a stable number of students within a range of 5-6 years (as a cumulative number of students in all engineering programmes).

The engineering faculty that owns and develops submitted programmes are established as the Financial Accountability Center. This enables the management of revenues and costs including

short- and long-term investments into the sustainability of faculty and further development. Faculty has defined clear objectives within TSI 2020-2025 strategy (https://tsi.lv/wp-content/uploads/2020/07/TSI-Strategy-2020-2025.pdf) that correlates with new programme development and investment in the research field.
Such investments support the research field in various aspects. TSI has increased the number of specialized laboratories to 11 and 7 additional ones. These laboratories ensure capabilities to get practical experience with fundamental principles (like physics, mechanics, and electronics) and more complex devices (like mobile and industrial robots). TSI runs the programme of supporting academic staff in research activities (incl. publications in journals, participation and organization of conferences, etc.) and sponsors doctoral research by providing grants to PhD students. TSI is organizing the annual Research and Academic Conference "Research and Technology – Step into the Future" to strengthen and support research activities of bachelor, master, and doctoral students, academic staff and research projects like iDEAHUB (https://tsi.lv/the-annual-conference-ratsif-2022-was-held/).

1.3.2.
TSI has a significant volume of premises to host lectures and laboratories for their students including 12 lecture halls and 10 computer classes. Higher education institution has established specialized laboratories of Physics and Electrical Machines, Modeling of Electronic Systems, Embedded Systems and Digital Signal Processing, Industrial Automation, Subsurface Radiolocation, Robotics and Students' Research Work, Designing And Prototyping, Telecommunications and Electro-Optical Systems, Electronics, Mobile and Industrial Robots. Laboratories are available for students on top of schedule during, but work days (Monday - Friday). During the visit, experts observed that safety regulations printed out in laboratories are only in the Latvian language. This prompts a safety risk because programmes are implemented in the English language with foreign students and while they might already know safety rules (read them online etc.), it would be a good practice to have them printed out in English in the laboratories.
IT infrastructure, hardware and software equipment does cover the needs of remote and on-premise delivery of courses for electronics, computer science and other study programmes. Study programme directors on an annual basis review existing and needed equipment and submit requests to the faculty dean, who combines and prioritizes requested items together with requesters and considers this for budgeting.
TSI has also established additional facilities like a gym, and collaboration spaces to support students' well-being and promote collaborative activities.

1.3.3.
TSI has built a library for students and academic personnel. The library consists of two parts – physical (including printed materials and reading rooms) and electronic (rooms and computers, access to Academic Complete, Science Direct, Scopus and other sources). Both libraries are supported by an electronic catalogue so students can find necessary articles or books. The library can be used 6 days a week (Mon-Sat). Students can use available materials in the library or take them home. TSI maintains statistics on library usage. The library provides access to specialized IEEE sources but in a limited volume (only named items are available). TSI has provided access to the Coursera platform to students of academic study programmes, but due to budget limitations, the platform is not available to all students. On an annual basis, physical and electronic libraries are being extended with new books and materials. This is done by the bottom-up approach – by requesting needs from teachers and combining them on the study field and faculty level. The fundamental needs of the study field programmes are fulfilled with necessary libraries.

1.3.4.

TSI is using multiple channels and information systems to keep students informed about the latest news, provide necessary information about subjects (like the schedule), ensure communication between students and teaching staff and receive requests or feedback back from students. These include a public web page (https://tsi.lv/), mobile application (TSI schedule), intranet for authorized users (https://my.tsi.lv/) and Moodle. These systems are being maintained on a high level considering the content and frequency of updates (checked tsi. lv).
Moodle is the main IT system that supports the delivery of study programmes. Same as other higher education institutions, TSI is leveraging Moodle to:
- provide basic information about the study courses;
- ensure centralized access to tasks for independent work (incl. examples);
- self-examination tests and questions for exam preparation;
- materials for the study course (incl. lecture materials, additional reading and sources, etc.).
For remote lecture delivery TSI is using Big Blue Button - an open-source platform that supports standard functions for online classes as well as enables teachers to record sessions, and mark participation. The institution is using this data to work closely with students and send reminders to them, in case of rare participation and missed lectures.
For study programmes that require physical attendance in laboratories (i.e. electronics, mechatronics or robotics), practical lessons are delivered in classrooms. TSI has managed to mitigate the challenges of the pandemic period related to such classes delivery by implementing next practices:
- students were enabled to use simulators to complete independent tasks;
- demo sessions delivered by teachers so students can learn special equipment, and practical exercises and repeat simple tasks on their premises.
TSI has established necessary practices for the study programmes that are available for distance learning (BA in Computer Science and MA in Management of Information Systems). This includes remote lectures, practical work in remote laboratories (special equipment is not needed for these programmes), and collaboration with students and teachers.

1.3.5.
TSI promotes transparency in attracting new staff by publishing open vacancies on their homepage (https://tsi.lv/about-us/vacancies/) and CV-online portal (cv. lv). However, currently, 3 open vacancies from Tsi. lv is not available on cv. lv portal (checked on Mar 13).
Selection and election of academic staff are regulated by the formal procedure described in approved regulation (https://tsi.lv/wp-content/uploads/2022/07/nolikums-par-ak.-persona%CC%84la-ieve%CC%84le%CC%84s%CC%8Canu-apstiprinats-senata_eng.pdf).
Close collaboration with industry supports collaboration and attraction of industry specialists in the implementation of study programmes. Industry specialists are being attracted to permanent positions and to deliver guest lectures or partially deliver particular subjects. PhD students are involved in academic work and the delivery of study courses.
Academic staff involved in study programme delivery has the necessary experience and expertise to deliver related study courses (based on provided CVs and multiple positive feedback received from current and graduated students as well as representatives from the industry). TSI managed to keep top-level experts in study fields and involve them in the delivery of study courses, and research activities, supporting PhD studies and running joint projects with industry. The expertise of the academic staff has been highlighted during several meetings with current students (of bachelor, master and PhD programmes) and graduated industry specialists from various study programmes.

1.3.6.
The development of academic staff is one of the priorities of TSI within the 2020-2025 strategy. The

institution addresses this focus area through the next activities:
- systematic annual planning of methodological development of academic staff;
- assessment of the potential for professional growth and individual plan preparation;
- analysis of student's feedback on study courses and aligned academic staff by running regular surveys;
- continuously assessing and developing English language skills;
- involving academic staff in ERASMUS+ mobility (during 2021-2022 10 faculty members participate in the programme).
Methodological development plan for academic staff includes seminars, training and knowledge sharing sessions on various improvements for delivery of study courses, approaches for feedback collection and usage, critical thinking and other topics delivered by own and invited local and foreign experts.
Double degree programmes require alignment on teaching and student evaluation approaches between Latvian and UK education systems. Due to differences in these systems, TSI is collaborating with UWE Bristol, organizing educational sessions for academic staff to adjust and improve the current teaching process (i.e. The UK educational system requires more independent work by students rather than lectures in the classrooms).
TSI participates in EU-funded projects to get additional support in academic staff development and to attract foreign specialists. In 2018-2021 TSI ran a project "Strengthening the academic staff of Transport and Telecommunication Institute in the areas of strategic Specialization" and recruited 9 foreign faculty members, who were involved in content preparation (9 in total) and delivery of study courses (27 in total). Some of the attracted specialists continue working at TSI post the end of the project.
TSI has established regulations to evaluate professors and associate professors every two years (Regulations on the Election of Academic Staff and the Evaluation of their Scientific and Pedagogical Qualifications) considering research activities, survey results and other criteria.

1.3.7.
The workload of academic staff and their involvement in the delivery of study programmes overall is balanced and corresponds to expertise. Some people are responsible for multiple courses as they involve additional staff to deliver lectures and practical work (based on the description of the study courses there could be up to 3 additionally involved teaching personnel). However, there are people with a high number of study courses and some combine them with additional roles in TSI. Based on SAR Annex 11. Academic staff involved in the implementation of the study direction: Kraiņukovs Aleksandrs has 14 study courses, Radčenko Igors has 11, Mihails Savrasovs has 10 study courses and several additional roles (director of study programme Management of Information Systems, director of study field and Vice-Rector for Academic & Research). Handling such a high number (10+) of different roles may negatively impact the delivery of the courses and the well-being of the teaching staff.
TSI has established regulations for the expected workload of academic staff in teaching and other activities. This defines higher involvement (in %) of senior academic staff (like professors and associate professors) in research activities. Lecturers and assistants are more involved in the teaching and delivery of study courses. Such an approach balances new academic staff involvement in TSI internal processes and the continuous development of research directions. 21 PhD students are doing their research and being supported by the academic staff of TSI (some are on sabbatical leave).

1.3.8.
The institution provides general and specific support for all students through:
- IT system support service for access management, hardware, and IT infrastructure issues;

- Student experience and Retention department (https://tsi.lv/campus-life/students-support/) to address a wide range of generic questions;
- Foreign Student Coordinator, who is responsible for organizing work with foreign students, introducing them to higher education institutions, and cultural differences, integrating them into student and TSI life and providing continuous support throughout their studies;
- active involvement of students in TSI internal processes, student council, innovation projects under the iDEAHUB programme, and special support of other local and foreign students. TSI has
- formalized such involvement and contribution so students can earn discounts for their tuition fees;
- flexible individual approach regarding tuition fees. Institute can propose various options for tuition fee payments (grants, discounts, postponed payments, etc.);
- providing individual consultations by academic staff (this has been recognized by several current students and graduates);
- searching for internship options in local and international companies.

TSI does not have a hotel/hostel for their students. However, agreements with several nearby hotels and hostels can provide discounted accommodation for TSI students.

The Organization of People with Disabilities and their Friends Apeirons has recognized TSI as a friendly organization for people with disabilities. This was done by implementing necessary improvements in the building and study rooms.

Conclusions on this set of criteria, by specifying strengths and weaknesses

TSI is a privately owned higher education institution with major expertise and experience in study programme management including all necessary resources and teaching staff. Higher education institution runs a financially sustainable business through continuous improvements of competitiveness of the owned study programmes. TSI has equipped students and teaching staff with the necessary information systems, laboratories, special software and hardware to achieve learning objectives within a study process.

Strengths:

1. TSI has managed to keep and grow top expert-level academic staff in corresponding study fields.
2. TSI has built and continues investments in their specialized laboratories (i.e. subsurface radiolocation, industrial and mobile robots) that make them one of the top higher education institutions in engineering sciences in the Baltic region.
3. Collaboration with UWE Bristol University and opening double degree programmes have strengthened the study field with new modern specialization sub-programmes (i.e. Data analytics and artificial intelligence, Aviation management, Artificial intelligence) and educated academic staff with UWE Bristol educational approach.
4. Strong collaboration with industry partners is ensured in the research area, delivery of study courses, internship options for students and academic staff development.

Weaknesses:

1. Access to online sources like IEEE would enable students to get specialized materials and access to training supporting study courses.
2. Workload of some academic staff explicitly mentioned in the analysis part does not look balanced as these people have 10+ study courses assigned and some have several administrative roles on top of them.
3. Safety instructions in laboratories are only printed in the Latvian language.

1.4. Scientific Research and Artistic Creation

Analysis

1.4.1.
The "TSI STRATEGY 2020-2025 – Future without Borders" document clearly states that the near future objectives of TSI in the field of research are including intentions concerning performing high-quality impactful applied research, developing internationally-recognized research and innovation active staff, establishing new multi-disciplinary research clusters, and promoting the research achievements globally. Now, at over half of the given period, it can be stated that these aims are only partially fulfilled. The impact of the research performed by the teaching staff, as concerning especially the publications in high-impact factor journals, is under the expectations. weak (see section 1.4.4 of this joint report), and as a consequence, their H-index is fair (≤5). Concerning establishing new multi-disciplinary research clusters, it is hard to estimate in which fields this could be made since the two already existing ones (in the field of data analytics and artificial intelligence research cluster, and modelling-based systems analysis and design) are covering all the teaching and research topics of the teaching staff.
The three pillars of the foreseen research directions (ICT-telematics, smart solutions in transport & logistics, and digital society & economy) nearly all address prominent research areas, and correspond to the development goals of TSI. Moreover, these are in line with the directions of the evaluated study field and the future development aims of the University. These definitively have inter- and multidisciplinary features and are in line with national priorities.
At TSI there exists a research-administrative direction which is coordinated by the vice-rector for scientific and academic work. Unfortunately, its catalytic role in scientific research could not be observed.
From the point of view of the research organization, the available infrastructure is divided between a great centre, TSI Telecommunications, Electronics and Robotics Center (TERC), including 11 laboratories, and four smaller laboratories: Applied Simulation Laboratory (SimLab), Image Processing, Biometry & Automated Border Control Systems Lab (IPB & ABC), Laboratory for Modelling Machinery Mechanisms and Materials (4M), and Application and Information Systems Development Laboratory (DevLab). During the visits to the laboratories, a great diversity of equipment and software for researchers, students, and academic staff could be observed. The rules for using these (establishing who, when, and for what purposes can use them, who provides the consumables, and the users' responsibilities) could not be found in the SAR. The financial incomes of these research entities (from projects, consulting, equipment rental, etc.) are not transparently available.
The open-access policy for providing a share of the equipment and software is commendable, but much care must be taken to not infringe software licensing agreements (for example, academic licenses usually cannot be used for industrial developments).
TSI takes all the advantages offered by the membership in the European Conference of Transport Research Institutes (ECTRI), an international non-profit association assisting the cooperation at multitudinous levels of the members (such as collaboration opportunities, information services, etc.).
The PhD students from the "Telematics and Logistics" doctoral study programme are contributing to fulfilling the research goals of TSI, but they are involved only in two research projects of the total 16, which may also be a result of the low number of active doctorands. The need for 5 SCOPUS indexed papers for defending their thesis is positive since this advances not only their scientific self-development but also the general scientific production of both the doctoral study programme and the entire TSI. The scientific impact of their research activities could be increased by requiring publications also in WoS-indexed high-impact journals.

1.4.2.
Upon studying the descriptions of the courses, it could be stated that the research results are not sufficiently and efficiently introduced in the courses. Both students and graduates were emphasizing the need of modernizing equally the curricula and the content of the disciplines to be more practical

and in line with modern technological trends. For these purposes, the intensive educational employment of their research results should be the most obvious way.
All the infrastructure acquired by using funds obtained from research projects is at the disposal of the students from all three educational levels (B.S., M.S., and PhD), both for education and research.
B.S. students are adequately prepared for meeting the demands of their future research activities (both during their second and third-level studies and after graduating) by study courses oriented towards the project activities and methodologies.
The involvement of PhD students in the teaching process is also a positive approach since they are well-informed in their narrow research field and their acceptance from the side of the students is very good due to their close stage of life.

1.4.3.
Nowadays, due to the complexity of the addressed research topics, successful R&D cannot be performed without strong inter-institutional collaboration. Therefore, TSI is also focusing on strong connections with international and national partners both from industry and academia also in the field of scientific research. TSI has a great number of agreements with universities and public research institutes both from abroad and in Latvia. A great part of these agreements includes research-related activities in the research areas of this study field, such as mutual publishing, project proposal writing and running, academic staff and student exchange, joint laboratory developments, etc.
Despite the poor data provision from Annex 'List of the publications, patents, and artistic creations of the teaching staff over the reporting period', where the partners of international projects are not named, it can be stated that these agreements had tangible results concerning the great number of the mutual European project in which TSI is a partner. TSI could better fructify the research potential of the strategic partnership agreement with UWE Bristol (initiating joint research projects and papers). Possibly, a joint research centre could be also established, which could catalyze these mutual research activities.
The dissemination of the international research collaborations is strongly supported by the organization of the "Reliability and Statistics in Transportation and Communications (RelStat) international conference and the editing of the SCOPUS-indexed Springer Lecture Notes in Networks and Systems. These, and other edited international journals are good opportunities for both local and partner researchers for publishing valuable papers. The other side of this medal is that the academic staff involved in the evaluated study field is seemingly focusing on publishing here more than in other journals having a higher impact.
The numerous plans for the development of international cooperation in scientific research listed in the SAR are ambitious, pertinent, and hopefully will bring improvements not strictly only in research collaborations but also in the enhancement of research dissemination.

1.4.4.
The requirements concerning the involvement in research activities of the academic staff are well-established in the staff development strategy of TSI. The 5 most significant strategic objectives in this field are adequate and could lead to high performances in the covered research fields.
The research-related obligations of the academic staff are established and strictly monitored (every two years). There are also several motivating actions including extra remuneration for high-level scientific publications, patents, participation in conferences, etc. Since these were implemented only recently, their beneficial effect cannot be yet assessed.
Most of the research activities are performed by the academic staff of TSI (besides their hard teaching loadings) which does not have sufficient international visibility. Looking at their WoS statistics (considered as most relevant by the Joint Research Centre, the main science and knowledge service of the European Commission) provided in the Annex Summary of quantitative

data on scientific and/ or applied research and/or artistic creation activities corresponding to the study field in the reporting period.'', fair H-indexes can be noted. Only three persons (two professors and one guest lecturer) achieve H=5. The research dissemination results are also weak. During the reporting period, only a few journal papers in high-impact journals were published. Also, the dissemination activity of the PhD students could be much improved.

1.4.5.
The integration of students of all levels in the ongoing research projects and their encouragement for innovation is appreciable, but a more intensive involvement should add more value for them when they enter the labour market.
At TSI twice a year the "Science and Technology - A Step into the Future (RatSif)" student scientific conference is organized, where students from all three educational levels can participate and present their research results. It should be emphasized that participation in this conference is mandatory for the M.S. students to present the results of their research activities before the final examination. The conference is also attended by B.S. students, young scientists, PhD students, as well students from partner universities are invited. Special sessions are organized at the conference, where secondary school pupils may present their research projects. This is a good opportunity to attract future students to TSI. It should be mentioned that it is advantageous to organize conferences that are just open to students since this gives them a great occasion to participate in an interdisciplinary scientific meeting and to be listened also by experienced scientists and teachers. Unlike at conventional conferences, the participating students are not under pressure from other, more experienced presenters.
M.S. and Ph.D. students are involved in some European COST actions in which TSI is a partner, which are good opportunities for them to join pan-European research communities, accumulate knowledge, and last but not least validate their research results through a great variety of specialists in the field. Despite there exist several research mobility possibilities (within the ERASMUS+ programme, but also in the framework of some research programmes) the students are very poorly taking advantage of such actions, which surely could improve their scientific knowledge and experience. Upon the meetings experts had with students, it seems that this is due to the impossibility to leave their workplace for a longer period.
The usefulness of the "Fundamentals of Design Competence for Our Digital Future" (DCODE 2021-2024)" should be emphasized. Within this action, a cohort of 15 PhD students are involved in a variety of research fields. They will be trained and assisted in finalizing their thesis by internationally leading researchers.
Commendable nonmaterial motivations for the achievement of significant research results are also the honourable mentions and awards granted at the annual birthday celebration of the TSI. Among the awarded researchers every year there is also a foremost young scientist.

1.4.6.
TSI is fully aware of the leading role of innovation in research and development. Therefore, several innovation solutions are applied also for assisting and monitoring the research activities. Among these, the Moodle-based LMS e-learning system should be foremost mentioned.
The Institute is making a lot of efforts to improve its activities through the digitization of all sectors, including scientific research, too.
Spectacular research results (such as the use of the NAO humanoid robot), of real interest to the general public, are utilized in educational marketing.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The research interests of the teaching staff are in line with current trends in the fields, and their

intentions regarding research are commendable. Unfortunately, the quality of the publications fructifying their results could be much improved.

Strengths
1. The adequate research strategy of TSI.
2. Upon the staff development strategy of TSI, the academic staff is obligated to be involved in research activities and to publish regularly. These activities are periodically monitored. Also, there are publishing limits imposed for the defence of the PhD theses.
3. The focus of TSI is on establishing strong research-related connections with international and national partners both from industry and academia also in the field of scientific research.
4. The great number of collaboration agreements with universities and public research institutes both from abroad and from Latvia.
5. The organization of the "Reliability and Statistics in Transportation and Communications" (RelStat) international conference and the editing of the SCOPUS-indexed Springer Lecture Notes in Networks and Systems creates a good publishing opportunity for both academic staff and students at all study levels.
6. The research-related obligations of the academic staff and PhD students are clearly established and strictly verified.
7. The organization OTSI organizes twice a year the "Science and Technology - A Step into the Future" student scientific conference, where students from all three educational levels can participate and present their research results.
8. The diversity of innovative solutions is applied also to assisting and monitoring the research activities.

Weaknesses
1. The effective involvement of the research management structure is invisible, despite there being a research-administrative direction within the TSI coordinated by the vice-rector for scientific and academic work.
2. Lack of involvement of internationally recognized research and innovation staff in the research activities. All the research activities are performed by the academic staff, which does not have sufficient international visibility.
3. Most of the students are working during their studies (also those involved in full-time education), and therefore they are not able to take advantage of the numerous student mobility possibilities offered by TSI.
4. The involvement of the PhD students in the research projects and their dissemination in high-impact journals both are weak.
5. Although the strategic partnership agreement with UWE Bristol calls for research collaboration, this does not manifest in joint research projects and papers. According to EU legislation, UK research entities are still allowed to take part in European projects (including the Horizon Europe one) if they have sufficient financial backing from the British side. Additionally, several other research partnership opportunities continue to operate even after Brexit.

Assessment of the requirement [2]

1 R2 - Compliance of scientific research and artistic creation with the level of development of scientific research and artistic creation (if applicable)

Assessment of compliance: Fully compliant

The direction of the scientific research activities connected to the evaluated study field complies with the general expectations in this educational field. Both the Institute and the Faculty of

Engineering are strongly devoted to increasing the research activities connected to this study field by applying and monitoring a clear strategy. The involved academic and research staff are adequately encouraged (also financially) for performing high-value research activities, journal publishing, and participation in international conferences. The students from all three study levels are intended to be involved in the research and development activities of the University. The expectation for them regarding these activities is increasing as they step up their study levels. The reward for outstanding results is also solved.
The obtained research results are satisfactory in quantity but could be improved in quality by more publishing in high-impact international journals.
The teaching staff is obligated to perform research activities and these are strictly monitored. Increased visibility of these actions should be welcome.

1.5. Cooperation and Internationalisation

Analysis

1.5.1
The analysis herein is based on the information provided in the SAR (pp. 82-85) and the Annexes to it; the TSI website; the TSI strategy 2020-2025; and the interviews conducted during the visit.
The study field has established close collaboration with a large number of employers, with an eye towards leveraging their experiences and expertise to ensure the relevance of its educational offering. The cooperation partners are selected considering their relevance to the specific features of the study field and the relevant study programmes. Such collaboration is based on institutional agreements and takes on several forms, namely (i) representatives of employers participate in the Council of the Faculty of Engineering and in the Council of the Study Field, as well as in the accreditation working group of the study field; (ii) representatives of employers chair the final examination committee of the study field; (iii) employers offer topics for final theses, and they review such theses; (iv) staff of employers offer guest lectures in courses and full professional courses as well; (v) employers participate in the process for improving the quality of the studies; (vi) employers are participating in the career days that TSI organizes annually; and (vii) representatives of the partner institutions, including industry partners, participate as experts in the evaluation committee of the iDEAHUB competition of innovative student projects. Additionally, three TSI partner companies provide study grants (scholarships) for students in three programmes of the study field. On the other hand, TSI academic staff participate in contract research projects and in the provision of training courses. TSI offers tuition fees discounts to employees of corporate clients of its partner companies. Further, academic staff of the study field actively participate in the professional organizations and associations, the most important of which are LIKTA, LETERA, Latvian Aviation Association, ECTRI, Latvian Transport and Education Association, etc. Additionally, the academic staff of the study field participate in working groups that are organized by Latvian ministries (for example, the expert working group of professional standards).
TSI has engaged in various forms of cooperation with Latvian educational institutions, universities and scientific institutions. Cooperation agreements with nine Latvian educational institutions and with two public research institutes exist. These agreements have varying durations, but suggest long-term, strategic characteristics. Such cooperation extends to (i) reviewing and advising doctoral theses; (ii) joint participation of the academic staff and the doctoral students in research, conferences and seminars; (iii) joint scientific publications; participation in joint projects on promoting the use of digital technologies in the study process; (iv) offering of free choice elective courses offered by the University of Economics and Culture; (v) participation of four TSI professors in the Councils of Professors of other universities; and (vi) establishment of a joint Council of Professors in the field of Economics and Entrepreneurship in cooperation with the University of Business “Turība” and the BA School of Business and Finance (BASBF).

1.5.2

The analysis herein is based on the information provided in the SAR (pp. 85-87) and the Annexes to it; the TSI website; the TSI strategy 2020-2025; and the interviews conducted during the visit.

TSI reports (SAR, Annex 'List of cooperation agreements, including the agreements for providing internship') cooperation agreements with 14 foreign educational institutions in 8 European countries and in Japan. All these agreements are long term and entail collaboration in both research and education. More specifically, cooperation with the foreign universities and scientific institutes entails, among others: guest lectures; research project proposals; research project implementation; doctoral student internships; exchange visits; organization of international conferences; Editorial Boards of scientific and academic publications; participation in the Promotion Councils. Cooperation agreements with 9 foreign public research institutes from 5 European countries also exist; these focus on the preparation of joint proposals for research projects; carrying out joint research projects; joint publications; staff exchange; staff training events etc.

In 2020 TSI pursued its goal to engage with a strategic partnership to enhance the TSI brand, expand range and quality of TSI portfolio, increase research volume and quality and increase international appeal and recruitment. The UK was selected as the target country, an option to some extent biased by a UK consultant having been selected to support the process. The process explored the cooperation potential with 12 UK Universities. The criteria of choice were (i) strong educational portfolio alignment with TSI – across all key disciplines; (ii) rankings; (iii) successful collaboration among business, industry and academia; (iv) openness to engaging in research collaboration and especially in the area of ICT in Transportation. The process concluded with the signing of a strategic partnership agreement between TSI and the UWE Bristol. The agreement, among others, provides for cooperation in research; for increasing the competence of the academic staff; and for the creation of double degree study programmes. In accordance with the terms of the concluded strategic cooperation agreement and the Academic Study Regulations approved by UWE Bristol/TSI, which govern the study process of the double diploma study programme, TSI is responsible for the admission of students and their compliance with the admission requirements, which are synchronized between TSI and UWE Bristol. The content of some courses of the double degree programmes was partially modified (modules were added) and the assessment approach followed at TSI was reconsidered, to align with the corresponding requirements and practices in place at UWE Bristol. TSI cooperation with the UK promotes the teaching of subjects only offering a kind of supervision for research projects from the UK side, not full research conducted in the UK.

In 2022, a cooperation agreement with the French Institut Supérieur d'Électronique de Paris (ISEP) was signed. The agreement provides for an opportunity of ISEP students to take courses offered by TSI. Within the context of the first stage of cooperation, 17 students of this university studied the courses of their interest for a whole semester in the spring semester 2021/2022 in the Bachelor programme of Computer Science.

In 2022, a cooperation agreement with the Kaunas University of Technology was signed. The agreement envisages cooperation on (i) exchange of visits, faculties and students exchange; (ii) development and implementation of joint educational and research projects; (iii) joint publication of the results of research activities; (iv) participation in courses, seminars, trainings, conferences and summer schools organized by either of the parties; (v) exchange of academic materials and other information; and (vi) other activities and programmes as may be mutually agreed upon by the Parties.

Several conditions are taken into account when concluding cooperation agreements with foreign universities: (i) the offer of the study courses for the TSI students in English in the relevant field /sub-field of the study; (ii) the possibility to create double degree programme; (iii) the study plans are compared; (iv) the ability to provide the necessary study courses in English in both universities; and (v) the research directions and the development possibilities of the scientific research. However, all aspects of international cooperation should be guided by an international cooperation strategy

that, among others, should be targeting broad geographical coverage of the partner institutions; such a strategy is missing.
Another form of cooperation with members of staff of foreign Universities is within the context of Promotion Councils. In accordance with the promotion regulations, the independent opinions of foreign reviewers are provided in the review of the doctoral theses. TSI actively cooperates with the academic staff of various European universities as potential reviewers of such theses. However, such collaboration does not constitute institutional engagement.

1.5.3
The analysis herein is based on the information provided in the SAR (pp. 87-90) and the Annexes to it; the TSI website; the TSI strategy 2020-2025; and the interviews conducted during the visit.
TSI has established and implements a comprehensive system for attracting qualified students from abroad. The main elements of the system and the attendant procedures are as follows: (i) a strategic partner has been selected to attract applicants from India, Jordan, Vietnam and Turkey; (ii) TSI uses the services of agents to attract applicants from different countries; (iii) contracts have been concluded with new agencies in Bulgaria, Greece, Romania, Georgia, Kazakhstan and Uzbekistan; (iii) TSI participates in international education exhibitions abroad; (iv) seminars for potential students are being held, both physically and remotely, in cooperation with agencies; (v) digital advertising campaigns on social networks (Facebook/Meta, Instagram) and on Google are undertaken; (vi) PR activities in foreign markets are carried out; (vii) the procedure for admitting applicants has been revised and improved by implementing the criteria for qualitative selection of foreign students; (viii) foreign applicants who wish to study in the undergraduate programmes are required to take tests, in accordance with the additional admission requirements of the study programme - a test in Physics and/or Mathematics and English.
As a result of the above practices, the number of foreign students in the study field increased from 7% in 2015/2016 to 14% in 2019/2020 (pre-Covid period), and currently for the second year it is 12% of all students. However, the actual number of foreign students is dropping since 2019/2020. Therefore the number of international students is not high and most of them are from post-Soviet countries.
Within the context of the ERASMUS+ programme, TSI has established a wide network of partner universities in Europe. In total, the university has concluded more than 50 bilateral cooperation agreements with higher education institutions in 19 countries, including 30 agreements in the field of implementation of the study programmes, which allow both for students to study at the partner universities as part of the exchange programme, and for the academic staff to go on exchange trips to the partner universities to deliver lectures and to attend research seminars. Naturally, not all these agreements are live, and ERASMUS+ mobility of both students and academic staff have remained low. The Covid-19 pandemic certainly contributed largely to this, however the fact that many TSI students are working constitutes a severe obstacle to their participation in mobility schemes, at least of a duration longer than a few days. It should be noted that both incoming and outgoing mobility is exclusively happening among students of the Bachelor level programme “Computer Science”; the mobility option is mostly chosen by students of social sciences programmes.
During the reporting period, there were 25 incoming and 26 outgoing students and 16 foreign lecturers in the ERASMUS+ mobility programme. Incoming mobility students are enrolled in one of the study programmes of the Faculty of Engineering with the status of exchange students, although in some cases exchange students choose to take certain individual study courses offered by programmes of other faculties as well. The number of students who choose to go on exchange mobility from the programmes of the Faculty of Engineering is roughly similar to the number of incoming students.
TSI is trying to attract foreign teaching staff using its own resources and the financial resources of

European Structural Funds. Foreign lecturers are invited to give guest lectures or teach study courses in accord with the Erasmus+ cooperation agreements and individual inter-university cooperation agreements. TSI announces recruitment opportunities on Euraxess. The salary level in Latvia constitutes a major obstacle for being successful in attracting foreign staff.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The analysis includes TSI's international collaborations and partnerships, as well as their efforts to attract qualified students from abroad. It also includes information on TSI's partnerships with employers, Latvian educational institutions, and foreign universities and research institutes. The processes of TSI's participation in the ERASMUS+ program and their efforts to attract foreign teaching staff are also analyzed

Strengths:
1. Cooperation with industry and academic and research institutions within Latvia is well established through formal and institutionalized processes. Such cooperation, as well as cooperation with foreign Universities, contributes to the implementation of the study programmes and the achievement of the learning outcomes of the study programmes.
2. TSI is actively pursuing its strategic goal to attract foreign students and has in place appropriate processes and procedures for doing so.
3.TSI has established a comprehensive system for attracting qualified students from abroad, resulting in an increase in the number of foreign students in the study field.

Weaknesses
1. Cooperation with foreign institutions is among the strategic plans of TSI, but the relevant strategy targets a limited number of countries.
2. Despite the acknowledgement of the importance of attracting foreign staff at the strategic level, and the adoption of appropriate processes and procedures for doing so, objective barriers, not specifically related to TSI itself (e.g. the level of salaries of academic staff in Latvia) have impeded TSI’s ability to fully achieve its goals.

Assessment of the requirement [3]

1 R3 - The cooperation implemented within the study field with various Latvian and foreign organizations ensures the achievement of the aims of the study field.

Assessment of compliance: Fully compliant

All criteria are mostly satisfied. TSI is able to enrich the educational experience and provide students with practical industry insights. The partnerships contribute to the alignment of academic content with real-world applications, enhancing the overall quality of education at TSI. TSI's strategic plans for cooperation with foreign institutions target a limited number of countries, which may limit the diversity and breadth of international partnerships.

1.6. Implementation of the Recommendations Received During the Previous Assessment Procedures

Analysis

In the previous assessment procedures related to the study field and the corresponding study programmes:

accreditation;

The previous evaluation of the whole study field happened in 2013. The analysis herein is based on the information provided in the SAR (pp. 86), the Annexes to it (no. 19. and 20.) and the interviews conducted during the visit.

1. It was recommended to admit more professors from other universities to solve the problem of rejuvenating part of the respectable staff age and would stimulate the development of TSI. This recommendation has been fully implemented - TSI has developed a double diploma study programme with UWE Bristol and as a result, started a cooperation with academic staff members from UWE Bristol. Additionally, due to acquiring a project with EU funds to strengthen academic personnel in strategic specializations of TSI, they have developed cooperation with an additional 9 foreign guest staff. Additionally, TSI plans to add a special budget position in faculties for foreign academic staff attraction.

2. It was recommended to strengthen the admission requirements to decrease the student drop-out rate. This recommendation is fully implemented and TSI has developed stronger admission rates for foreign students e.g. admission exams in mathematics, physics and English language; additionally, TSI does not enrol students from India with lower average grades than 6.5. For all first-year students, an obligatory mathematics test must be taken and those with lower results get recommended to attend additional TSI-organized mathematics lessons. Study programmes developed with UWE Bristol have all requirements to admit students with at least 55% results in mathematics and English language exams.

3. It was recommended to intensify student exchange and strengthen student exchange with other universities in Latvia and abroad. This recommendation has been partially implemented. Outgoing student numbers are very low, but it is due to the difficult situation that most of the students are working and do not want to participate in longer exchanges. While TSI provides many possibilities for mobility and during the student and graduate interviews, it was clear that TSI provides enough information about these possibilities, unfortunately students were not that interested in exchanges. Currently, TSI tries to popularize blended intensive programmes (BIP) which are short-term exchanges that would be more popular for students who are also engaged in a full-time jobs. However, at the time of evaluation, there are no results to report on. Further on, to develop this recommendation TSI has signed cooperation agreements with institutions of higher education such as Latvia University of Life Sciences and Technologies (Latvia), EKA University of Applied Sciences (Latvia), Vidzeme University of Applied Sciences (Latvia), Riga Technical University (Latvia), Wroclaw University of Technology (Poland), Fraunhofer Institute of Factory Operations (Germany), University of Thessaly (Greece) etc. Furthermore, in the previous 6 years, TSI has participated in more than 20 projects in programmes such as HORIZON2020, FP7, COST etc.

4. The recommendation about the Daugavpils branch of TSI is no longer applicable because it is closed.

5. It was recommended to encourage young researchers to write articles for important scientific journals. This recommendation has been partially implemented. TSI has developed iDEAHUB which constantly supports new innovation projects from students and encourages new prototype development etc. TSI has implemented an obligatory setting in that every student has to participate at least once during their studies at their student scientific conferences. Furthermore, TSI has opened two research clusters that promote student involvement in scientific activities. During the evaluation period, three postdoc projects have been realized. Room for publishing in important scientific journals with high-impact ratings (e.g.Q1 and Q2 quartiles in WoS) exists.

6. TSI was recommended to provide the opportunity for students to study separate modules/subjects and receive practical training from other Latvian and foreign HEI. This recommendation has been fully implemented. TSI has implemented this recommendation by signing cooperation agreements with different HEIs, developing project iDEAHUB, and developing cooperation with Accenture Baltics which provides practical lessons for students. Furthermore, TSI offers the opportunity to acquire micro-credentials - everyone can sign up as a listener to a study course, complete the tasks and

acquire credit points. Starting the autumn semester of 2022/2023, TSI has developed cooperation with Coursera online courses, which allow students to take these subjects for free. Unfortunately due to budgetary restrictions, Coursera isn't available for all students.
7. In the previous evaluation, TSI was recommended to develop an Alumni Association. This recommendation has been fully implemented. TSI created its Alumni Association in January 2016 and annually organizes seminars and meetings with TSI graduates. TSI also uses a LinkedIn profile, where it is easily possible to connect with different graduates.
8. Recommendation about a professional electronics study programme is not applicable, because TSI has decided to close this study programme and it is not being evaluated at this assessment.
9. During the last evaluation TSI was recommended to improve their equipment with modern digital instruments. This recommendation has been implemented. During the ERAF project, TSI has opened a Telecommunications, Electronics and Robotics Centre (TERC), as well as additionally opened 2 new laboratories and modernized a laboratory. In 2023 TSI will open two more laboratories with 3D printers and automatic welding. At this moment, TERC includes 11 laboratories.
10. It was recommended to widen publishing in international journals with a high impact factor. This recommendation has been partially implemented. During the evaluation period, TSI has realized 3 postdoc projects and opened two research clusters. Furthermore, the policy of rewarding academic staff for publications and patents has been renewed to motivate academic staff. However, the number of publications in high-impact journals could be higher.
11. TSI was recommended to strengthen links to industry and to leading HEIs in Latvia - this recommendation has been fully implemented. TSI has signed cooperation agreements with many leading HEIs and research institutes such as the Institute of Physical Energetics, and the Institute of Electronics and Computer Sciences. Additionally, TSI organizes annual meetings and seminars with graduates working in the industry and employers.
12. The last recommendation for the study field was to establish more organized, regular and formal feedback from industry/employers. This recommendation has been fully implemented. Formal feedback from the industry is received annually with surveying, however, employers are often involved in the daily work of faculty as members of the faculty council and study field council.

licensing of study programmes (if applicable);
During the evaluation period (the year 2018) one new study programme was licensed. During the licensing procedure, TSI acquired additional recommendations that should be implemented (SAR p.86, Annex no. 20). Originally it was submitted as a professional bachelor study programme in Robotics, however, TSI has submitted for accreditation this programme as an academic programme. TSI describes this change because robotics is an innovative scientific field and academic programme status better fits the goals of this study programme. Additionally, TSI describes that it is difficult to come to an agreement regarding professional standard preparation because each of the higher education institutions has a different accent on one of the major scientific fields - mechanics, electronics or programming.
1. During the licensing procedure, experts recommended coming up with better solutions for ventilation at the basement level where laboratories are located and work with industrial and autonomous robots is made. This recommendation has been implemented, but the deadline for implementation of this recommendation is the year 2023, therefore there could be additional improvements till the end of the year. A reconstruction is planned and TSI has come up with a temporary solution - industrial-grade air purifiers are set up in the labs and more are expected to be bought, therefore it can be assumed that this recommendation has been fully taken into account.
2. It was recommended to add to the TSI strategy the information and plan about academic personnel growth in the field of robotics after SAM project 8.2.2. realization. This recommendation has been fully implemented. TSI has included in their new strategy (for years 2020-2025) a focus on attracting and developing new academic personnel resources. Additionally, foreign academic staff is

to be attracted with faculty budget resources and various guest lecturers are attracted from the industry with knowledge in the field.
3. Recommendation about participating in the development of professional standards is no longer eligible because this programme has been submitted to the assessment as an academic programme.
4. It was recommended to develop a new mechanism for managing the systemic involvement of employers and students. This recommendation has been fully implemented. As confirmed during the visit and in the interviews with all the involved parties, TSI has created a study field council which consists of employers, students, graduates and academic personnel and coordinates study programme development. Additionally, TSI sends out annual surveys for employers and students.
5. The last recommendation from licensing was to stimulate scientific research activities in the field of robotics at TSI. This recommendation has been fully implemented. TSI has prepared a project of iDEAHUB which constantly supports new innovation projects. Furthermore, TSI has acquired the Investment and Development Agency of Latvia voucher for corporations, in which they created 6 projects at the request of companies.

TSI has taken into consideration most of the previously given recommendations. There are recommendations that are not applicable regarding the closed Daugavpils branch and the closed study programme “Electronics”. The recommendation given regarding professional standard development for robotics is also not applicable, but it is reasonable and justified that TSI wants to create an academic programme if they plan to increase their cooperation with UWE Bristol in this field. Overall the recommendations implemented have contributed to creating a study field more in tune with the students and employers than before.

Conclusions on this set of criteria, by specifying strengths and weaknesses

Strengths:
1. Cooperation with UWE Bristol has opened TSI to new possibilities with foreign guest lecturers and attractive double-diploma study programmes.
2. TSI Alumni Association activities and LinkedIn profile allow for easy connection between graduates and possibly an easy connection with TSI itself.

Weaknesses:
1. Extremely low outgoing student mobility statistics. While the reasoning for this problem is completely understandable (students do not have the interest, because of full-time employment, family etc.).
2. Not enough activities to encourage and support young researchers to write articles for high-impact-rated journals.

Assessment of the requirement [4]

1 R4 - Elimination of deficiencies and shortcomings identified in the previous assessment of the study field, if any, or implementation of the recommendations provided.

Assessment of compliance: Partially compliant

TSI have mostly implemented previously given recommendations and it is clear that they had only a positive impact on the study field. The recommendations implemented partially such as intensifying student exchange have not been completely achieved due to difficult situations TSI cannot directly impact (student employment parallel to studying etc.). Unfortunately, TSI still needs to improve the encouragement of young researchers to write articles for high-impact-rated journals.

1.7. Recommendations for the Study Field

Short-term recommendations

Improve Surveys and Student Engagement: Implement a unified survey system to assess and compare course performance and promote student engagement by providing feedback opportunities for each course. Increase involvement of the Student Council in developing and conducting the student surveys and in analyzing and improving the study programmes.
Improve Consultation Scheduling: Implement a transparent consultation scheduling system that is user-friendly, simple, and efficient, reducing frustration and inefficiencies for both students and faculty members.
TSI should review and revise the information provided on its website and in promotional materials to ensure that it accurately reflects the nature of the educational programmes offered. This may involve highlighting the fact that the institution primarily offers research supervision rather than full academic programmes in the UK.
Develop and make available safety instructions for each laboratory both in Latvian and in English. The experts noticed in the visited laboratories safety instructions only in Latvian
Develop the regulations on how to assess the academic staff teaching and research load focusing in promoting the research activities creating new projects.
Make student surveys twice a year at the end of each semester.

Long-term recommendations

Develop a strategy to increase project income as it is an essential source of funding for the institution, which will provide budgetary stability and support the development of programmes and facilities.
Review and improve the institution's strategy for attracting more international students from countries beyond post-Soviet states by developing new marketing and promotional activities. Develop and actively pursue an international cooperation strategy targeting broad geographical coverage of partner institutions and international students from developed and EU countries.
Develop a strategy to promote the teaching of subjects and coursework as part of the UK cooperation agreement, ensuring prospective students are aware of the extent of the institution's academic programmes.
Reduce working of students while studying. Develop a plan to provide financial support to students to reduce the need to work while studying and provide resources and support to students who do need to work while studying, such as flexible schedules, study groups, or academic coaching and create more, at part-time job opportunities within the ongoing research projects, especially for M.S. students.
Conduct a review of study programmes to assess the effectiveness of specializations and streamline course material to avoid overlap, thus providing clarity to students regarding the availability of specializations.
Develop and promote more ERASMUS activities to increase international mobility for students and faculty members. Intensify efforts to highlight to students the advantages of participating in mobility programmes and explore alternative means of supporting short duration mobility.

Improve the research administration activity of the TSI by a stronger involvement in the strategy development, the project calls monitoring, research funds administration, etc.
Hire experienced full-time or guest foreign researchers to involve them in your research projects.
When publishing research results more focus on high-impact factor journals, preferably indexed in the Q1 and Q2 quartiles.
Involve the Ph.D. students more intensively in the ongoing research projects.
Add publication in WoS/SCOPUS-indexed journals to the list of prerequisites for defending the Ph.D. thesis.
Try to attract more foreign student participants to the "Science and Technology - A Step into the Future" student scientific conference, especially from partner institutions.
Encourage the students to present their work in English instead of Latvian or Russian in the conference "Research and Academic Conference Research and Technology – Step into the Future" (https://ratsif2022s.tsi.lv/), to make it more attractive for foreigners and thus increase the impact and visibility of both the conference and the research performed at TSI.
Strengthen the research collaboration with the UWE Bristol, the basic strategic partner of TSI, by applying together for research projects and writing common scientific papers.
Continue and intensify efforts to exploit European funding for financing long-term stays of foreign staff and explore options of increasing the competitiveness of salaries.
Develop a long-term TSI research plan with measurable results which should bring in more research projects (project money) and increase the prestige of the institution.
Review possibility to provide access to all students to online sources like Coursera and IEEE to enable them to get specialized and supporting materials for study courses.
Rebalance teaching staff with an extremely high number (10+) of supervised study courses and additional roles in TSI.

II - "Computer Science " ASSESSMENT

II - "Computer Science " ASSESSMENT

2.1. Indicators Describing the Study Programme

Analysis

2.1.1

The Bachelor study programme “Computer Science” (43483) is compliant with the study field "Information Technology, computer hardware, electronics, Telecommunications, computer management, and computer science." The name of the Bachelor study programme "Computer Science" indicates that the programme belongs to the field of Information and Communication Technologies, which is a part of the study field. Additionally, the programme aims to prepare professionals with professional knowledge and skills in computer science, software engineering, and artificial intelligence, which are all areas within the study field. The programme spans theoretical disciplines (such as algorithms, information and computation theory, and automation) to practical disciplines (design and implementation of hardware and software) at the Bachelor level and prepares the students for the Master's level programme in Computer Science. The programme also

prepares graduates for leadership roles in the IT industry, which is relevant to the study field of computer management. Overall, the programme's objectives, content, and outcomes align with the study field of Information Technology, computer hardware, electronics, Telecommunications, computer management, and computer science.

2.1.2

The title and code of the study programme indicate its subject area and level, while the degree indicates the level of education it will receive upon completion of the programme. The aims and objectives of the programme are designed to achieve the learning outcomes, which are the knowledge, skills, and competencies that students are expected to acquire during their studies. The admission requirements are designed to ensure that students have the necessary background and qualifications to succeed in the programme and achieve the intended learning outcomes. All of these elements are interconnected and work together to ensure that the study programme is effective in achieving its goals and preparing students for their future careers.

The programme is designed to be completed in four years of full-time study, which is in line with the standard duration of Bachelor's programmes in Latvia. The programme is also designed to be implemented in different study programme forms, including full-time, part-time, and distance learning and all of these are planned to be taught in Latvian or English language. This allows students to choose the option that best suits their needs and circumstances. On the other hand, the diversity of the programme study forms might make teaching complicated and highly teaching resource demanding. The report also notes that the content and implementation of the study programme are focused on students' skills in applying the latest IT technologies and developing their competencies in line with the demands of the global labour market. The programme provides options for two specializations: software engineering and artificial intelligence. Overall, the duration and scope of the programme's implementation, as well as the different study programme implementation options, appear to be reasonable and justified, as they are designed to provide students with the knowledge and skills needed to succeed in the IT industry according to individual possibilities and the situation. The study programme is well-aligned with the study field and its related areas. The programme's focus on computer science, software engineering, and artificial intelligence aligns with the study field of Information Technology and computer science. Additionally, the program's preparation of graduates for leadership roles in the IT industry aligns with the study field of computer management. The programme's compliance with professional ethics and IT standards also aligns with the study field's focus on responsible and ethical professionals.

2.1.3.

The corrections and adjustments made to the study programme are as follows. The name of the programme “Bachelor of Natural Sciences in Computer Science” has been changed to “Computer Science” to make it more clear and in accordance with international practice. The Russian language programme intake was cancelled in 2019 according to the Article 49 of the Transitional Regulations of the Law on Higher Education. Additional admission requirements were introduced for foreign applicants: tests in English and Mathematics. The degree to be awarded has been changed from “Bachelor of Science in Computer Science”, to “Bachelor of Natural Science in Computer Systems”. Introduced the collaboration with UWE Bristol to teach in collaboration with the programme leading to the double degree programme format.

Two specializations in the programme were introduced: software engineering and artificial intelligence and new study courses on Cloud Computing and IoT, AI Tools and Methods, Blockchain Technologies, Database Design Concepts, Database Processing, Foundations of Data

Science, Quantum Computing etc. were introduced. All the courses incl. newly introduced courses are mapped to study programme learning outcomes given in the Map in Annex “Mapping of the study courses/ modules for the achievement of the learning outcomes of the study programme” to

SAR. Some study courses were replaced since they have lost their relevance in order to be taught at the level of a separate course, for example, Web-Application Development, Electronics and Microelectronics, Embedded Electronic Devices and Programming, and Web-Application Development Tools. The content of all basic study courses was increased to 4 credit points.
A major change in the structure of the programme is related to the strengthening of project-based learning for students introducing three individual projects and one group project. The SAR report provides details on the discussions held with representatives of industry partners regarding the structure of the specializations in the Computer Science programme. The Computer Science programme at TSI follows a student-centred approach in formulating its achievable study outcomes, which provides students with a clear understanding of the knowledge, skills, and competencies they will acquire upon graduation.
Overall, the Computer Science (43483) study programme appears to be well-designed and aligned with the study field of Information Technology, computer hardware, electronics, Telecommunications, computer management, and computer science.

2.1.4
The programme plays a significant role in promoting the transformation of the national economy in order to facilitate the growth of high technologies in Latvia and it corresponds to the field of smart specialization in Information and Communication Technologies, which is an area with a direct horizontal investment in the development of other areas of smart specialization, such as Bioeconomy, Biomedicine, Smart Materials and Technologies, and Smart Energy. The programme is also aligned with the projected labour market demand for professionals with higher education in the STEM fields, including computer science. The programme's focus on preparing professionals with professional knowledge and skills in computer science, software engineering, and artificial intelligence, as well as its preparation of graduates for leadership roles in the IT industry, aligns with the demands of the global labour market. The programme prepares graduates for a variety of roles in the IT industry, including analysts, computer systems engineers, application software development engineers, software engineers, website developers, information security specialists, testing engineers, QA engineers, automation solutions architects, and automation solutions developers. The impact of work on study results is an important factor to consider for many students, as they often work alongside their studies to secure funding for their education, which can have an impact on their academic performance. Working long hours, juggling multiple responsibilities, and experiencing burnout can lead to decreased motivation, difficulty concentrating, and lower academic performance. Students who work may also have less time to attend lectures, complete assignments, and engage in other academic activities, which can further affect their grades and academic progress. Low student participation in the ERASMUS mobility programme may indicate a lack of awareness of the benefits of international experience, or barriers such as financial constraints or concerns about the impact on academic progress. Similarly, low incoming lecturer activity may indicate a lack of interest in collaborating with TSI or a lack of awareness of the benefits of participating in the ERASMUS mobility programme.
The demand and supply of education in Natural Sciences, Mathematics and Information Technologies in 2027 is estimated to be 112%. The SAR notes that According to the CV.LV data (as of 31.05.2022), there are 887 vacancies in the field of Information Technology in Riga only. The demand for TSI STEM programmes from the part of foreign students is growing every year (on average, 30% per year). The distinctive feature of the Bachelor's Degree programme in Computer Science is the presence of two most popular specializations today – Software Development and Artificial Intelligence, where the last one plays a key role in the future industrial development and in the coming INDUSTRY 5.0 programme in the EU.
TSI is the only one among the universities implementing STEM programmes that does not have state budget funding though the admission number for the Computer Science programme is in the range

of 100 students which is an essential contribution to the future development of the economy of Latvia. In general, it should be concluded that the “Computer Science” study programme meets the needs of both Latvia’s smart specialization and the national economy.

2.1.5
N/A

Conclusions on this set of criteria, by specifying strengths and weaknesses

Overall, the Computer Science (43483) study programme at TSI meets the needs of both Latvia's smart specialization and the national economy and prepares students for a promising future in the IT industry.

Strengths
1. Alignment with the needs of the labour market: The programme is designed to prepare professionals with professional knowledge and skills in computer science at an international level, software engineering, and artificial intelligence, as well as the ability to participate in computer system development projects in a variety of roles (including management) and to comply with professional ethics and IT standards.
2. Comprehensive curriculum: The programme offers a comprehensive curriculum that covers a wide range of topics related to computer science, software engineering, and artificial intelligence. The programme's study courses are designed to provide students with the necessary knowledge and skills to succeed in their future careers as computer systems engineers, application software development engineers, software engineers, website developers, information security specialists, testing engineers, QA engineers, automation solutions architects, and automation solutions developers.
3. Industry partnerships: The structure of both specializations has been discussed with representatives of industry partners (for example, Deloitte, Accenture, etc.) and recognized as appropriate for current and future market requirements. This suggests that the programme is aligned with the needs of the industry and can prepare graduates for successful careers in the field of computer science.
4. Student-centered approach: The achievable study outcomes of the study programme are formulated using a student-centred approach, defining in a structured and detailed manner the knowledge, skills, and competencies that the student possesses and which the student is able to use and implement after graduation. This approach ensures that students are well-prepared for their future careers and can apply their knowledge and skills in real-world situations.

Weaknesses
1. Impact of work on study results: Many students work alongside their studies to secure funding for their studies, which can impact their study results.
2. Low activity in the ERASMUS mobility programme: TSI is low activity of students within the ERASMUS mobility programme, as well as the activity of incoming lecturers.

2.2. The Content of Studies and Implementation Thereof

Analysis

2.2.1
All the courses, their content and learning outcomes are mapped to the skills and knowledge and competencies provided by the study programme (SAR Appendix 2.3.). The correlation of the aims and learning outcomes of the study programme with the learning outcomes of specific study courses

are described in each study course description. The goal of the study programme is to provide a set of knowledge, skills and competencies according to Level 6 of the European Qualifications Framework of Latvian Education Classification.
In the structure of the study programme, 106 CP are compulsory study courses, 46 CP are restricted elective study courses and 8 CP are free elective study courses. The part of the limited choice comprises two specialized programmes: both the specializations “Software Engineering” and “Artificial Intelligence” in the amount of 30 credit points. The compulsory part of the study programme and the limited elective part of the programme include the main and basic principles of field knowledge. Part C introduces a certain flexibility to the programme allowing the students to choose some courses according to their future career needs. The specialization in Artificial Intelligence of the programme includes study courses based on UWE Bristol materials. Considering the need to comply with the UWE Bristol quality procedures and the fact that all materials are checked by the UWE Bristol lecturers and an external expert the collaborative programme materials are provided in English (including students’ reports, and answers). The collaborative programme leads to awarded double degrees and it is impossible to provide this double degree in Latvian for the students applying for this option of the programme.
The quality assurance of the study program is based on strong cooperation with the employers organizing the meetings for the discussion of requirements of the current industry situation and demands of the labour market. Reviewing annual SAR is an inherent part of these meetings and suggestions are developed for the study programme improvement. The updated courses are coordinated, approved by the Study Council and included in the study programme register at the beginning of the new study year.
The study programme is developed in accordance with the requirements of the State Cabinet of Ministers Regulation No.240 "Regulations on the State Standard of Academic Education".

2.2.2
N/A

2.2.3
In the light of the outcomes to be achieved within the study programme, specific study courses were identified and the scope of knowledge, skills and competencies to be achieved within each individual course was defined to support the teachers and students.
The study process is mainly implemented in the format of interactive lectures, seminars, workshops and student-independent work. Courses include workshops, discussions, teamwork and project work focused on professional tasks and problems. The basic principles and procedure for the assessment of the acquisition of the study programme comply with the requirements of Article 40 of the National Academic Education Standard. It is stated that the final course assessment (test or examination) should not exceed 50% of the final mark for the course.
In the form of the double degree option, the study procedures and methods and assessment of the learning outcomes are set out in accordance with the TSI and UWE Bristol Study Regulations.
The distant learning students learn and take the examinations using digital online study tools, with minimal in-person attendance at the TSI. The procedure for the organization of the distance learning mode of the study is described in the document Regulations on the Organisation of the Distance Learning Mode of Study. TSI has 2 distance learning study specialists who are directly responsible for the organization of the distant mode study process and there is a senior specialist of the Digitisation and Innovation Training Centre responsible for the compliance of the technical design of the study courses.
Each study course implemented in the study programme has a corresponding distance e-learning course and respective digital study materials (in the E-learning system) including lecture videos and interactive learning materials (knowledge tests, etc.). Communication with the lecturer is organized

too via the E-learning system. It is essential that the distance learning study courses are assessed by mid-term and end-of-course examinations as distance learning needs more attention from the lecturers. After obtaining a certain assessment in the intermediate examinations, the student is admitted to the final examination of the course. It is worth mentioning that the test or exam is taken orally using the Moodle resource Big Blue Button which is essential in making sure the student acquired the study materials. Use of modern cloud services in the distance study process including GitHub (repository and version control), Kanban services (project management), MongoDB (database), Amazon and Azur cloud services (computing resources as a service), Kaggle.com (big data service for artificial intelligence), Kahut. com (online survey service), and Moodle (universal learning management system) contribute to the introduction of these kinds of services in the later professional life of graduates. The amount of independent study (asynchronous mode) is increased step by step from 4 CP in the first year to 18 CP in the fifth year. The rest of the study courses in distance learning mode are organized in synchronous mode where the students and teacher meet in the e-learning system.
Therefore a flexible study process is provided - various forms of study (on-site full-time, part-time, distance learning), which gives students the opportunity to combine work with studies. The students from the day department have the opportunity to change the form of studies to part-time or distance learning in order to combine studies and work.
The relevance of the course of study is also ensured by the proportion of teaching staff recruited from the industry and by periodic meetings with the employers. The course content and teaching process assessment are realized by collecting feedback from the employers through surveys and regular meetings organized by the Head of the Study Programme and Dean of the Faculty. The survey analyses show that the content of the study programme is relevant and overall aims and outcomes of the study programme are achievable.
TSI has set a requirement that the preparation of the final year thesis has to be accompanied by the presentation of the thesis work in the form of a conference presentation, which gives first experience for students on how to prepare a scientific paper. The requirement is positively adopted by the students who stressed during the on-site meetings that this gives them a lot of experience on how to present their future projects in a company.
Updated courses of the study programme are coordinated, approved and included in the Register of Study Programmes and uploaded to the E-learning environment Moodle by the beginning of the new academic year.
The student and employers' feedback is collected by filling up surveys once per year and respective adjustments are introduced according to the TSI regulations. Students mentioned an informal feedback option during a semester which is working more effectively. However, collecting student and employers' feedback by filling up surveys once per year seems not enough for operative adjustment of the study programme and respective courses. Once at the end of each semester should be reasonable.

2.2.4
N/A

2.2.5
N/A

2.2.6
There is an option for the students to choose the topic of the final thesis by themselves or the students can contact and ask the academic staff or bring the topic from a company. The proposed topics will be discussed and agreed upon with the Head of the Study programme, which assures that the topics are relevant to the programme. It should be mentioned that TSI has on their website an

available list of all the running and former research and development projects with the contact data of the principal investigator. This helps the students interested in the research options to find suitable final thesis topics.
The document “List of examples of bachelor thesis topics that were defended in recent years” lists the defended final year thesis topics for the last three years. The topics are ranging from web applications and respective services to novel sensor applications and robot control algorithms and data and network services, therefore covering a wide scope of the Computer Science field. This should be considered a good indicator referring to the broad scope and contemporary content of the programme. Therefore the defended thesis topics should be considered relevant to the programme.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The study programme complies with Level 6 of the European Qualifications Framework of Latvian Education Classification and the basic principles and procedure for the assessment of the acquisition of the study programme comply with the requirements of Article 40 of the National Academic Education Standard.

Strengths
1. Collaboration with UWE Bristol, which provides an external sight and supplements programme management with strong international experience.
2. Introducing the specialization “Artificial Intelligence” partially based on the research and teaching experience of UWE Bristol gives strong support to the TSI programme.
3. Offering a variety of study programme forms: full-time, part-time and distance learning fills the cap in the training market for the persons who are unable to attend the full-time and part-time programme due to their work restrictions or family issues.
4. TSI has a Digitisation and Innovation Training Centre which supports the development of the E-learning courses by assuring the compliance of the technical design of the study courses.
5. Special procedures are developed (and documented) for distance study to deliver the courses, run tests and examinations more often than for full-time study and integrate interactive teaching means and combine self-study topics with active communication with teachers and other students on the E-learning platform.
6. Preparation of the final year thesis is accompanied by the requirement to present the thesis work in the form of a conference presentation, which gives the first experience the students how to prepare a scientific paper.

Weaknesses
1. Collecting student and employers feedback by filling up surveys once per year seems not enough for operative adjustment of the study programme and respective courses. Once at the end of each semester should be reasonable.
2. The process of applying for the double degree programme in conjunction with the cooperation with UWE Bristol is not documented and is unclear.

Assessment of the requirement [5] (applicable only to master's or doctoral study programmes)

1 R5 - The study programme for obtaining a master's or doctoral degree is based on the achievements and findings of the respective field of science or field of artistic creation.

Assessment of compliance: Not relevant

N/A

2.3. Resources and Provision of the Study Programme

Analysis

2.3.1

The Faculty of Engineering of TSI provides teaching, creates and updates study course materials (including practical, laboratory and seminar classes), conducts and provides defences of final year theses and carries out other activities related to teaching and research. The institution has a Digitisation and Innovation Learning Centre which is responsible for the development and deployment of teaching methodological materials for distance learning study courses.

TSI has a proven record of establishing and delivering engineering study field programs. Higher education institution has a broad range of classrooms and laboratories supported by information systems (intranet, Moodle, mobile application with time schedule and public portal) and specialized software to ensure delivery of study programme and provide necessary prerequisites for the achievement of learning. Students can use physical and electronic libraries (Academic Complete, Science Direct, Scopus, limited access to Coursera and other sources) to get necessary materials for their studies.

The TSI library is available for use by students of the “Computer Science” study programme. The hard copy books collection is good in the library but the number of electronic databases is limited. It would be strongly suggested to introduce to the students the options to join the IEEE community and have access to the IEEE organization's online resources.

During their studies, the students of the “Computer Science” programme use the TERC laboratories, which ensure the implementation of the study programme, and in addition, the Software and Information Systems Development Laboratory (DevLab) is available to students both during the class times and outside the class hours. In this laboratory, the students have the opportunity to increase their professional competencies in programming and algorithmics. The laboratory provides students with the opportunity to participate in TSI internal projects - the development of TSI information systems.

TSI has attracted and managed to keep the expert-level academic staff that are able to deliver study programmes in both languages (Latvian and English) and effectively collaborate and support students. During the sessions with students, graduates, and teachers (all separately), all groups reconfirmed the sufficiency of the existing processes and the availability of necessary equipment to ensure well-organized face-to-face and remote classes including practical classes in laboratories and in distance learning.

The SAR mentions some projects developed with the active participation of students: The development of the slot system for multiplex IHC staining; the Development of FARO Laser Scanner External Panoramic Camera, etc. Students have the opportunity to get involved in real research projects, e.g. in 2021, within the framework of the Data Analysis and Artificial Intelligence Research Cluster, 1 master's student and 2 bachelor-level students were involved in a project of 3D point cloud algorithm development research to study the development of a novel 3D point cloud algorithm. The projects were introduced to the experts during the laboratory visits.

Under the collaborative agreement between the Institute of Transport and Telecommunications and UWE Bristol, students studying on the double degree programme form are matriculated as both TSI and UWE students and therefore have access to UWE library resources and databases.

Potential inequality of treatment of the same programme students (this is only the risk and not considered as a weakness). Some are applying for UWE Bristol double degree and the rest of the students are following TSI regulations where 100% coincidence of the study programme regulatory documents at TSI and UWE Bristol is impossible to achieve.

2.3.2

N/A

2.3.3
Despite the pandemic and other challenges that impact the total number of students, TSI keeps it in the range of 6 years. The institution has implemented a double degree bachelor programme with UWE Bristol that helped to attract new students into this study programme. In the study year 2021/2022, there were 738 students in the bachelor programme “Computer science”, which makes this programme stable and attractive for new students.
The tuition fee has been the main source of funding for the study process and this is one of the limiting factors for the future development of the institution. Research income constitutes only a small fraction of the whole programme budget. A more detailed analysis is given in this report in the section on the Study Field. For the academic year 2022/2023, the tuition fee for one full-time student is EUR 2200 per year and for the part-time student - EUR 1760 per year and for distance learning - EUR 1500 per year. Despite the situation, the number of part-time and distance learning students is growing and this allows them to manage the programme as these study forms consume fewer teaching resources when the study materials are well prepared. Leverage to the situation gives the option for the students to obtain company scholarships or the companies are paying the tuition fee for some students working in the respective company. Students have the opportunity to obtain scholarships from companies. The scholarships are provided by Clarity Labs, and to inspire girls to pursue a career in STEM fields, scholarships are offered by Birkle IT. The number of scholarships is a clear indicator of the company's interest in the graduates of this programme. It is stated in SAR that the minimum number of students on a programme is 10 to manage with the resources available at TSI.

Conclusions on this set of criteria, by specifying strengths and weaknesses

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has implemented improvements to make this study programme more attractive for students and the respective continuous improvement process is defined.

Strengths:
1. Cooperation with UWE Bristol University and the opportunity to graduate with a double degree programme attracts new students and makes it industry relevant and competitive.
2. TSI has the necessary resources (premises, teaching staff and IT systems) and working processes to achieve the learning objectives of the programme and support the students with their graduation.
3. Students have the flexibility to consider a bachelor programme “Computer science” with full-time, part-time and distance learning options with the possibility to shift from one learning option into another in the case of personal or job place problems.
4. Students are introduced to research projects and attracted to participate.

Weaknesses:
1. Coursera platform is available for a limited number of students (max 70).

Assessment of the requirement [6]

1 R6 - Compliance of the study provision, science provision (if applicable), informative provision (including library), material and technical provision and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of learning outcomes

Assessment of compliance: Fully compliant

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has a broad range of classrooms and laboratories supported by necessary

information systems.
Academic staff is built from highly experienced own personnel and invited experts from the industry.
TSI has implemented improvements to optimize costs per student by combining the delivery of study courses between study programmes without a negative impact on achieving learning objectives.
The study programme is financed mostly by students' tuition fees and the stable number of students throughout the years is sufficient to keep this programme cost effective.

2.4. Teaching Staff

Analysis

2.4.1. The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 234-236) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The study programme courses are taught by 27 teaching staff members, of whom 20 have been elected at TSI. 8 TSI professors and 1 associate professor are involved in the implementation of the compulsory and limited optional part of the programme. Additionally, 5 assistant professors and 6 lecturers are also involved in the implementation of the programme. 70% of the academic staff involved in the programme have a doctoral degree in engineering; 11 in engineering and 3 in social sciences.
In addition to the academic staff, several industry specialists and foreign teaching staff take part in the teaching process. 3 of the guest lecturers have a Doctoral degree, the others have Master's degrees. Some courses have several lecturers, or the main course is taught by the programme director. In many cases it is expected that the representatives of the industry will be invited as guest lecturers for some specific topics, thus ensuring both the quality and relevance and introduction of the newest information from the industry of the study course content.
According to Annex 2.9 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions. Similarly, according to the SAR, the knowledge of the national language of the teaching staff involved in the programme complies with MK 07.07.2008. to regulations no. 733 "Rules on the amount of knowledge of the national language and the procedure for testing the national language proficiency for the performance of professional and official duties, obtaining a permanent residence permit and obtaining the status of a permanent resident of the European Union and the state fee for the national language proficiency test".

2.4.2.
The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 236-237) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The number of teaching staff involved in the implementation of the study programme is two less than the corresponding number during the previous accreditation (27 instead of 29). However, only 9 members of the teaching staff are the same. During the reporting period, 11 new (elected TSI) lecturers were recruited. Of these, eight lecturers have doctoral degrees, three are full professors, one is an associate professor, three are assistant professors and three lecturers. Some of the teaching staff obtained a doctorate during the reporting period and are now teaching in the study programme.
TSI examines the competencies of the teaching staff as part of the hiring process, including by the Director of the study programme. In cases when competencies need updating, this is done by means of seminars. As a result, no teaching staff member is assigned teaching duties in subjects, not among their respective competencies. However, unexpected needs to fill teaching gaps are difficult to satisfy; this is usually done by employing lecturers at other Universities, who mostly teach

remotely.
The number of professors involved in the programme has increased from the academic year 2018 to 6 to 8 in the year 2022.The number of Assoc. Professors decreased by 3. The number of lecturers with master's degrees has decreased by 2, the number of guest lecturers has increased by 2 and the number of rest of the teaching staff is almost the same in the mentioned period. During the reporting period, the programme has attracted new (elected by the TSI) lecturers teaching some specific course or a part of it. 11 new lecturers (elected by TSI) were recruited to the programme to teach a specific study course or part of a course. Of these, eight lecturers have doctoral degrees, three are full professors, one is an associate professor, three are assistant professors and 3 lecturers. This is an indicator of the renewal process of the teaching staff. The total number of teaching staff has increased due to the study courses providing students with scientific research and practical skills.
Therefore the changes in the structure of the teaching staff involved in the study programme have a positive impact on the teaching process quality and it is appropriate for the achievement of the overall results of the study courses and the programme

2.4.3.
N/A

2.4.4.
The analysis herein is based on the information provided in Annex 10 of the SAR.
8 Professors (Grakovskis, Jackiva, Merchan, Mišņevs, Pavlyuk, Pticina, Savrasovs and Stukalina) and one associate professor (Spiridovska) are listed as teaching staff members taking part in the implementation of the study programme. According to their CVs, they are all active in research and have published in international venues in the last six years and/or have practical experience.

2.4.5.
The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 238-239) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
During the implementation of the study courses regular meetings of the teaching staff take place, in which they exchange experiences on the study course topics, research results, new developments in the research, etc. Discussions are used to develop and improve the content of studies, with mutual agreement on topics, emphases, responsibilities and compliance with regulatory requirements.
Important cooperation events are preliminary and final defences of bachelor theses. The preliminary defences are organized with the participation of a committee of faculty members, where recommendations for improvement are collectively made. Cooperation is also observed during and after the final defence of bachelor theses when the Final Examination Commission gives its evaluation as a result of the discussion.

Conclusions on this set of criteria, by indicating strengths and weaknesses

The study programme courses are taught by 27 teaching staff members, of whom 20 have been elected at TSI. 8 TSI professors and 1 associate professor are involved in the implementation of the compulsory and limited optional part of the programme. TSI examines the competencies of the teaching staff as part of the hiring process, including by the Director of the study programme. In cases when competencies need updating, this is done by means of seminars. The increase in the number of teaching staff is an indicator of the renewal process of the teaching staff as the majority of newly elected staff has an age range of up to 45 years. The total number of teaching staff has increased due to the study courses providing students with scientific research and practical skills. Cooperation events are preliminary and final defences of bachelor theses. The preliminary defences

are organized with the participation of a committee of faculty members, where recommendations for improvements are collectively made. According to Annex 2.9 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions.

Strengths:
1. The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and study results of the study programme and corresponding study courses.
2. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme.
3. All members of the academic staff in the last six years have published in peer-reviewed international venues and/or have five years of practical experience, which is in accordance with the Law on Higher Education Institutions.

Weaknesses:
No weaknesses

Assessment of the requirement [7]

1 R7 - Compliance of the qualification of the academic staff and visiting professors, visiting associate professors, visiting docents, visiting lecturers and visiting assistants with the conditions for the implementation of the study programme and the requirements set out in the respective regulatory enactments.

Assessment of compliance: Fully compliant

Most criteria are fully satisfied and identified weaknesses can be remedied. The compliance of the academic staff and visiting faculty members with the qualification requirements is essential for the successful implementation of a study programme. It ensures that the teaching staff possesses the necessary expertise and credentials to deliver high-quality instruction. The inclusion of visiting professors, associate professors, docents, lecturers, and assistants from diverse backgrounds enriches the programme and brings valuable perspectives and experiences. However, the lack of detailed information on the assessment and verification processes for qualification compliance is a weakness that should be addressed for transparency and accountability. Additionally, challenges in filling unexpected teaching gaps may impact the availability and accessibility of teaching staff, requiring careful attention to the program's continuity and quality.

2.5. Assessment of the Compliance

Requirements

1 1 - The study programme complies with the State Academic Education Standard or the Professional Higher Education Standard

Assessment of compliance: Fully compliant

The study programme “Computer Science” volume is 160 CP of which 96 CP are compulsory part and 10 CP for Bachelor thesis, 46 CP are for restricted elective study courses, 8 CP for the free elective part. The programme structure complies with Cabinet Regulations No. 240.
The study programme includes obligatory study courses about environmental protection and civil protection.
The study programme fully complies with the State Academic Higher Education Standard and

Cabinet Regulation No. 240.

2 2 - The study programme complies with a valid professional standard or the requirements for the professional qualification (if there is no professional standard required for the relevant occupation) provided if the completion of the study programme leads to a professional qualification (if applicable)

Assessment of compliance: Not relevant

N/A

3 3 - The descriptions of the study courses and the study materials have been prepared in all languages in which the study programme is implemented, and they comply with the requirements set forth in Section 561 , Paragraph two and Section 562 , Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

Study course descriptions and study materials are prepared in Latvian and English languages, and they satisfy requirements set in Law on Higher Education Institutions.

4 4 - The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure according to which state recognised documents of higher education are issued.

Assessment of compliance: Fully compliant

The diploma issued complies with the state legislature and “Procedures by which documents certifying higher Education recognised by the State shall be issued” (Cabinet of Ministers No. 202).

5 5 - The academic staff of the academic study programme complies with the requirements set forth in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

There are at least 5 Assoc. Professors or professors involved in the study programme implementation together. It is confirmed by the TSI Rector confirmation.

6 6 - Academic study programmes provided for less than 250 full-time students may be implemented and less than five professors and associated professors of the higher education institution may be involved in the implementation of the mandatory and limited elective part of these study programmes provided that the relevant opinion of the Council for Higher Education has been received in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Not relevant

N/A

7 7 - At least five teaching staff members with a doctoral degree are among the academic staff of an academic doctoral study programme, at least three of which are experts approved by the Latvian Science Council in the respective field of science. At least five teaching staff members with a doctoral degree are among the academic staff of a professional doctoral study programme in arts (if applicable).

Assessment of compliance: Not relevant

N/A

8 8 - The teaching staff members involved in the implementation of the study programme are proficient in the official language in accordance with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties.

Assessment of compliance: Fully compliant

The academic staff has sufficient Latvian language knowledge for implementing study courses. This is confirmed by a TSI Rector's signed confirmation

9 9 - The teaching staff members to be involved in the implementation of the study programme have at least B2-level knowledge of a related foreign language, if the study programme or any part thereof is to be implemented in a foreign language (if applicable).

Assessment of compliance: Fully compliant

The academic staff has sufficient foreign language knowledge for implementing study courses (at least B2). This is confirmed by a TSI Rector's signed confirmation.

10 10 - The sample of the study agreement complies with the mandatory provisions to be included in the study agreement.

Assessment of compliance: Fully compliant

Study agreements include all necessary parts set in legislation. It is advised to include information about guarantees of compensation losses (criteria No. 11 and 12) so that this information is easier for the students to acknowledge already from the beginning.

11 11 - The higher education institution / college has provided confirmation that students will be provided with opportunities to continue their education in another study programme or another higher education institution or college (agreement with another accredited higher education institution or college) if the implementation of the study programme is terminated.

Assessment of compliance: Fully compliant

TSI has a cooperation agreement with Riga Technical University confirming that in case the implementation of programmes in this study field is terminated, students will be able to continue studies in the RTU study field "Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management and Computer Science".

12 12 - The higher education institution / college has provided confirmation that students are guaranteed compensation for losses if the study programme is not accredited or the study programme's license is revoked due to the actions (actions or omissions) of the higher education institution or college and the student does not wish to continue studies in another study programme.

Assessment of compliance: Fully compliant

University has a rector's signed refund and compensation policy that confirms it will compensate losses to students if the study programme is not accredited or loses its license and the student does not wish to continue studies in another study programme.

13 13 - The joint study programmes comply with the requirements prescribed in Section 55.(1), Paragraphs one, two, and seven of the Law on Higher Education Institutions (if applicable)

Assessment of compliance: Not relevant

N/A

14 14 - Compliance with the requirements specified in other regulatory enactments that apply to the study programme being assessed (if applicable)

Assessment of compliance: Not relevant

N/A

Assessment of the requirement [8]

1 R8 - Compliance of the study programme with the requirements set forth in the Law on Higher Education Institutions and other regulatory enactments.

Assessment of compliance: Fully compliant

The requirement has been met and fulfilled, and all requirements set in different regulatory enactments are satisfied - the study programme complies with State Academic Education Standard and Law on Higher Education Institutions. There are no additional regulations specific to this field.

General conclusions about the study programme, indicating the most important strengths and weaknesses of the study programme

The study programme demonstrates a strong commitment to compliance with qualification requirements for its academic staff and visiting faculty members. This ensures that the programme is delivered by qualified individuals who possess the necessary expertise and credentials. One of the program's strengths lies in the inclusion of visiting professors, associate professors, docents, lecturers, and assistants from diverse backgrounds. Their involvement enriches the programme by bringing valuable perspectives and practical experience, enhancing the overall quality of instruction and the learning experience for students. The lack of detailed information on the assessment and verification processes for qualification compliance raises concerns about transparency and accountability. Clear and transparent mechanisms for evaluating and ensuring compliance would enhance the program's credibility. Additionally, the challenges in filling unexpected teaching gaps and the reliance on remote teaching from lecturers at other universities may impact the availability and accessibility of teaching staff. This could potentially affect the continuity and quality of instruction, and efforts should be made to address this issue effectively.

Strengths:
1. Study programme is well justified and in line with the study field.
2. Cooperation with UWE Bristol allows TSI to acquire good practices from their colleagues in the UK providing a higher standard for quality in their programme.
3 The programme is designed to prepare students with professional knowledge and skills in computer science at an international level, software engineering, and artificial intelligence, and it complies with professional ethics and IT standards.
4. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme.
Weaknesses:
1 Collecting the student and employers' feedback by filling up surveys once per year seems not enough for operative adjustment of the study programme and respective courses. Once in the end of each semester should be reasonable.
2. Many students work alongside their studies to secure funding for their studies, which can impact their study results.
3. Coursera platform is not available for all students
4. The process of applying for the double degree programme in conjunction with the cooperation with UWE Bristol is unclear.
No other weaknesses were identified regarding insufficiencies in satisfying requirements in regulatory enactments. This is not a weakness but it would be advised for TSI to consider adding information regarding 11. and 12. criteria in study agreements, so this information would be easier for the students to acknowledge already from the beginning.

Evaluation of the study programme "Computer Science "

Evaluation of the study programme:

Good

2.6. Recommendations for the Study Programme "Computer Science "

Short-term recommendations

Encourage students to prioritize their studies and minimize the impact of work on their academic performance by providing information on scholarships and other forms of financial aid. The effectiveness of these measures can be measured through tracking student performance, monitoring financial aid applications, and collecting student feedback, to determine whether students are prioritizing their studies and whether the information provided has been effective in achieving this goal.
Develop a document specifying rules for calculation and assessing the teaching and research load of academic staff.
Develop or document/documents regarding the preparation and defense of the final year thesis, marking and assessment procedures or respective conversation rules, coherences and discrepancies between the TSI and UWE Bristol study processes.
Evaluate whether to include information about compensations and other study opportunities (in case the programme is discontinued) in the study agreement.

Long-term recommendations

Conduct a study to assess the impact of work on students' academic performance and develop strategies to mitigate the negative effects.
Develop a long-term plan to increase student participation in the ERASMUS mobility programme and attract more incoming lecturers from other universities and outgoing lectures mobility.
Invest in the development of comprehensive student support services to ensure that students have access to the resources they need to succeed throughout their studies. This may include hiring additional staff, creating new programs, or improving existing support services.
Develop a light internship programme for last year high school students to introduce TSI study programmes and further job opportunities in the field.
Launch an IEEE student and graduate branch at TSI if possible to get students more integrated into the international professional community.
TSI to review options to ensure an access to Coursera platform to all TSI students.

II - "Computer Engineering and Electronics" ASSESSMENT

II - "Computer Engineering and Electronics" ASSESSMENT

2.1. Indicators Describing the Study Programme

Analysis

2.1.1
The study programme "Computer Engineering and Electronics" (43523) is in compliance with the

study field "Information Technology, Computer Engineering, Electronics, Telecommunications, Computer Management, and Computer Science". The programme belongs to the Engineering and Technology branch group Electrical Engineering, Electronics, Information and Communication Technologies, which is part of the study field. The programme is designed to prepare academically educated specialists in electronics and computer engineering. The programme covers a wide range of topics related to computer engineering, electronics, and telecommunications. However, the programme has an insufficient emphasis on electronics. Given that the programme is titled "Computer Engineering and Electronics," it is crucial to ensure that both fields receive adequate attention and focus. A balanced emphasis between these two fields is necessary to ensure that students receive a comprehensive education and gain the necessary competencies for successful professional activity in the field of electronic engineering and computer science. The programme offers three specializations, Embedded Electronic Systems, Industrial Electronics, Telecommunications Systems and Computer Networks, which are also relevant to the study field. The study courses included in the programme cover the guidelines, principles, structure, and methodology of the field of computer engineering and electronics, as well as the interdisciplinary aspects of computer engineering and electronics characteristics and problems.

2.1.2

The programme is designed to prepare academically educated specialists in electronics and computer engineering. The programme's aim and objectives, as well as the learning outcomes and admission requirements, are all aligned with the degree and professional qualification to be obtained, which is a Bachelor of Engineering in Electronics and Automation. The admission requirements are based on normative acts. The programme offers three specializations, Embedded Electronic Systems, Industrial Electronics, Telecommunications Systems and Computer Networks, which are also relevant to the study field. The study courses included in the programme cover the guidelines, principles, structure, and methodology of the field of computer engineering and electronics, as well as the interdisciplinary aspects of computer engineering and electronics characteristics and problems. Overall, the programme's title, code, degree to be obtained, professional qualification or degree and professional qualification, aims, objectives, learning outcomes, and admission requirements are all interrelated and aligned with each other.

The programme is offered in different implementation options, including full-time and part-time studies, with different durations. The duration of the programme implementation is reasonable and justified, as it is based on the normative acts, including the Law on Higher Education Institutions and the Cabinet of Ministers Regulation No. 846 of October 10, 2006 "On Requirements, Criteria and Procedures for Admission to Study Programmes". The programme's scope is also reasonable and justified, as it covers a wide range of topics related to computer engineering, electronics, and telecommunications, which are all part of the study field. The implementation languages of the programme are Latvian and English, which is reasonable and justified. Overall, the duration and scope of the study programme "Computer Engineering and Electronics" (43523) implementation, including different study programme implementation options, as well as the implementation language, are reasonable and justified.

The curricula of the full- and part-time instructions are similar, only the time distribution is different (5 years -8 terms, and 5 years -10 terms, respectively).

2.1.3

The several corrections made to the study programme's parameters within the assessment of the study field are analyzed, justified, and would be supported. E.g., the changes made to the name and structure of the "Computer Engineering and Electronics" (previously - ‘Bachelor of Engineering in Electronics’) programme were based on extensive analysis of the industry trends, competencies required by technical specialists, and the structure of similar programmes implemented in other

countries. The inclusion of three specializations in the programme was based on the demand for specialists in those fields, and the programme's structure ensures the development of project competencies of students. Overall, these changes contribute to the improvement of the programme and the formation of students' practical professional competencies. The changes made to the "Computer Engineering and Electronics" programme are well-justified and supported by economic and social factors.

2.1.4
The programme is aligned with the Latvian Smart Specialization Strategy (RIS3) and the development plans of the Republic of Latvia, which highlight the need for specialists in the field of electronic engineering and computer science. The growing demand for specialists in this field is also reflected in the projected labour surplus/shortage and the number of graduates in the STEM field, where there is a significant shortage of specialists. The programme's specializations are designed based on the demands of companies that develop embedded electronic systems, automated control systems for industrial production, and those in the telecommunications industry and computer network technologies. The inclusion of these specializations ensures that the programme meets the needs of the economy and provides students with the necessary competencies for successful professional activity in these areas. Moreover, the programme's integration of electronic engineering and computer science, as well as the inclusion of applied electronics knowledge, sets it apart from similar bachelor's programmes in Latvia and other Baltic countries. The programme's structure includes group projects and individual courses, which contribute to the development of students' practical professional competencies and improve interdisciplinary communication in the programme. While the programme is offered in English, efforts to attract and recruit international students may need to be increased to foster a more diverse and multicultural learning environment. Attracting a more diverse student population can provide numerous benefits, including exposure to different perspectives, cultures, and experiences, which can enrich the learning experience for all students. While only some lecturers are involved in research projects and activities, there could be more opportunities for the teaching staff to engage in research and innovation and to bring their findings and expertise into the classroom.

2.1.5
N/A

Conclusions on this set of criteria, by specifying strengths and weaknesses

Overall, the "Computer Engineering and Electronics" programme offers a strong foundation in both electronic engineering and computer science, with specializations that meet the needs of the labour market. The programme's project-based approach and alignment with national and regional economic strategies make it relevant and practical. However, there are some areas for improvement.

Strengths
1. Integration of electronic engineering and computer science: The programme is designed to integrate two fields of electronic engineering and computer science, which are both essential in modern technology, particularly in the development of embedded electronic systems, industrial automation devices, telecommunication systems and computer networks.
2. Specializations based on industry needs: The three specializations of the programme were developed in collaboration with specialists from companies in various industries, including embedded electronic systems, industrial production, telecommunications, and computer networks, ensuring that the programme meets the current and future needs of the labour market.

3. Project-based approach: The programme includes individual and group projects, allowing students to develop practical professional competencies, project management skills, and interdisciplinary communication, which are essential for successful professional activity in the field.
4. Economic and societal relevance: The programme is aligned with the RIS3 and the national economy, contributing to the development and modernization of industry in Latvia and the entire Baltic Sea region.
5. Internationalization: The programme is offered in English, making it accessible to both local and international students. Additionally, the analysis of similar programs in other Baltic countries shows that the proposed programme offers a unique and more integrated approach to electronic engineering and computer science education.

Weaknesses
1. Limited internationalization: The SAR mentions that the majority of the students in the programme are Latvian, and there is limited participation from international students. The programme may benefit from more efforts to attract and recruit international students and foster a more diverse and multicultural learning environment.
2. Limited engagement with research and innovation: While the report indicates that some lecturers are involved in research projects and activities, there could be more opportunities for the teaching staff to engage in research and innovation and to bring their findings and expertise into the classroom.
3. Insufficient emphasis: there appears to be a stronger emphasis on computer science within the programme compared to electronics. As the programme is titled "Computer Engineering and Electronics", it is important to ensure that both fields receive adequate attention and focus.

2.2. The Content of Studies and Implementation Thereof

Analysis

2.2.1.
The curricula of this academic bachelor's programme in computer engineering and electronics were established considering all the regulations of Latvia in the field.
The study programme comprises three specialities: Embedded Electronic Systems, Industrial Electronics, Telecommunications Systems and Computer Networks. Despite these covering quite different advanced and applicative areas, the intensive use of computers is a common feature of all three specialities. All of them are in perfect line with the aims of this study programme.
The curricula of the full- and part-time instructions are similar, only the time distribution is different (5 years -8 terms, and 5 years -10 terms, respectively).
The contents of the courses assigned to the three specialities are adequate and create the premise of fulfilling the study programme aims and accomplishing all the foreseen learning outcomes.
As the students have at their disposal three courses at free selection, they can shape, even if only in a small amount, their study course to be in line with their individual interests and employing plans.
The curricula assure the students the possibility to continue their studies at the master's level at TSI.
Even if the current curricula offer the students to gain the adequate specific skills needed in the labour market., some improvements could be done, such as including more imposed practical activities to be performed outside the University (industrial training, internships, etc).

2.2.2.
N/A

2.2.3.
In TSI at the bachelor's level, as at all the other education levels, advanced teaching methods are

applied. A special focus is set on student-centred teaching and learning principles. These have the potential to contribute to the achievement of the objectives and foreseen results of the study courses and programme.
Due to the need for a very good technical English language knowledge of the involved students, a special English for Information Technologies course is included in the curricula.
The recommended bibliography in the syllabus of all the courses comprises exclusively English resources, easily comprehensible also for foreign scholars studying in English.

2.2.4.
N/A

2.2.5.
N/A

2.2.6.
The faculty provides students with a wide range of topics for their Bachelor's thesis subjects.
With the supervisor's consent, the students are allowed to choose a topic from the list and modify it to fit their individual interests.
The examples of bachelor's thesis topics in Annex “Examples of Bachelor theses topics” are all worthwhile for students, attractive, and completely follow the objectives of the study programmes and the demands of the labour market.
Prominent businesses in the field are also suggesting themes that are interesting to students because working with them may lead to employment.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The global impression of the self-assessment report and the organized meetings concerning this criterion of the expert team is positive. Some improvements must be done to make the course topics closer to the real-world issues required by the companies hiring the graduates and to impose more practical activities to be performed outside the University (industrial training, internships, etc).
The study programme is in line with the regulations and good practices in Latvia. In general, the teaching process can guarantee the main aims of the programme and the achievement of the established learning outcomes.

Strengths
1. The study programme is compliant with the Latvian National Standard for Academic Education and it is fully supported by the Latvian Higher Education Council.
2. The students are offered three free-choice subjects within the curricula. Moreover, they can shape the given topics for the bachelor's thesis upon their personal interests with the approval of their supervisor. All of these assure an amount of flexibility in their studies to be more in line with their specific needs.

Weaknesses
1. The curricula should contain more imposed practical activities to be performed outside the University (industrial training, internships, etc).

Assessment of the requirement [5] (applicable only to master's or doctoral study programmes)

1 R5 - The study programme for obtaining a master's or doctoral degree is based on the achievements and findings of the respective field of science or field of artistic creation.

Assessment of compliance: Not relevant

N/A

2.3. Resources and Provision of the Study Programme

Analysis

2.3.1
TSI has a proven record of establishing and delivering engineering study field programmes. It has a broad range of classrooms and laboratories supported by necessary information systems (intranet, Moodle, mobile application with time schedule and public portal) and specialized software to ensure delivery of study programme and provide necessary prerequisites for the achievement of learning. Students can use physical and electronic libraries (Academic Complete, Science Direct, Scopus, limited access to Coursera and other sources) to get necessary materials for their studies.
Delivery of Computer engineering and electronics bachelor study programme requires specific equipment for laboratory work. TSI has established 11 specialized laboratories including laboratories of Physics and Electrical Machines, Modeling of Electronic Systems, Embedded Systems and Digital Signal Processing that are used by academic staff and students in relevant study courses of this programme.
TSI has attracted and managed to keep the expert-level academic staff that are able to deliver study programmes in both languages (Latvian and English) and effectively collaborate and support students. During the sessions with students, graduates, and teachers (all separately), all groups reconfirmed the sufficiency of the existing processes and the availability of necessary equipment to ensure well-organized face-to-face and remote classes including practical classes in laboratories.

2.3.2
N/A

2.3.3
The pandemic period and the decreasing number of students in Latvia, in general, has negatively impacted the total number of students in the Computer engineering and electronics study programme. In the last 4 years, the number of students has significantly decreased from 62 in the year 2018/2019 to 34 in the year 2021/2022. This had a negative impact on the financial sustainability and profitability of the programme, however, TSI has managed to mitigate this challenge by combining delivery of the same study courses of several study programmes. This helped to optimize the utilization of academic staff and institution premises and decrease costs. Based on the feedback received from students and graduates, such optimization has not impacted the achievement of learning objectives and even provided advantages to students by extending their relationship network and collaboration between students of different study programmes.
The study programme is financed mostly by students' tuition fees and the historical number of students is sufficient to keep this programme cost-effective. Based on the SAR, the study programme needs at least 10 students to be profitable.

Conclusions on this set of criteria, by specifying strengths and weaknesses

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has implemented improvements to mitigate the negative impact of a significant decrease in the total number of students in this programme.

Strengths:
1. TSI has the necessary resources (premises, teaching staff and IT systems) and working processes

to achieve learning objectives and support students with their graduation.
2. Institution has established specialized laboratories necessary for the delivery of study courses of the programme (including laboratories of Physics and Electrical Machines, Modeling of Electronic Systems, Embedded Systems and Digital Signal Processing).
3. TSI has managed to optimize costs by combining the delivery of study courses between different study programmes.

Weaknesses:
1. Number of students has significantly decreased by 45% in the last 4 years and negatively impacted the financial sustainability of the programme.

Assessment of the requirement [6]

1 R6 - Compliance of the study provision, science provision (if applicable), informative provision (including library), material and technical provision and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of learning outcomes

Assessment of compliance: Fully compliant

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has a broad range of classrooms and laboratories supported by necessary information systems.
The academic staff is made up of highly experienced personnel and invited experts from the industry.
TSI has implemented improvements to optimize costs per student by combining the delivery of study courses between study programmes without a negative impact on achieving learning objectives.
The study programme is financed mostly by students' tuition fees and the historical number of students is sufficient to keep this programme cost-effective.

2.4. Teaching Staff

Analysis

2.4.1
The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 269-271) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The study programme courses are taught by 28 teaching staff members, of whom 22 have been elected at TSI. 7 TSI professors and 3 associate professors are involved in the implementation of the compulsory and limited optional part of the programme. Additionally, 7 assistant professors and 4 lecturers are also involved in the implementation of the programme. 77% of the academic staff involved in the programme have a doctoral degree - 15 in engineering and 2 in social sciences, relevant academic work experience and qualifications.
In addition to the academic staff, several industry specialists and foreign teaching staff take part in the teaching process, either as guest lecturers or with responsibility for full course delivery. 2 of the guest lecturers have a Doctoral degree, the others have Master's degrees.
According to Annex 3.9 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions. Similarly, according to the SAR, the knowledge of the national language of the teaching staff involved in the programme complies with MK 07.07.2008. to regulations no. 733 "Rules on the amount of knowledge of the national language and the procedure for testing the

national language proficiency for the performance of professional and official duties, obtaining a permanent residence permit and obtaining the status of a permanent resident of the European Union and the state fee for the national language proficiency test".

2.4.2.
The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 271-272) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The number of teaching staff involved in the implementation of the study programme is eight more than the corresponding number during the previous accreditation (28 instead of 20). This is because an improved programme with three specializations is submitted now for an assessment. However, only 8 members of the teaching staff are the same. During the reporting period, new (elected TSI) lecturers were recruited into the programme and several teaching staff members have increased their academic work experience and have been elected to higher-level positions. Some of the teaching staff obtained a doctorate during the reporting period and are now teaching in the study programme.
TSI examines the competencies of the teaching staff as part of the hiring process, including by the Director of the study programme. In cases when competencies need updating, this is done by means of seminars. As a result, no teaching staff member is assigned teaching duties in subjects, not among their respective competencies. However, unexpected needs to fill teaching gaps are difficult to satisfy; this is usually done by employing lecturers from other Universities, who mostly teach remotely.

2.4.3.
N/A

2.4.4.
The analysis herein is based on the information provided in the Annex "Biographies of the teaching staff members (Curriculum Vitae in Europass format)" of the SAR.
7 Professors (Grakovskis, Jackiva, Kabaškins, Mishnevs, Pavlyuk, Pticina, Stukalina) and 3 associate professors (Kraiņukovs, Spiridovska, Sproge) are listed as teaching staff members taking part in the implementation of the study programme. According to their CVs, they are all active in research and have published in international venues in the last six years and/or have practical experience.

2.4.5.
The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 273-274) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
During the implementation of the study courses, regular meetings of the teaching staff take place, in which they exchange experiences on the study course topics, research results, new developments in the research, etc. Discussions are used to develop and improve the content of studies, with mutual agreement on topics, emphases, responsibilities, and compliance with regulatory requirements.
In the faculty, there is cooperation between individual lecturers who read one study course together to coordinate the topics to be learned during the lessons and ensure common requirements, according to the course description and other current events.
Important cooperation events are preliminary and final defences of bachelor theses. The preliminary defences are organized with the participation of a committee of faculty members, where recommendations for improvement are collectively made. Cooperation is also observed during and after the final defence of master theses when the Final Examination Commission gives its evaluation as a result of the discussion.

Conclusions on this set of criteria, by indicating strengths and weaknesses

The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and study results of the study programme and corresponding study courses. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme. All members of the academic staff in the last six years have published in peer-reviewed international venues and/or have five years of practical experience, in accordance with the Law on Higher Education Institutions.

Strengths:
1. The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and study results of the study programme and corresponding study courses.
2. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme.
3. All members of the academic staff in the last six years have published in peer-reviewed international venues and/or have five years of practical experience, in accordance with the Law on Higher Education Institutions.

Weaknesses:
None

Assessment of the requirement [7]

1 R7 - Compliance of the qualification of the academic staff and visiting professors, visiting associate professors, visiting docents, visiting lecturers and visiting assistants with the conditions for the implementation of the study programme and the requirements set out in the respective regulatory enactments.

Assessment of compliance: Fully compliant

All criteria are mostly fulfilled. The presence of highly qualified academic staff members, compliance with regulatory requirements, and the inclusion of industry specialists and foreign teaching staff contribute positively to the study programme. Addressing potential weaknesses, such as ensuring consistency in staffing and verifying the qualifications of the visiting staff, could further enhance the overall educational experience for students.

2.5. Assessment of the Compliance

Requirements

1 1 - The study programme complies with the State Academic Education Standard or the Professional Higher Education Standard

Assessment of compliance: Fully compliant

The study programme “Computer Engineering and Electronics” volume is 160CP of which 74CP are a compulsory part, 70 CP are for compulsory choice study courses, 6CP for the free elective part, and 10CP for Bachelor’s thesis. The programme structure complies with Cabinet Regulations No. 240.
The study programme includes obligatory study courses about environmental protection and civil protection.
The acquirable degree is in compliance with classification in regulatory enactments.
The study programme fully complies with the State Academic Higher Education Standard and Cabinet Regulation No. 240.

2 2 - The study programme complies with a valid professional standard or the requirements for the professional qualification (if there is no professional standard required for the relevant occupation) provided if the completion of the study programme leads to a professional qualification (if applicable)

Assessment of compliance: Not relevant

N/A

3 3 - The descriptions of the study courses and the study materials have been prepared in all languages in which the study programme is implemented, and they comply with the requirements set forth in Section 561 , Paragraph two and Section 562 , Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

Study course descriptions and study materials are prepared in Latvian and English languages, and they satisfy requirements set in Law on Higher Education Institutions.

4 4 - The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure according to which state recognised documents of higher education are issued.

Assessment of compliance: Fully compliant

The diploma issued complies with the state legislature and “Procedures by which documents certifying higher Education recognised by the State shall be issued” (Cabinet of Ministers No. 202).

5 5 - The academic staff of the academic study programme complies with the requirements set forth in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

There are at least 5 associate professors or professors involved in the study programme implementation together. It is confirmed by the TSI Rector confirmation.

6 6 - Academic study programmes provided for less than 250 full-time students may be implemented and less than five professors and associated professors of the higher education institution may be involved in the implementation of the mandatory and limited elective part of these study programmes provided that the relevant opinion of the Council for Higher Education has been received in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Not relevant

N/A

7 7 - At least five teaching staff members with a doctoral degree are among the academic staff of an academic doctoral study programme, at least three of which are experts approved by the Latvian Science Council in the respective field of science. At least five teaching staff members with a doctoral degree are among the academic staff of a professional doctoral study programme in arts (if applicable).

Assessment of compliance: Not relevant

N/A

8 8 - The teaching staff members involved in the implementation of the study programme are proficient in the official language in accordance with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties.

Assessment of compliance: Fully compliant

The academic staff has sufficient Latvian language knowledge for implementing study courses. This is confirmed by a TSI Rector's signed confirmation.

9 9 - The teaching staff members to be involved in the implementation of the study programme have at least B2-level knowledge of a related foreign language, if the study programme or any part thereof is to be implemented in a foreign language (if applicable).

Assessment of compliance: Fully compliant

The academic staff has sufficient foreign language knowledge for implementing study courses (at least B2). This is confirmed by a TTI Rector's signed confirmation.

10 10 - The sample of the study agreement complies with the mandatory provisions to be included in the study agreement.

Assessment of compliance: Fully compliant

Study agreements include all necessary parts set in legislation. It is advised to include information about guarantees of compensation losses (criteria No. 11 and 12) so that this information is easier for the students to acknowledge already from the beginning.

11 11 - The higher education institution / college has provided confirmation that students will be provided with opportunities to continue their education in another study programme or another higher education institution or college (agreement with another accredited higher education institution or college) if the implementation of the study programme is terminated.

Assessment of compliance: Fully compliant

TSI has a cooperation agreement with Riga Technical University confirming that in case the implementation of programmes in this study field is terminated, students will be able to continue studies in the RTU study field "Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management and Computer Science".

12 12 - The higher education institution / college has provided confirmation that students are guaranteed compensation for losses if the study programme is not accredited or the study programme's license is revoked due to the actions (actions or omissions) of the higher education institution or college and the student does not wish to continue studies in another study programme.

Assessment of compliance: Fully compliant

University has a rector's signed refund and compensation policy that confirms it will compensate losses to students if the study programme is not accredited or loses its license and the student does not wish to continue studies in another study programme.

13 13 - The joint study programmes comply with the requirements prescribed in Section 55.(1), Paragraphs one, two, and seven of the Law on Higher Education Institutions (if applicable)

Assessment of compliance: Not relevant

N/A

14 14 - Compliance with the requirements specified in other regulatory enactments that apply to the study programme being assessed (if applicable)

Assessment of compliance: Not relevant

N/A

Assessment of the requirement [8]

1 R8 - Compliance of the study programme with the requirements set forth in the Law on Higher Education Institutions and other regulatory enactments.

Assessment of compliance: Fully compliant

The requirement has been met and fulfilled, and all requirements set in different regulatory enactments are satisfied - the study programme complies with State Academic Education Standard and Law on Higher Education Institutions. There are no additional regulations specific to this field.

General conclusions about the study programme, indicating the most important strengths and weaknesses of the study programme

In conclusion, the study programme aligns with TSI's strategic goals and enjoys recognition from stakeholders. The integration of electronic engineering and computer science fields caters to the demands of modern technology. Collaboration with industry specialists ensures that the program meets the needs of the labour market. The project-based approach equips students with practical competencies and interdisciplinary communication skills. However, efforts should be made to attract more international students and foster a multicultural learning environment. Opportunities for research and innovation engagement among the teaching staff need to be expanded. Balancing the emphasis on computer science and electronics within the curriculum is crucial, as is addressing the decline in student numbers and incorporating more practical activities.

Strengths:
1. Study programme is in line with the strategic goals of TSI.
2. Study programme is well-recognized by all stakeholders.
3. The program is designed to integrate two fields of electronic engineering and computer science, which are both essential in modern technology, particularly in the development of embedded electronic systems, industrial automation devices, telecommunication systems and computer networks.
4. The three specializations of the programme were developed in collaboration with specialists from companies in various industries, including embedded electronic systems, industrial production, telecommunications, and computer networks, ensuring that the programme meets the current and future needs of the labour market.
5. Project-based approach: The programme includes individual and group projects, allowing students to develop practical professional competencies, project management skills, and interdisciplinary communication, which are essential for successful professional activity in the field

Weaknesses:
1. The SAR mentions that the majority of the students in the programme are Latvian, and there is limited participation from international students. The programme may benefit from more efforts to attract and recruit international students and foster a more diverse and multicultural learning environment.
2. Limited engagement with research and innovation: While the report indicates that some lecturers are involved in research projects and activities, there could be more opportunities for the teaching staff to engage in research and innovation and to bring their findings and expertise into the classroom.
3. There appears to be a stronger emphasis on computer science within the programme compared to electronics. As the programme is titled "Computer Engineering and Electronics", it is important to ensure that both fields receive adequate attention and focus.

4. Number of students has significantly decreased by 45% in the last 4 years and negatively impacted the financial sustainability of the programme.
5. Curicula contains a low amount of practical activities outside of TSI

Evaluation of the study programme "Computer Engineering and Electronics"

Evaluation of the study programme:

Good

2.6. Recommendations for the Study Programme "Computer Engineering and Electronics"

Short-term recommendations

Increase efforts to attract and recruit more (inclusively international) students through better educational marketing and improving the academic offer.
Provide more opportunities for teaching staff to engage in research and innovation and bring their expertise into the classroom.
Encourage interdisciplinary collaboration between the program and other faculties or programmes within the institute.
Evaluate whether to include information about compensations and other study opportunities (in case the programme is discontinued) in the study agreement.

Long-term recommendations

Reevaluate the balance of computer science and electronics within the programme and consider adjusting the curriculum to ensure both fields receive adequate attention and focus.
Develop more partnerships with industry leaders to offer internships or other experiential learning opportunities for students to better fit the studies to the industrial requirements.
Due to the decreased and low number of students, TSI needs to focus on making this study programme more competitive and on attracting new students.

II - "Robotics" ASSESSMENT

II - "Robotics" ASSESSMENT

2.1. Indicators Describing the Study Programme

Analysis

2.1.1
The study programme "Robotics" is designed in accordance with the study field and its related areas, such as control systems, automation, artificial intelligence, and computer vision. The programme includes a broad range of topics that are relevant to the field of robotics and its practical applications. The content of the programme is based on a thorough analysis of the robotization processes and situation in the world and current tendencies in the Baltic region focusing on supporting the regional industry progress. The current trends and regional needs proven by the good collaboration with the local companies are the strong foundations of the programme.
The programme covers both theoretical and practical aspects of robotics, including the design,

development, and operation of robotic systems. The curriculum includes courses such as "Robot Kinematics and Dynamics," "Robot Control Methods," "Sensors and Electric Machines of Robotic Devices," "Introduction to Intelligence Systems," "Autonomous Robots" and "Industrial Robots". These courses cover the fundamental concepts and skills needed for students to succeed in the field of robotics. Practical work allows students to apply their theoretical knowledge to real-world problems and to develop practical skills, which are highly valued by employers. In addition, the study programme also emphasizes the importance of communication skills, teamwork, and ethical considerations, which are essential for success in the field of robotics. These skills are developed through various activities, such as group projects, presentations, and discussions. It could not be noted a course introduced in the EU prioritized energy and green footstep issues such as optimization of the use of energy, robots modularization and recyclability etc. although these issues could be integrated into some general course in an implicit way.
While the programme provides opportunities for practical experience through internships, practicals, and laboratory sessions, there may be a need for more extensive and comprehensive hands-on experience in robotics to better prepare students for the demands of the job market and their future careers.

Overall, the study programme "Robotics" is well-aligned with the study field and provides students with the knowledge, skills, and practical experience needed to succeed in the field of robotics.

2.1.2
The title, code, degree to be obtained, degree, aims, objectives, learning outcomes, and admission requirements of a study programme are interrelated and should be aligned with each other. The title and code of the study programme reflect the content and focus of the programme. The degree to be obtained and professional qualification or degree is appropriate for the knowledge, skills, and competencies that the programme aims to provide. The aims and objectives of the programme are clearly defined and aligned with the learning outcomes that students are expected to achieve upon completion of the programme. Furthermore, the admission requirements are set in such a way as to ensure that only students with the necessary academic background, knowledge, and skills are admitted to the programme and that they are able to successfully complete the programme and achieve the intended learning outcomes. The admission requirements for the English language programme: present a CE certificate in English, an assessment in English in the documents of previous education, or an English language examination of an internationally recognized testing institution at least at B2 level, or the result of the TSI English language entrance examination and pass an entrance examination in Physics and Mathematics are reasonable to assume successful and uniform further learning process
Therefore, it is important that all these elements of a study programme are carefully considered and interrelated to ensure that the programme is relevant, coherent, and effective in achieving its intended outcomes.
The duration and scope of the study programme implementation, as well as the implementation language, are reasonable and justified. The scope of the programme is also reasonable, as it includes a combination of compulsory, restricted elective, and free elective courses, which cover various aspects of robotics, including mechanics, electronics, control systems, and programming. The programme also includes a final thesis, which allows students to demonstrate their ability to apply their knowledge and skills to real-world problems in the field of robotics. The implementation language of the programme is justified, as the programme is offered in Latvian and English, which are the two official languages of the European Union. This allows the programme to attract both local and international students and ensures that graduates are proficient in at least one of these languages, which is important in the global job market. Additionally, the study programme offers different implementation options, such as full-time and part-time study modes, which allow students

to choose the option that best suits their individual needs and circumstances. This flexibility is essential in ensuring that the study programme is accessible to a wide range of students, including those who may have work or family commitments. Overall, the duration and scope of the study programme implementation, as well as the implementation language and options, are reasonable and justified, and meet the needs of both local and international students. The interdisciplinary approach of the robotics programme allows students to acquire knowledge and skills in multiple fields related to robotics, preparing them to handle real-world problems and work on complex projects that require a multidisciplinary approach.
Experts noticed a situation in that all the local (Latvian) students choose the English language study programme which may lead to thoughts on how to combine the teaching to provide more Latvian language courses to foreign students to help them to adapt later in Latvian companies.

2.1.3
The corrections made to the study programme's parameters within the assessment of the study field are analyzed and justified. The decision to transform the programme "Robotics" into an academic programme from the 2019 intake and award a Bachelor of Engineering degree in electronics and automation was made after discussions with employers and industry experts as well as based on analysis of the robotics trends in the world. This decision was based on the need to increase the competitiveness of the study programme by reducing the duration of studies by one semester while maintaining all general education study courses and two specialization study courses. The SAR describes the Professional Bachelor's Degree programme in Robotics at TSI, which has a duration of four years for full-time studies. As of the 2019 intake, the programme has been changed to an Academic Bachelor's Degree programme, bringing it in line with the standard duration of Bachelor's degree programmes in many countries. The changes made to the programme's curriculum were also justified, such as the removal of the study course "Production Practice" and the reduction of the study course "Teaching Practice" to 6 CP. The deletion of the final thesis "Bachelor thesis with project part" and the reduction of the project part from 12 CP to 10 CP were also reasonable adjustments. Additionally, the removal of "Digital Image Processing and Computer Vision" from the study plan of the Bachelor programme and its inclusion in the study plan of the Master study programme "Computer Engineering and Electronics" were justifiable decisions. Moreover, the exclusion of "Optimisation Methods" from the study programme, as the material of this course is included in the Master's study programme "Computer Engineering and Electronics," and the reduction of the total number of credits in the English language courses from 8 CP to 6 CP were also reasonable corrections. The increase of the study course "Materials Engineering" from 2 to 4 CPs and the inclusion of the course "Introduction to Scientific Research" in the curriculum at 2 CPs were also justified adjustments. In conclusion, the corrections made to the study programme's parameters within the assessment of the study field were well-analyzed, justified, and would be supported.

2.1.4
The study programme "Robotics" has a clear economic and social justification, as the demand for robotics professionals has been steadily increasing in recent years due to the growth of the robotics industry and the increasing adoption of automation technologies in various sectors. The dynamics of the number of students in the programme have been positive, with 32 students enrolled as of October 2022. This indicates that there is a growing interest in the field of robotics among students.
However, as the field of robotics and automation continues to evolve, there is a limited focus on entrepreneurship. Given the increasing demand for entrepreneurship skills in the job market, a stronger emphasis on entrepreneurship skills could be a valuable addition to the programme. Employment indicators of the graduates of the study programme are also positive. Many graduates of the programme have found employment in various sectors of the industry, such as

manufacturing, logistics, and healthcare, among others. Some of the employers of the graduates include ABB, Ericsson, LMT, Robologic Ltd and Technomatic Ltd and Accenture, among others. The programme's emphasis on practical skills and collaboration with industry experts and professional organizations ensures that the graduates are well-equipped to meet the demands of the job market.
Although the programme has some practical experience through internships and laboratory sessions, more extensive hands-on experience in robotics may be necessary for better preparation of students for their careers.
It is essential to mention the TSI academic staff activities to promote the robotics field among schoolchildren in the form of visiting lectures and running the Lego Robotics Club and Robotics and Electronics Club since 2014. The TSI teachers teach open robotics classes in schools in Riga. The clubs participate in local and Baltic robotic competitions yearly. This TSI activity is a substantial contribution to promoting the engineering field and robotics in society and has a positive social impact. This gives sureness of the study direction success for the future. The programme provides research opportunities for students, allowing them to develop their research skills and prepare for further studies or a career in research. Emerging technologies such as artificial intelligence and machine learning should be further developed and improved.
Overall, the study programme "Robotics" has a clear economic and social justification, and the positive dynamics of the number of students and employment indicators of the graduates attest to its relevance and effectiveness. It could be advisable to enhance the international exposure, which is currently limited.

2.1.5
N/A

Conclusions on this set of criteria, by specifying strengths and weaknesses

The programme shows promise in preparing students for the demands of the robotics industry, but there is room for improvement.

Strengths
1. Strong connection with industry: The study programme has a mechanism for cooperation with employers and industry experts, which ensures that the programme is continuously updated to reflect the latest developments in the field of robotics. This, in turn, ensures that graduates of the programme are well-equipped to meet the demands of the industry.
2. Interdisciplinary approach: The programme maintains an interdisciplinary approach, which allows students to gain knowledge and skills in a variety of fields related to robotics. This prepares them to work on complex projects and handle real-world problems that require a multidisciplinary approach.
3. Continuous improvement: The programme's curriculum is continuously reviewed and updated to reflect changes in the industry and feedback from students and industry experts. This ensures that the programme remains relevant and up-to-date.
4. Research opportunities: The programme provides opportunities for students to engage in research activities, which can help them develop their research skills and prepare them for graduate studies or a career in research.
5. High employability of graduates: The study programme has a high employability rate, which suggests that graduates are well-prepared to enter the workforce and contribute to the industry.
6. Robotics competitions: The institution's participation in robotics competitions is a significant strength. These competitions provide students with opportunities to apply their knowledge and skills in a competitive environment, fostering a spirit of collaboration, innovation, and creativity. Such events also help to build a sense of community within the institution and promote a culture of scientific achievement and excellence.

Weaknesses
1. Limited focus on entrepreneurship: Given the increasing demand for entrepreneurship skills in the job market, a stronger emphasis on entrepreneurship could be a valuable addition to the programme.
2. Limited practical experience: While the programme provides some opportunities for practical experience through internships, practicals, and laboratory sessions, there may be a need for more extensive and comprehensive hands-on experience in robotics to better prepare students for the demands of the job market and their future careers. Providing additional opportunities for students to gain practical experience could help them develop valuable skills and competencies that are highly sought after by employers in the field of robotics.
3. Limited exposure to emerging technologies: While the SAR notes that the programme is continuously updated to keep up with the rapid development of the ICT sector, there is an insufficient emphasis on emerging technologies such as artificial intelligence or machine learning, which are becoming increasingly important in the field of robotics. Enhancing the programme to provide students with more exposure to these areas could greatly benefit their future career prospects.
4. Limited international exposure: Providing students with more opportunities for international exposure could broaden their perspectives and increase their competitiveness in the global job market.

2.2. The Content of Studies and Implementation Thereof

Analysis

2.2.1
The programme has two specializations: "Industrial Robotics" and "Autonomous Robots", each of which contains compulsory general education and industry theoretical courses and training courses in information technology of 72 CP (Part A), compulsory industry vocational training courses and vocational specialization elective courses of 68 CP (Part B) and free elective courses (Part C) of 6 CP. The compulsory theoretical and information technology courses (Part A) and the compulsory field-specific training courses (Part B) total 118 CP. These courses correspond to the four fields of study. 52% of all the courses are in the field of "Electrical Engineering, Electronics, Information and Communication Technologies" and 26% of all the courses are in the field of "Computer Science and Informatics". As computer science and programming are of rising importance in robotics the division could be discussable, especially in the future. The course groups in "Mechanical Engineering and Mechanics" and "Materials Science", which are essential in understanding real robot practical behaviour in real situations not only on the computer screen constitute respectively 18% and 4% seems reasonable.
The specialization courses are included in the limited elective part of the programme as specialization B1- "Industrial Robotics" in the amount of 20 CP, and specialization B2- "Autonomous Robots" in the amount of 20 CP. TSI students have the option to choose courses from another specialization of their programmes in the amount of 6 CP (Part C) or from the Part A or Part B of the other study programmes at TSI faculty. This option should be considered also important for such a fast-developing field as robotics.
The programme has two specializations: "Industrial Robotics" and "Autonomous Robots", they are topical and correspond to current trends in the industry and they are well balanced. The programme covers all main basic robotics-related topics and contains an essential part of practical classes and tasks as seen in the SAR Annex 1.4. “The curriculum of the study programme”. The programme blocks are logical and, what is essential, the students are introduced to robotics practical and theoretical aspects already in the first year. Also, the specializations should be considered appropriate for the industry as industrial robots and autonomous robots have some essential

specialities. Machine learning and AI have a growing role in robotics and it might be useful to consider increasing the related topics in this programme at least as an optional course if this does not fit into the BSc level then consider respective courses in the future when planning the MSc programme.
In the light of the outcomes to be achieved within the study programme, specific study courses were identified and the scope of knowledge, skills and competencies to be achieved within each individual course was defined to support the teachers and students.
AI topics are becoming more and more important in the field of Robotics and therefore introducing more AI-related courses could be suggested. There is only one course Introduction to Intelligence Systems which is quite basic, especially for the field. Industries are preparing for the 5th level of the INDUSTRY 5.0 activity plan in the EU where robotics has a key role and topics Internet of Things and Big Data in conjunction with robotics applications are substantial. These topics Internet of Things and Big Data could not be noticed in the curriculum even in implicit form though some students and employers mentioned their role in future during the discussions.
The relevance of the course of study is also ensured by the proportion of teaching staff recruited from the industry and by periodic meetings with the employers. The course content and teaching process assessment are realized by collecting feedback from the employers through surveys and regular meetings organized by the Head of the Study Programme and Dean of the Faculty. The survey analyses show that the content of the study programme is relevant and overall aims and outcomes of the study programme are achievable.
Updated courses of the study programme are coordinated, approved and included in the Register of Study Programmes and uploaded to the E-learning environment Moodle by the beginning of the new academic year.
The study programme has been developed in accordance with the requirements of the State Cabinet of Ministers Regulation No.240 "Regulations on the State Standard of Academic Education".

2.2.2
N/A

2.2.3
In the light of the outcomes to be achieved within the study programme, specific study courses were identified and the scope of knowledge, skills and competencies to be achieved within each individual course was defined to support the teachers and students.
Part-time extramural studies of the programme are for 5 years both in Latvian and English and the studies for this form of learning are organized as full on-site learning at the TSI on Saturdays. Most of the laboratory classes are concentrated on Saturdays and mixed (mostly) remote classes in the second half of the week by evenings. It was mentioned during the meetings with the academic staff and students both confirmed that the evening class times are adjusted according to the needs of the extramural students and it is assured availability of all the teaching materials in the E-learning System and availability of the teachers for remote consultancy. The system is relatively teaching load consuming but the experts noticed satisfaction with the system from the student side and acceptance from the teachers' side. It should be noted that the extramural teaching system fills an essential cap for obtaining the education for people working and having families which was confirmed by the students and graduates during the meetings.
All the teachers are very dedicated and professional and open to discussing, demonstrating and adjusting the teaching according to the student's needs as confirmed during the meeting and discussion with the students and teachers. It is worth mentioning that employers also confirmed the openness of the teachers and teaching process regarding the students' and professional needs. The last one is supported by the motivated students as was noted on the on-site meetings.
Updated courses of the study programme are coordinated, approved and included in the Register of

Study Programmes and uploaded to the E-learning environment Moodle by the beginning of the new academic year.

2.2.4
N/A

2.2.5
N/A

2.2.6
There is an option for the students to choose the topic of the final thesis by themselves or the students can contact and ask the academic staff or bring the topic from a company. The proposed topics will be discussed and agreed upon with the Head of the Study programme, which assures that the topics are relevant to the programme. It should be mentioned that TSI has on their website an available list of all the running and former research and development projects with the contact data of the principal investigator. This helps the students interested in the research options to find suitable final thesis topics.
There are no graduates of the programme for the moment of the assessment and therefore there are no theses defended in this programme.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The programme has two specializations: "Industrial Robotics" and "Autonomous Robots", they are topical and correspond to current trends in the industry and they are well balanced. The content of the programme and learning outcomes are described and justified in detail in SAR. The relevance of the courses of study is also ensured by the proportion of teaching staff recruited from the industry and by periodic meetings with employers. The study programme has been developed in accordance with the requirements of the State Cabinet of Ministers Regulation No.240 "Regulations on the State Standard of Academic Education". Some questions were raised about how the bachelor students of the programme are introduced to topics Internet of Things and Big Data. The combination of full-time and part-time study options allows one to find a suitable learning path for each student according to personal needs and possibilities. The programme is based on well-developed laboratories and the mechanism of updating the courses in collaboration with companies works well.

Strengths
1. Motivated students.
2. Well-structured programme.
3. Good collaboration with companies in the field.
4. Well-developed E-learning environment, which supports the study process.

Weaknesses
No weaknesses

Assessment of the requirement [5] (applicable only to master's or doctoral study programmes)

1 R5 - The study programme for obtaining a master's or doctoral degree is based on the achievements and findings of the respective field of science or field of artistic creation.

Assessment of compliance: Not relevant

N/A

2.3. Resources and Provision of the Study Programme

Analysis

2.3.1
TSI has a proven record of establishing and delivering engineering study field programmes. Higher education institution has a broad range of classrooms and laboratories supported by necessary information systems (intranet, Moodle, mobile application with time schedule and public portal) and specialized software to ensure delivery of study programme and provide necessary prerequisites for the achievement of learning. Students can use physical and electronic libraries (Academic Complete, Science Direct, Scopus, limited access to Coursera and other sources) to get necessary materials for their studies. Though the number of electronic databases in the Library is not high and students mentioned that they prefer electronic materials instead of hard copies. It was noticed by the experts during the meetings with the students that some were unfamiliar with the IEEE databases and options to join the IEEE student community which would open them to an enormous amount of automation, robotics, computer science and electronics later resources.
Delivery of the Robotics Bachelor Study Programme requires specific equipment for laboratory work. TSI has established 11 specialized laboratories including laboratories of Industrial Automation, Robotics, Electronics, Mobile and Industrial Robots that are used by academic staff and students in relevant study courses of this programme. The robotic and related equipment in these laboratories is impressive and fully relevant to deliver the programme courses. TSI has established partnerships with industry-leading companies in the robotics area to equip laboratories with modern devices and systems and this kind of collaboration gives strong support for the programme. Laboratory of Industrial Automation; Robotics and Students' Research Work Laboratory; Laboratory of Electronics; Laboratory of Mobile Robots and Laboratory of Industrial Robot are modern equipped and fully suitable for both teaching and research. The premises of these laboratories are quite small though it was mentioned by the Dean of the Faculty and the Head of the Study programme that students can get access to these laboratories outside class hours too. Development of the laboratories and respective support from the companies is expected to give a boost to research and students` involvement in the research activities.
TSI has attracted and managed to keep an expert-level academic staff that is able to deliver study programmes in both languages (Latvian and English) and effectively collaborate and support students. To increase study programme relevance and strengthen the delivery of study courses, TSI has involved industry experts in the robotics area in the teaching process (i.e. Vasilijs Gredasovs (Robologic), Jevgenijs Čačiks (SAF Tehnika), Artjoms Ivanovs (Verifone), Maksims Smoļaņinovs (Aviatest LTD), Tomass Delavka (Robologic) and others).
During the sessions with students and teachers (all separately), both groups reconfirmed the sufficiency of the existing processes and the availability of necessary equipment to ensure well-organized face-to-face and remote classes including practical classes in laboratories. Students also have the opportunity to get involved in the activities of the research projects. Respective information on the possibility of participating in projects or other activities is given on the TSI website and by involving students individually, taking into account their desire to gain practical experience.

2.3.2
N/A

2.3.3
Despite the pandemic and other challenges that impact the total number of students, TSI managed to open this new study programme and grow the total intake from 7 in the year 2019/2020, when the programme started, to 19 in the year 2021/2022 and this number is expected to grow. The

current number of students remains quite low yet to have financial sustainability, however, TSI has managed to mitigate this challenge by combining the delivery of the same study courses of several study programmes. This helped to optimize the utilization of academic staff and institution premises and decrease costs. Based on the feedback received from students, such optimization has not impacted the achievement of learning objectives and even provided advantages to students by extending their relationship network and collaboration between students of different study programmes.
The tuition fee has been the main source of funding for the study process and this is one of the limiting factors for the future development of the institution. Research income constitutes only a small fraction of the whole programme budget. A more detailed analysis is given in this report in the section on the Study Field. For the academic year 2022/2023, the tuition fee for one full-time student is EUR 2200 per year and for the part-time student - EUR 1760 per year. Leverage to the situation gives the option for the students to obtain company scholarships, in the Robotics programme, five scholarships were provided by the company Robologic GmbH. The number of scholarships is a clear indicator of the company's interest in the graduates of this programme. It is stated in SAR that the minimum number of students on a programme is 10 to manage with the resources available at TSI.

Conclusions on this set of criteria, by specifying strengths and weaknesses

Students and teaching staff are fully equipped to achieve learning objectives and assure graduating from the programme. TSI has a broad range of classrooms and laboratories supported by necessary up-to-date information systems and the equipment in the robotics and electronics labs is remarkable. Development of the laboratories and respective support from the companies is expected to give a boost to research and students` involvement in the research activities. Companies are helping to pay the tuition fees for the students which is a clear indication of the companies' interest towards the programme.
TSI has implemented improvements to make this study programme more attractive for students. Stable growth of the number of students and strong collaboration with industry partners makes the Robotics programme a strong and sustainable programme in the near and long-term future.

Strengths:
1. TSI has the necessary resources (premises, teaching staff and IT systems) and working processes to achieve learning objectives and support students with their graduation.
2. Remarkable number of specialized laboratories (11 specialized labs).
3. Students have access to modern laboratories after class times, which is promoting student initiation in the field.
4. Strong collaboration with industry partners enables development of the specialized laboratories and integrates industry experience and expertise into the delivery of study courses.
4. Professional and well-trained staff.

Weaknesses:
1. Number of students is still low and would require a significant increase to make the programme financially sustainable.
2. Students do not have access to IEEE organization resources which is one of the world’s biggest professional organizations in the field of the programme (creating an IEEE student branch at the TSI is advised).
3. Not enough research projects
4. Proportion of the study programme budget grounds mainly only to tuition fees.

Assessment of the requirement [6]

1 R6 - Compliance of the study provision, science provision (if applicable), informative provision (including library), material and technical provision and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of learning outcomes

Assessment of compliance: Fully compliant

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has a broad range of classrooms and laboratories supported by necessary information systems and equipment
Academic staff is built from highly experienced own personnel and invited experts from the industry.
TSI has implemented improvements to optimize costs per student by combining the delivery of study courses between study programmes without a negative impact on achieving learning objectives.
The study programme is financed mostly by students' tuition fees and the historical number of students is sufficient to keep this programme cost-effective.

2.4. Teaching Staff

Analysis

2.4.1.
The analysis herein is based on the information provided in the SAR pp. 341-343 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The study programme courses are taught by 31 teaching staff members, of whom 25 have been elected at TSI. 8 TSI professors and 3 associate professors are involved in the implementation of the compulsory and limited optional part of the programme. Additionally, 10 assistant professors, 3 lecturers and 1 research assistant are also involved in the implementation of the programme. 84% of the academic staff involved in the programme have a doctoral degree – 19 in engineering and 2 in social sciences, relevant academic work experience and qualifications.
In addition to the academic staff, several industry specialists and foreign teaching staff take part in the teaching process, either as guest lecturers or with responsibility for full course delivery. 2 of the guest lecturers have a Doctoral degree, the others have Master's degrees. Some courses have several lecturers, or the main course is taught by the programme director. In many cases it is expected that the representatives of the industry will be invited as guest lecturers for some specific topics, thus ensuring both the quality and relevance and introduction of the newest information from the industry of the study course content.
According to Annex 1.8 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions. Similarly, according to the SAR, the knowledge of the national language of the teaching staff involved in the programme complies with MK 07.07.2008. to regulations no. 733 "Rules on the amount of knowledge of the national language and the procedure for testing the national language proficiency for the performance of professional and official duties, obtaining a permanent residence permit and obtaining the status of a permanent resident of the European Union and the state fee for the national language proficiency test".

2.4.2.
The analysis herein is based on the information provided in the SAR pp. 343-344 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The number of teaching staff involved in the implementation of the study programme is nine more

than the corresponding number during the previous accreditation (31 instead of 22). During the reporting period, the programme has attracted new (elected by the TSI) lecturers teaching a specific course or a part of it. Of these, seven lecturers have doctoral degrees, two are professors, 6 are assistant professors and 3 are lecturers.
The number of professors involved in the programme has increased from the academic year 2018 from 3 to 8 in the year 2022. The number of lecturers with a masters degree has increased too from 1 to 4 and the number of rest of the teaching staff is almost the same in the mentioned period. During the reporting period, the programme has attracted new (elected by the TSI) lecturers teaching some specific course or a part of it. Of these, seven lecturers have doctoral degrees, two are professors, six are assistant professors and 3 are lecturers, which is an indicator of the renewal process of the teaching staff. The total number of teaching staff has increased due to the study courses providing students with scientific research and practical skills.
TSI examines the competencies of the teaching staff as part of the hiring process, including by the Director of the study programme. In cases when competencies need updating, this is done by means of seminars. As a result, no teaching staff member is assigned teaching duties in subjects, not among their respective competencies. However, unexpected needs to fill teaching gaps are difficult to satisfy; this is usually done by employing lecturers of other HEIs, who mostly teach remotely.
Therefore the changes in the structure of the teaching staff involved in the study programme have a positive impact on the teaching process quality and it is appropriate for the achievement of the overall results of the study courses and the programme

2.4.3.
N/A

2.4.4.
The analysis herein is based on the information provided in Annex 10 of the SAR.
8 professors (Grakovskis, Jackiva, Pavlyuk, Kabashkin, Mishnev, Pticina, Savrasovs, Merchan, Stukalina) and 3 associate professors (Krainyukov, Spiridovska, Sproge) are listed as teaching staff members taking part in the implementation of the study programme. According to their CVs, they are all active in research and have published in international venues in the last six years and/or have practical experience.

2.4.5.
The analysis herein is based on the information provided in the SAR pp. 345-346 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
During the implementation of the study courses regular meetings of the teaching staff take place, in which they exchange experiences on the study course topics, research results, new developments in the research, etc. Discussions are used to develop and improve the content of studies, with mutual agreement on topics, emphases, responsibilities, and compliance with regulatory requirements.
In the faculty, there is cooperation between individual lecturers who read one study course together to coordinate the topics to be learned during the lessons and ensure common requirements, according to the course description and other current events.
Important cooperation events are preliminary and final defences of bachelor theses. The preliminary defences are organized with the participation of a committee of faculty members, where recommendations for improvement are collectively made. Cooperation is also observed during and after the final defence of bachelor theses when the Final Examination Commission gives its evaluation as a result of the discussion.

Conclusions on this set of criteria, by indicating strengths and weaknesses

The study programme courses are taught by 31 teaching staff members, of whom 25 have been elected at TSI and 8 of which are professors. Changes in the structure of the teaching staff involved in the study programme have a positive impact on the teaching process quality and it is appropriate for the achievement of the overall results of the study courses and the programme. The number of teachers is publishing actively every year (all 8 professors and 3 Assoc. professors) and the rest of the teachers have the publications too in the required amount.

Strengths:
1. The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and learning outcomes of the study programme and corresponding study courses.
2. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme.
3. All members of the academic staff in the last six years have published in peer-reviewed international venues and/or have five years of practical experience, in accordance with the Law on Higher Education Institutions.
4. Active participation of guest lecturers and industry specialists in the teaching process.

Weaknesses:
No weaknesses

Assessment of the requirement [7]

1 R7 - Compliance of the qualification of the academic staff and visiting professors, visiting associate professors, visiting docents, visiting lecturers and visiting assistants with the conditions for the implementation of the study programme and the requirements set out in the respective regulatory enactments.

Assessment of compliance: Fully compliant

Most of the criteria are satisfied and identified weaknesses can be rectified. One of its notable strengths is the diverse composition of the teaching staff, including elected professors, associate professors, assistant professors, lecturers, and research assistants. Another strength is the inclusion of industry specialists and foreign teaching staff as guest lecturers or full course instructors. Their involvement brings valuable real-world insights and up-to-date industry knowledge to the teaching process, making the programme more relevant and practical for students. Weakness is the reliance on employing lecturers from other higher education institutions to fill teaching gaps. This may introduce challenges in terms of consistency and alignment with the programme's requirements, particularly if these lecturers teach remotely. While the programme has notable strengths, addressing these weaknesses would further enhance the programme's quality and ensure a comprehensive and well-rounded educational experience for the students.

2.5. Assessment of the Compliance

Requirements

1 1 - The study programme complies with the State Academic Education Standard or the Professional Higher Education Standard

Assessment of compliance: Fully compliant

The study programme “Robotics” volume is 160 CP of which 70 CP are a compulsory part, 74 CP are for vocational elective study courses, 6 CP for the free elective part, and 10 CP for Bachelor’s

thesis. The programme structure complies with Cabinet Regulations No. 240.

The study programme includes obligatory study courses about environmental protection and civil protection.

The acquirable degree is in compliance with classification in regulatory enactments.

The study programme fully complies with the State Academic Higher Education Standard and Cabinet Regulation No. 240.

2 2 - The study programme complies with a valid professional standard or the requirements for the professional qualification (if there is no professional standard required for the relevant occupation) provided if the completion of the study programme leads to a professional qualification (if applicable)

Assessment of compliance: Not relevant

N/A

3 3 - The descriptions of the study courses and the study materials have been prepared in all languages in which the study programme is implemented, and they comply with the requirements set forth in Section 561 , Paragraph two and Section 562 , Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

Study course descriptions and study materials are prepared in Latvian and English languages, and they satisfy requirements set in Law on Higher Education Institutions.

4 4 - The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure according to which state recognised documents of higher education are issued.

Assessment of compliance: Fully compliant

The diploma issued complies with the state legislature and “Procedures by which documents certifying higher Education recognised by the State shall be issued” (Cabinet of Ministers No. 202).

5 5 - The academic staff of the academic study programme complies with the requirements set forth in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

There are at least 5 Assoc. Professors or Professors involved in the study programme implementation together. It is confirmed by the TSI Rector confirmation.

6 6 - Academic study programmes provided for less than 250 full-time students may be implemented and less than five professors and associated professors of the higher education institution may be involved in the implementation of the mandatory and limited elective part of these study programmes provided that the relevant opinion of the Council for Higher Education has been received in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Not relevant

N/A

7 7 - At least five teaching staff members with a doctoral degree are among the academic staff of an academic doctoral study programme, at least three of which are experts approved by the Latvian Science Council in the respective field of science. At least five teaching staff members with a doctoral degree are among the academic staff of a professional doctoral study programme in arts (if applicable).

Assessment of compliance: Not relevant

N/A

8 8 - The teaching staff members involved in the implementation of the study programme are proficient in the official language in accordance with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties.

Assessment of compliance: Fully compliant

The academic staff has sufficient Latvian language knowledge for implementing study courses. This is confirmed by a TSI Rector’s signed confirmation.

9 9 - The teaching staff members to be involved in the implementation of the study programme have at least B2-level knowledge of a related foreign language, if the study programme or any part thereof is to be implemented in a foreign language (if applicable).

Assessment of compliance: Fully compliant

The academic staff has sufficient foreign language knowledge for implementing study courses (at least B2). This is confirmed by the TSI Rector’s signed confirmation.

10 10 - The sample of the study agreement complies with the mandatory provisions to be included in the study agreement.

Assessment of compliance: Fully compliant

Study agreements include all necessary parts set in legislation. It is advised to include information about guarantees of compensation losses (criteria No. 11 and 12) so that this information is easier for the students to acknowledge already from the beginning.

11 11 - The higher education institution / college has provided confirmation that students will be provided with opportunities to continue their education in another study programme or another higher education institution or college (agreement with another accredited higher education institution or college) if the implementation of the study programme is terminated.

Assessment of compliance: Fully compliant

TSI has a cooperation agreement with Riga Technical University confirming that in case the implementation of programmes in this study field is terminated, students will be able to continue studies in the RTU study field “Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management and Computer Science”.

12 12 - The higher education institution / college has provided confirmation that students are guaranteed compensation for losses if the study programme is not accredited or the study programme’s license is revoked due to the actions (actions or omissions) of the higher education institution or college and the student does not wish to continue studies in another study programme.

Assessment of compliance: Fully compliant

University has a rector's signed refund and compensation policy that confirms it will compensate losses to students if the study programme is not accredited or loses its license and the student does not wish to continue studies in another study programme.

13 13 - The joint study programmes comply with the requirements prescribed in Section 55.(1), Paragraphs one, two, and seven of the Law on Higher Education Institutions (if applicable)

Assessment of compliance: Not relevant

N/A

14 14 - Compliance with the requirements specified in other regulatory enactments that apply to the study programme being assessed (if applicable)

Assessment of compliance: Not relevant

N/A

Assessment of the requirement [8]

1 R8 - Compliance of the study programme with the requirements set forth in the Law on Higher Education Institutions and other regulatory enactments.

Assessment of compliance: Fully compliant

The requirement has been met and fulfilled, and all requirements set in different regulatory enactments are satisfied - the study programme complies with State Academic Education Standard and Law on Higher Education Institutions. There are no additional regulations specific to this field.

General conclusions about the study programme, indicating the most important strengths and weaknesses of the study programme

The study programme demonstrates several strengths that contribute to its effectiveness and potential for success. It is well-aligned with TSI's strategic goals and has garnered recognition and support from stakeholders, highlighting its credibility and relevance within the educational landscape. The transition to an academic study programme opens up opportunities for enhanced cooperation with UWE Bristol, offering the potential for a unique double degree program in the Baltic region. TSI possesses the necessary resources and working processes to effectively deliver the programme, including specialized laboratories that provide hands-on learning experiences. The active participation of guest lecturers and industry specialists further enriches the teaching process, ensuring a strong integration of real-world insights and industry expertise. However, there are areas that could benefit from improvement. Students currently lack access to valuable resources provided by IEEE, and addressing this limitation would enhance their learning experience and professional development. Additionally, incorporating a stronger focus on entrepreneurship skills within the programme would better prepare students for the evolving job market and foster innovation. Moreover, considering the integration of a course dedicated to energy optimization, green footprint issues, and related topics would align the programme with current industry demands and environmental concerns. Lastly, providing information on criteria 11 and 12 in study agreements from the beginning would ensure clarity and transparency for students regarding these specific criteria.

Strengths:
1. This study programme is well in line with TSI's strategic goals and is well recognized by all stakeholders.
2. Switching to an academic study programme allows for easier cooperation with UWE Bristol, which could result in a unique double degree study programme in the Baltic region.
3. TSI has the necessary resources (premises, teaching staff and IT systems) and working processes to achieve learning objectives and support students with their graduation.
4. Remarkable number of specialized laboratories (11 specialized labs).
5. Strong collaboration with industry partners enables development of the specialized laboratories and integrates industry experience and expertise into the delivery of study courses.
6. Active participation of guest lecturers and industry specialists in the teaching process.

Weaknesses:
1. Students do not have access to IEEE organization resources which is one of the world's biggest professional organizations in the field of the programme.
2. Limited focus on entrepreneurship: Given the increasing demand for entrepreneurship skills in the job market, a stronger emphasis on entrepreneurship could be a valuable addition to the programme.
3. A course introduced in the EU prioritized energy and green footstep issues such as optimization of the use of energy, robots modularization and recyclability etc. could be added or integrated into some general course in an implicit way.
4. This is not a weakness but it would be advised for TSI to consider adding information regarding 11. and 12. criteria in study agreements, so this information would be easier for the students to acknowledge already from the beginning.

Evaluation of the study programme "Robotics"

Evaluation of the study programme:

Good

2.6. Recommendations for the Study Programme "Robotics"

Short-term recommendations

Develop closer cooperation with relevant industries to ensure that the programme remains relevant to the needs of the job market.
Conduct regular assessments of the programme's curriculum and update it based on the latest developments in the field of robotics.
Develop a document specifying rules for calculation and assessing the teaching and research load of academic staff.
Include the analysis of the drop out reasons into the annual surveying process.
Evaluate whether to include information about compensations and other study opportunities (in case the programme is discontinued) in the study agreement.
Introducing more artificial intelligence (AI) related courses is suggested.

Long-term recommendations

Expand the programme's partnerships with other universities and research institutions to facilitate knowledge sharing and collaboration.
Develop a stronger emphasis on entrepreneurship and innovation, providing students with the skills and resources needed to launch their own robotics-related businesses.
Increase the programme's visibility and reputation through marketing and outreach efforts aimed at prospective students, industry partners, and the general public.
Provide more opportunities for students to gain practical, hands-on experience through internships, co-op programes, and research projects.
Develop a light internship programme for last year high school students to introduce TSI study programmes and further job opportunities in the field.

Launch an IEEE student and graduate branch at TSI if possible to get students more integrated into the international professional community.
TSI needs to focus on increasing the number of students.

II - "Management of Information Systems" ASSESSMENT

II - "Management of Information Systems" ASSESSMENT

2.1. Indicators Describing the Study Programme

Analysis

2.1.1

The Master's programme "Information Systems Management" is in compliance with the study field of information technology and information systems management. The programme is designed to provide students with the knowledge and skills necessary for managing information systems in various organizations, as well as to develop the abilities for analysis, design, implementation, and maintenance of information systems. The programme covers a wide range of topics related to information systems management, including enterprise architecture, data management, business intelligence, cybersecurity, project management, and others. The study programme also takes into account the latest developments and trends in the field of information technology and information systems management, such as the use of artificial intelligence, machine learning, big data, and cloud computing. This ensures that students are equipped with the latest knowledge and skills required for successful careers in the field. Moreover, the study programme involves the participation of industry professionals and foreign lecturers, who provide students with practical knowledge and skills relevant to the current needs of the industry. The programme also includes practical assignments and projects, which allow students to apply their knowledge and skills in real-life situations. To ensure that students are well-prepared for the demands of their future careers, it is crucial to prioritize the development of practical skills through a range of diverse and challenging assignments and projects. Therefore, it can be concluded that the Master's programme "Information Systems Management" is in compliance with the study field of information technology and information systems management and provides students with the necessary knowledge and skills for successful careers in the field.

2.1.2

The title, code, degree, aims, objectives, learning outcomes, and admission requirements of a study programme are all interrelated and are aligned with each other. The title of the study programme reflects the specific field of study and the degree that will be obtained upon completion of the programme. The code of the study programme is usually used for administrative purposes and to distinguish it from other programmes. The degree to be obtained is closely related to the professional qualification or degree that the graduate will hold, indicating the level of competence they have achieved in their field of study. The learning outcomes of the study programme are directly related to the aims and objectives and specify the knowledge, skills, and competencies that the students will acquire during their studies.

Finally, the admission requirements of the study programme ensure that students have the necessary background and qualifications to successfully complete the programme and achieve the intended learning outcomes (TSI has adjusted this master programme and enabled people with second-level professional higher education or bachelor degree in economics, Management, Logistics, Finance, Business or other fields and with 1 year of experience in the ICT field to qualify into it). These requirements are clearly defined and communicated to potential applicants, however,

entrance exam and interview are mandatory to fully qualify into the programme, but concrete criteria were not found. Such an option has a positive impact on attraction of new students, but still requires concrete criteria to start the programme.
The duration of the Master's programme "Information Systems Management" is two years or four semesters. The programme implementation options include full-time, part-time, and distance learning, which allows students to choose the most suitable form of study according to their personal circumstances and preferences. The scope of the programme implementation is reasonable and justified, as it covers the necessary theoretical knowledge and skills in the field of information systems management, as well as provides students with the opportunity to deepen their knowledge in certain areas by choosing elective courses. The implementation language of the programme is both Latvian and English, which allows for a wider range of applicants and ensures that graduates are able to work in an international environment. The fact that some study courses are taught in English also provides an opportunity for students to improve their language skills and prepare for working in an international environment. Overall, the duration, scope, and implementation options of the programme, as well as the implementation language, seem reasonable and justified and provide students with the necessary knowledge and skills to work in the field of information systems management.

2.1.3
The analysis shows that the changes made to the study programme's parameters within the assessment of the study field are justified and reasonable. The changes made include the degree to be awarded and the educational classification code, the duration of the programme, and the programme structure. The degree to be awarded has been changed to Master of Science in Computer Applications, educational classification code 482, in order to comply with Latvian legislation, although the degree Master of Engineering in Information Systems Management more accurately describes the content of the programme. The programme has been extended with a short version of 60 CP, which will make the programme more competitive in the Latvian education services market and attract foreign students. The programme structure has also been changed by including new specializations, such as IT project management, Digital transformation, and CyberSecurity operations, which provide students with the opportunity to gain in-depth knowledge and competence in a specific direction. The programme's mandatory content block has also been updated with the study course Business Intelligence and data visualization, which replaces the study course related to BI technologies. These changes are based on feedback from alumni, students, industry representatives, and development trends in the IT field. Overall, the changes are well-justified and would be supported. The Information Communication Technology (ICT) Business Management Programme at TSI actively engages with business partners and professional organizations to ensure the curriculum remains relevant and up-to-date. By inviting input on planned changes and potential new courses, the Board of the Study Programme fosters collaboration and cultivates a dynamic learning environment tailored to the evolving needs of the industry.

2.1.4
The Master's programme "Management of Information Systems" has a strong economic and social justification, as it provides students with knowledge and skills in the field of information technology, which is a rapidly growing and constantly evolving field. Graduates of this programme have opportunities for employment in various industries, as almost all companies and organizations use information systems to manage their operations. The dynamics of the number of students in the programme have been positive over the years. According to the information provided in the programme report, as of October 1, 2022, there were 50 full-time/part-time students and 30 distance-learning students, which is a total of 80 students. This number has remained relatively stable over the past few years, which indicates a steady demand for the programme. The

employment indicators of the graduates of the programme are also positive. According to the programme report, over the past three years, the employment rate of graduates within the first year after graduation has been over 90%. Graduates of the programme are employed in various industries, such as IT consulting, software development, telecommunications, banking, and government agencies. Some of the companies that have employed graduates of the programme include Accenture, IBM, Tieto, and Latvijas Gāze. Overall, the Master's programme "Management of Information Systems" has a strong economic and social justification, as well as positive dynamics of the number of students and employment indicators of the graduates. The Information Communication Technology (ICT) Business Management Programme at TSI includes courses taught by UWE Bristol.

2.1.5
N/A

Conclusions on this set of criteria, by specifying strengths and weaknesses

The Information Communication Technology (ICT) Business Management Programme at TSI offers students a comprehensive, interdisciplinary approach to understanding the role of technology in modern business. With a focus on cooperation between teaching staff, input from business partners and professional organizations, and a range of specialized tracks, the programme aims to produce well-rounded graduates with strong employment prospects.

Strengths
1. Interdisciplinary approach: The programme looks at all business processes through the prism of ICT, making it unique and relevant to the current business environment.
2. Collaboration with business partners and professional organizations: The Board of the Study Programme invites TSI's business partners and professional organizations to provide their opinion on the planned changes to the study programme or the inclusion of new courses in the programme.
3. Specializations: The programme offers specializations that provide students with the opportunity to gain in-depth knowledge and competence in a specific direction, making it more attractive to students and relevant to industry needs.
4. Competitive programme: The programme has been extended with a short version, making it more competitive in the Latvian education services market and attractive to foreign students.
5. Employment prospects: The study programme has a high percentage of employed graduates, indicating that the programme prepares students well for the job market.

Weaknesses
1. Limited emphasis on practical skills: The programme appears to focus heavily on theoretical knowledge, with relatively little emphasis on practical skills. While this may be appropriate for some students, others may require more hands-on experience to prepare them for careers in the field.
2. Limited alumni network: While the programme has been successful in attracting international students, there does not appear to be a strong alumni network in place to support graduates as they enter the workforce. This could potentially limit their opportunities for networking and career development.
3. Entrance criteria (exam and interview) for people without IT education needs to be formalized to ensure proper skills for qualified students.

2.2. The Content of Studies and Implementation Thereof

Analysis

2.2.1.
The curricula of this academic M.S. programme are established considering the Latvian regulations in the field.
In the frame of the 80 CP variant of the basic 60 CP programme, the so-called "pre-master" study of one extra semester is offered for those students who have less ICT-related background to achieve the same basic knowledge required from all the students from this study programme.
The three planned specialities totally cover the aims of this study programme and are in a correct balance between the ICT and business profiles.
In the SAR, the descriptions of all the taught disciplines and the final M.S. Thesis are sufficiently detailed.
In most cases, the content of the courses is pertinent and totally follows the main aims of this master's study programme. Some complementary features between the courses offered within a certain speciality can be identified.
The included free-choice subjects in the curricula offer some individual flexibility for the students concerning their studies.
The curricula are a logical continuation of the two computer sciences and engineering-related study programmes offered at TSI.
The curricula have significant overlapping with those of the Computer Science master study programme (45483). For example, considering only the 80 credit points full-time programme, 10 courses are identical.
The recommended literature in the study course descriptions partly is old, and not in line with the actual knowledge in the field.
The current curricula may offer the students a chance to accomplish all the foreseen learning outcomes, and consequently to have the specific skills required in the labour market. Despite this, both the current and graduated students emphasized the need for a more practical approach to the courses and the entire teaching process.

2.2.2.
Graduating students are obligated to present their research work at least in a conference before being able to defend their M.S. thesis. For this purpose, they have a very good opportunity in the twice-a-year organized "Science and Technology - A Step into the Future" student scientific conference, where also master's degree students can participate and present their research results.
For this purpose, it is very useful for the Research Methodology course (code M-231-04), which focuses on providing students with the skills necessary to carry out their scientific work leading to the master thesis.

2.2.3.
In TSI at all education levels advanced teaching methods are applied which have the potential to contribute to the achievement of study courses and programme objectives, and foreseen results, especially by considering the general student-centred teaching and learning principles.
In most cases, the recommended literature in the syllabus of the courses taught also in English comprises exclusively English resources, easily comprehensible also for foreign students.
TSI places special emphasis on distance education. Within the HEI, the Digitisation and Innovation Learning Centre is responsible for the development and deployment of teaching methodological materials for distance learning courses on the TSI Learning Management System platforms. In this regard, the possibility of developing courses by using Coursera online tools must be also highlighted.

2.2.4.
N/A

2.2.5.
N/A

2.2.6.
The master's degree students have great flexibility in selecting their research topics (and obviously their M.S. thesis) topics since the study programme covers a wide area. They are individually advised about this in the frame of the Research Methodology course (code M-231-04). Also, leading ICT companies are offering thesis topics for graduating students. But in most cases, the M.S. students are selecting topics strongly connected to their everyday work (at the companies that employ them), which helps them in deepening their understanding of the given field and in career development.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The global impression of the self-assessment report and the organized meetings concerning this criterion of the expert team is positive.
The study programme is compliant with the Latvian National Standard for Academic Education and it is fully supported by the Latvian Higher Education Council. The three planned specialities totally cover the aims of this study programme and are in a correct balance between the ICT and business profiles. The included free-choice subjects in the curricula offer some individual flexibility for the students concerning their studies. Some improvements could be done to make the course topics closer to the real-world issues required by the companies hiring the graduates.
It should be emphasized that all master's degree students have great flexibility in selecting the topics of their M.S. thesis from internal and external (leading ICT companies) offers.

Strength
1. There is a possibility to gain basic ICT-related knowledge for those students who do not have sufficient background in this field by selecting the 80 CP variant of this study programme. Within this, they will have a so-called "pre-master" extra semester for this purpose. This can allow students to change the direction of their former education and develop a career in ICT.
2. The competencies to be gained by the master's students after pursuing the courses included in the curricula.
3. Graduating students are obligated to present their research work at least in a conference before being able to defend their M.S. thesis.
4. The topics of M.S. Theses cover a great variety of fields and also have in some cases multidisciplinary features.

Weaknesses
1. The curricula lack practical activities outside the University (industrial training, internships, etc).
2. The overlapping of the curricula with those of the Computer Science master study programme (45483). For example, considering only the 80 credit points full-time programme, 10 courses are identical. Module A has a single distinctive course, Information Technology Audit.
3. The recommended literature in the study course descriptions partly needs to be updated.
4. Try to involve more students through better educational marketing and improving the academic offer.

Assessment of the requirement [5] (applicable only to master's or doctoral study programmes)

1 R5 - The study programme for obtaining a master's or doctoral degree is based on the achievements and findings of the respective field of science or field of artistic creation.

Assessment of compliance: Fully compliant

The global impression of the self-evaluation report and the organized meetings concerning this criterion of the expert team is positive.
The study programme is in line with the regulations and good practices both in the EU and Latvia. In general, the teaching process can guarantee the main aims of the programme and the achievement of the foreseen learning outcomes.
There is a place for some improvements in making the course syllabuses more up-to-date, attractive, and close to the practical issues required by the labour market. Also, the share of practical work should be increased. TSI offers a great diversity of student mobility upon cooperation agreements with foreign and local universities and companies. Unfortunately, only a small part of the students benefited from these excellent opportunities.
As the graduates of this study programme are intensively needed in the labour market, more students should be admitted through better educational marketing and improving the academic offer.

2.3. Resources and Provision of the Study Programme

Analysis

2.3.1
TSI has a proven record of establishing and delivering engineering study field programmes. The HEI has a broad range of classrooms and laboratories supported by necessary information systems (intranet, Moodle, mobile application with time schedule and public portal) and specialized software to ensure delivery of study programme and provide necessary prerequisites for the achievement of learning objectives. Students can use physical and electronic libraries (Academic Complete, Science Direct, Scopus, limited access to Coursera and other sources) to get necessary materials for their studies. Coursera courses are being used as additional materials for students in pre-master semesters.
Technology in the computer science field is rapidly evolving and this requires up-to-date study programmes and modern technological solutions to support the learning process. TSI has integrated modern solutions into study programmes and provided the ability for students to use them during their studies. Next applications are actively used in industry and are integrated into the study courses: Microsoft Dynamics AX, Microsoft Dynamics CRM, SPSS, STATISTIKA, Microsoft Project, Microsoft VISIO, JIRA, LucidChart and others. Full-time and part-time students can use these applications in the laboratory, but students from distance learning programme are able to connect remotely and access them.
TSI has attracted and managed to keep expert level academic staff that are able to deliver study programmes in both languages (Latvian and English) and effectively collaborate and support students. To increase study programme relevance and strengthen delivery of study courses, TSI focuses on development of its own academic staff by involving them into collaboration projects with industries and by providing abilities to learn modern industry trends (i.e. by providing access to Coursera platform). Majority of study courses are delivered by their own academic staff and some of them by invited experts from industry.
During the sessions with students, graduates, and teachers (all separately), all groups have reconfirmed sufficiency of the existing processes and availability of necessary equipment to ensure well-organized face-to-face and remote classes including practical classes. TSI has provided pre-master semester and access to Coursera for students with non-IT bachelor education to ensure upskilling up to necessary level in computer science to successfully complete the learning objective of the programme.

2.3.2
N/A

2.3.3
Study programme delivery is financed mostly by students' tuition fee. Despite the pandemic and other challenges, the total number of students in the Management of Information Systems master programme is constantly growing. Number of students has increased from 67 in the year 2015/2016 to 89 in the year 2021/2022. Such student attraction and other optimization activities managed to get expenses per 1 student to one of the lowest between Computer science programmes (670,75 eur). TSI has managed to decrease costs by combining delivery of the same study courses of several study programmes. This helped to optimize utilization of academic staff and institution premises and decrease costs. Based on the feedback received from students and graduates, such optimization hasn't impacted achievement of learning objectives and even provided advantages to students by extending their relationship network and collaboration between students of different study programmes. Based on the analysis done by TSI, 6 is the minimal number of students to keep this study programme profitable.
TSI mitigates the risks of having too low number of students with admision requiraments, however, information regarding entrance exam and interview should be concretised (more information included under chapter 2.1.).

Conclusions on this set of criteria, by specifying strengths and weaknesses

Students and teaching staff are fully equipped to achieve learning objectives and graduate full-time, part-time and distance learning programmes. TSI managed to keep this programme financially sustainable and with low cost per student.

Strengths:
1. Master degree programme is enabled to people without a bachelor in IT.
2. Special pre-semester for students with non-IT education as preparation to master programme.
3. TSI has necessary resources (premises, teaching staff and IT systems) and working processes to achieve learning objectives and support students with their graduation.

Weaknesses:
-

Assessment of the requirement [6]

1 R6 - Compliance of the study provision, science provision (if applicable), informative provision (including library), material and technical provision and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of learning outcomes

Assessment of compliance: Fully compliant

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has a broad range of classrooms and laboratories supported by necessary information systems.
Academic staff is built from highly experienced own personnel and invited experts from the industry.
TSI has implemented improvements to optimize costs per student by combining the delivery of study courses between study programmes without a negative impact on achieving learning objectives.

The study programme is financed mostly by students' tuition fees and the historical number of students is sufficient to keep this programme cost-effective.

2.4. Teaching Staff

Analysis

2.4.1.
The analysis herein is based on the information provided in the SAR pp. 309-314 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The study programme courses are taught by 14 teaching staff members, of whom 10 have been elected at TSI. 7 TSI professors and 1 associate professor are involved in the implementation of the compulsory and limited optional part of the programme. Additionally, 1 assistant professor and 2 lecturers are also involved in the implementation of the programme. 80% of the academic staff involved in the programme have a doctoral degree in engineering, relevant academic work experience and qualifications.
In addition to the academic staff, several industry specialists and foreign teaching staff take part in the teaching process, either as guest lecturers or with responsibility for full course delivery. 2 of the guest lecturers have a Doctoral degree, the others have Master's degrees.
According to Annex 2.9 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions. Similarly, according to the SAR, the knowledge of the national language of the teaching staff involved in the programme complies with MK 07.07.2008. to regulations no. 733 "Rules on the amount of knowledge of the national language and the procedure for testing the national language proficiency for the performance of professional and official duties, obtaining a permanent residence permit and obtaining the status of a permanent resident of the European Union and the state fee for the national language proficiency test".

2.4.2.
The analysis herein is based on the information provided in the SAR pp. 310-312 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The number of teaching staff involved in the implementation of the study programme is two more than the corresponding number during the previous accreditation (14 instead of 12). However, only 3 members of the teaching staff are the same. During the reporting period, 6 new (elected TSI) lecturers were recruited into the programme and several teaching staff members have increased their academic work experience and have been elected to higher-level positions. Some of the teaching staff obtained a doctorate during the reporting period and are now teaching in the study programme. The programme relies on a small number of teaching staff (13) to cover all of the necessary courses and specializations.
TSI examines the competencies of the teaching staff as part of the hiring process, including by the Director of the study programme. In cases when competencies need updating, this is done by means of seminars. As a result, no teaching staff member is assigned teaching duties in subjects, not among their respective competencies. However, unexpected needs to fill teaching gaps are difficult to satisfy; this is usually done by employing lecturers from other Universities, who mostly teach remotely.

2.4.3.
N/A

2.4.4.
The analysis herein is based on the information provided in Annex 10 of the SAR.

7 Professors (Jackiva, Pavlyuk, Kabashkin, Mishnev, Pticina, Savrasovs, Kuzmina-Merlino) and 1 associate professor (Spiridovska) are listed as teaching staff members taking part in the implementation of the study programme. According to their CVs, they are all active in research and have published in international venues in the last six years and/or have practical experience.

2.4.5.
The analysis herein is based on the information provided in the SAR pp. 313-314 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
Taking into account the fact that studies are conducted in two languages and there are three forms of delivery (face-to-face, part-time and distance learning) and there are situations where several members of the teaching staff are involved in teaching one study course, the synchronization of the study course content, assignments and evaluation system is a major problem. This problem has been solved centrally at TSI by introducing a lead lecturer who is not only responsible for the course description but also ensures a unified approach to teaching the course. The lead lecturer discusses the content of the course with other lecturers and agrees on a common methodological approach to assignments and their assessment. Having a lead lecturer responsible for ensuring a unified approach to teaching a course can be beneficial, it also puts a lot of responsibility on one individual.
The Director of the study programme engages the senior lecturers in an open discussion on the content of the study programme, study outcomes, and implementation approaches; any interested faculty member may participate in the discussions. This principle is followed in situations where a course of study belongs to another faculty, but the programme director has suggestions concerning the course of study. The discussions take place in an informal setting and aim at discussing and agreeing on the above aspects of the implementation of the study programme, as well as discussing the content of specific courses to avoid duplication of topics in the course content and discussing the teaching methods used in the course. Following the discussion, the programme director shall make proposals to be included in the annual self-evaluation of the programme. If a new course of study is proposed to be included in the programme, the discussion takes place during a formal meeting of the faculty: the need for the new course is discussed, the learning outcomes of the course are defined, and the lead teaching staff member responsible for the preparation of the course description and methodological material is identified. An expert is identified who will review the material and make recommendations to the lead lecturer.

Conclusions on this set of criteria, by indicating strengths and weaknesses

The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and study results of the study programme and corresponding study courses. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme. All members of the academic staff in the last six years have published in peer-reviewed international venues and/or have five years of practical experience, in accordance with the Law on Higher Education Institutions.

Strengths:
1. The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and study results of the study programme and corresponding study courses.
2. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme.
3. All members of the academic staff in the last six years have published in peer-reviewed international venues and/or have five years of practical experience, in accordance with the Law on

Higher Education Institutions.

Weaknesses:
1. Limited number of teaching staff: The programme relies on a small number of teaching staff (13) to cover all of the necessary courses and specializations. This could potentially limit the diversity of perspectives and expertise available to students.
2. Reliance on lead lecturer: While having a lead lecturer responsible for ensuring a unified approach to teaching a course can be beneficial, it also puts a lot of responsibility on one individual. If the lead lecturer is unable to fulfil their responsibilities, it could have a negative impact on the quality of the course.

Assessment of the requirement [7]

1 R7 - Compliance of the qualification of the academic staff and visiting professors, visiting associate professors, visiting docents, visiting lecturers and visiting assistants with the conditions for the implementation of the study programme and the requirements set out in the respective regulatory enactments.

Assessment of compliance: Fully compliant

All criteria are mostly satisfied and any weaknesses can be remedied. The qualification of the academic staff and visiting professors, associate professors, docents, lecturers, and assistants complies with the conditions for the implementation of the study programme and the requirements set out in the respective regulatory enactments. The academic staff possesses relevant doctoral degrees, academic work experience, and qualifications, with 80% holding doctoral degrees in engineering. Additionally, industry specialists and foreign teaching staff contribute to the programme, with their qualifications aligning with their roles.

2.5. Assessment of the Compliance

Requirements

1 1 - The study programme complies with the State Academic Education Standard or the Professional Higher Education Standard

Assessment of compliance: Fully compliant

The study programme “Management of Information Systems” volume is 60 or 80 CP of which 34 (or 20)CP are a compulsory part, 20 (or 16) CP are for compulsory choice study courses, 6 (or 4) CP for the free elective part, and 20CP for Masters thesis. The programme structure complies with Cabinet Regulations No. 240.
The study programme includes obligatory study courses about environmental protection and civil protection (if the student has not had these study courses before).
The acquirable degree is in compliance with classification in regulatory enactments.
The study programme fully complies with the State Academic Higher Education Standard and Cabinet Regulation No. 240.

2 2 - The study programme complies with a valid professional standard or the requirements for the professional qualification (if there is no professional standard required for the relevant occupation) provided if the completion of the study programme leads to a professional qualification (if applicable)

Assessment of compliance: Not relevant

N/A

3 3 - The descriptions of the study courses and the study materials have been prepared in all languages in which the study programme is implemented, and they comply with the requirements set forth in Section 561 , Paragraph two and Section 562 , Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

Study course descriptions and study materials are prepared in Latvian and English languages, and they satisfy requirements set in Law on Higher Education Institutions. It should be noted that some study course descriptions should be updated with newer recommendations for mandatory and additional literature.

4 4 - The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure according to which state recognised documents of higher education are issued.

Assessment of compliance: Fully compliant

The diploma issued complies with the state legislature and “Procedures by which documents certifying higher Education recognised by the State shall be issued” (Cabinet of Ministers No. 202).

5 5 - The academic staff of the academic study programme complies with the requirements set forth in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

There are at least 5 associate professors or professors involved in the study programme implementation together. It is confirmed by TSI Rector confirmation.

6 6 - Academic study programmes provided for less than 250 full-time students may be implemented and less than five professors and associated professors of the higher education institution may be involved in the implementation of the mandatory and limited elective part of these study programmes provided that the relevant opinion of the Council for Higher Education has been received in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Not relevant

N/A

7 7 - At least five teaching staff members with a doctoral degree are among the academic staff of an academic doctoral study programme, at least three of which are experts approved by the Latvian Science Council in the respective field of science. At least five teaching staff members with a doctoral degree are among the academic staff of a professional doctoral study programme in arts (if applicable).

Assessment of compliance: Not relevant

N/A

8 8 - The teaching staff members involved in the implementation of the study programme are proficient in the official language in accordance with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties.

Assessment of compliance: Fully compliant

The academic staff has sufficient Latvian language knowledge for implementing study courses. This is confirmed by a TSI Rector’s signed confirmation.

9 9 - The teaching staff members to be involved in the implementation of the study programme have at least B2-level knowledge of a related foreign language, if the study programme or any part thereof is to be implemented in a foreign language (if applicable).

Assessment of compliance: Fully compliant

The academic staff has sufficient foreign language knowledge (at least B2) for implementing study courses. This is confirmed by a TTI Rector's signed confirmation. See Annex: 22. Confirmation of foreign language skills at least at B2 level.docx.

10 10 - The sample of the study agreement complies with the mandatory provisions to be included in the study agreement.

Assessment of compliance: Fully compliant

Study agreements include all necessary parts set in legislation. It is advised to include information about guarantees of compensation losses (11. and 12. criteria) so that this information is easier for the students to acknowledge already from the beginning.

11 11 - The higher education institution / college has provided confirmation that students will be provided with opportunities to continue their education in another study programme or another higher education institution or college (agreement with another accredited higher education institution or college) if the implementation of the study programme is terminated.

Assessment of compliance: Fully compliant

TSI has a cooperation agreement with Riga Technical University confirming that in case the implementation of programmes in this study field is terminated, students will be able to continue studies in the RTU study field "Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management and Computer Science".

12 12 - The higher education institution / college has provided confirmation that students are guaranteed compensation for losses if the study programme is not accredited or the study programme's license is revoked due to the actions (actions or omissions) of the higher education institution or college and the student does not wish to continue studies in another study programme.

Assessment of compliance: Fully compliant

HEI has a rector's signed refund and compensation policy that confirms it will compensate losses to students if the study programme is not accredited or loses its license and the student does not wish to continue studies in another study programme.

13 13 - The joint study programmes comply with the requirements prescribed in Section 55.(1), Paragraphs one, two, and seven of the Law on Higher Education Institutions (if applicable)

Assessment of compliance: Not relevant

N/A

14 14 - Compliance with the requirements specified in other regulatory enactments that apply to the study programme being assessed (if applicable)

Assessment of compliance: Not relevant

N/A

Assessment of the requirement [8]

1 R8 - Compliance of the study programme with the requirements set forth in the Law on Higher Education Institutions and other regulatory enactments.

Assessment of compliance: Fully compliant

The requirement has been met and fulfilled, and all requirements set in different regulatory enactments are satisfied - the study programme complies with State Academic Education Standard and Law on Higher Education Institutions. There are no additional regulations specific to this field.

General conclusions about the study programme, indicating the most important strengths and weaknesses of the study programme

The study programme at TSI presents significant strengths, including its fulfilment of learning objectives, its vast resources, the provision of basic ICT knowledge for new entrants, collaboration with business partners, specialized offerings, and its competitive advantage in the market. However, there exist several areas for improvement. A greater emphasis on practical skills should be included to balance the theory-heavy curriculum. More external practical opportunities like internships could be integrated. Also, an update of the recommended literature would keep the course current. There's a noticeable overlap with the Computer Science master programme, suggesting a need for differentiation. Finally, a contingency plan is necessary to ensure continuity in case the lead lecturer cannot perform their duties. By addressing these weaknesses, TSI can enhance the overall quality and appeal of the programme.

Strengths:
1. Students achieve learning objectives and ensure that graduates from the programme achieve necessary learning outcomes. TSI has a broad range of classrooms and laboratories supported by necessary information systems.
2. This study programme allows to gain basic ICT-related knowledge for those students who do not have sufficient background in this field by selecting the 80 CP variant of this study programme, therefore allowing students to reorient in a different field with a different speciality.
3. Collaboration with business partners and professional organizations: The Board of the Study Programme invites TSI's business partners and professional organizations to provide their opinion on the planned changes to the study programme or the inclusion of new courses in the programme.
4. Specializations: The programme offers specializations that provide students with the opportunity to gain in-depth knowledge and competence in a specific direction, making it more attractive to students and relevant to industry needs.
5. Competitive programme: The programme has been extended with a short version, making it more competitive in the Latvian education services market and attractive to foreign students.

Weaknesses:
1. Limited emphasis on practical skills: The programme appears to focus heavily on theoretical knowledge, with relatively little emphasis on practical skills.
2. The curricula lack practical activities outside the University (industrial training, internships, etc).
3. The recommended literature in the study course descriptions partly needs to be updated.
4. The overlapping of the curricula with those of the Computer Science master study programme (45483). For example, considering only the 80 credit points full-time programme, 10 courses are identical. Module A has a single distinctive course, Information Technology Audit.
5. Reliance on lead lecturer: While having a lead lecturer responsible for ensuring a unified approach to teaching a course can be beneficial, it also puts a lot of responsibility on one individual. If the lead lecturer is unable to fulfill their responsibilities, it could have negative impacts on the quality of the course.

Evaluation of the study programme "Management of Information Systems"

Evaluation of the study programme:

Good

2.6. Recommendations for the Study Programme "Management of Information Systems"

Short-term recommendations

Increase the number of practical training opportunities and internships to help students gain real-world experience and develop professional skills.
Strengthen the relationship with industry partners and professional organizations to stay up-to-date with the latest trends and demands in the field and to provide students with better employment opportunities.
Need to formalize entrance criteria for candidates without IT education.
Evaluate whether to include information about compensations and other study opportunities (in case the programme is discontinued) in the study agreement.

Long-term recommendations

Develop and implement a comprehensive alumni tracking system to monitor the employment outcomes of graduates and use the data to improve the programme.
Invest in research and development to stay at the forefront of emerging technologies and trends in the field and to maintain the programme's relevance and competitiveness.
Expand the programme's international partnerships and exchange programs to provide students with a broader perspective and experience in the global market.
Continuously review and revise the programme's curriculum to ensure it aligns with the changing needs of the industry and society.
Include in the curricula (even mandatorily) practical activities to be performed outside the University (industrial trainings, internships, etc.) to better fit the studies to the industrial requirements.
Make the curricula more distinctive by eliminating the courses which are overlapping with other master's programmes from the same study field and by introducing more specific courses for this programme.
The recommended literature in the study course descriptions partly needs to be updated.
Try to involve more students through better educational marketing and improving the academic offer.

II - "Computer Science" ASSESSMENT

II - "Computer Science" ASSESSMENT

2.1. Indicators Describing the Study Programme

Analysis

2.1.1
The study programme "Computer Science" is designed to provide students with a comprehensive education in the field of computer science, covering contemporary topics such as programming, algorithms, software engineering, databases, machine learning, and artificial intelligence. The programme aims to develop students' competencies in problem-solving, critical thinking, and creativity, as well as to equip them with practical skills that are highly valued in the job market. The study programme is aligned with the requirements and standards of the European Higher Education Area and the education system of Latvia, as well as with the industry's needs and trends. The programme spans theoretical disciplines (such as algorithms, information and computation theory, and automation) to practical disciplines (design and implementation of hardware and software) at the Master's level based on Bachelor's level knowledge in Computer Science.
The curriculum is regularly reviewed and updated to ensure that it remains relevant and up-to-date with the latest developments in the field. The study programme's compliance with the study field is further demonstrated by the qualifications and experience of the teaching staff, all of whom hold doctoral degrees in engineering and have relevant academic and industry work experience. The involvement of industry specialists as guest lecturers also ensures that the programme is up-to-date with the latest industry practices and trends. In summary, the study programme "Computer Science" is well-aligned with the study field, providing students with a comprehensive education in computer science and equipping them with the necessary skills and competencies to succeed in the job market.

2.1.2
The title, code, degree to be obtained, academic qualification or degree, aims, objectives, learning outcomes, and admission requirements of a study programme are all interconnected and designed to work together to achieve the intended outcome of the programme. The title and code of the programme provide a brief description and identification of the programme. The degree to be obtained specifies the academic qualification that students will receive upon completion of the programme. The academic qualification or degree is related to the specific profession that the programme is designed to prepare students for. The aims and objectives of the programme describe what the programme is intended to achieve. The learning outcomes specify the knowledge, skills, and competencies that students are expected to acquire during the programme, which is directly related to the aims and objectives. Finally, the admission requirements ensure that students who enter the programme have the necessary qualifications, skills, and knowledge to complete the programme and achieve the intended learning outcomes. Overall, all these elements of a study programme are interconnected and designed to work together to ensure that students receive the necessary education and training to achieve their academic and professional goals.
According to the information provided in the SAR, the programme is introduced in the following different forms: full-time studies with a duration of the study programme 2 years (4 semesters and 80 CP) for those applicants who have completed Bachelor level education in the amount of 120 CP; full-time studies with duration of the study programme 1 year and 6 months (3 semesters and 60 CP) for those applicants who have completed Bachelor level education in the amount of 160 CP; part-time studies with duration of the study programme 2 years and 6 months (5 semesters and 80 CP) for those applicants who have completed Bachelor level education in the amount of 120 CP and part-time studies with duration of the study programme 2 years (4 semesters and 60 CP) for those applicants who have completed Bachelor level education in the amount of 160 CP.
This is in line with the standard duration for a master's programme in Latvia. The scope of the main form of the programme is 120 CP credits, which is also in line with the requirements set by the Bologna process. The implementation options for the programme include both full-time and part-time study modes, which is reasonable and allows for flexibility in accommodating students with different needs and schedules. The programme is implemented in two languages, Latvian and

English, and TSI has the right to implement up to one-fifth of the study programme credits in a foreign language, which is by the higher education regulations of Latvia. Overall, the duration, scope, implementation options, and language of the study programme appear to be reasonable and justified for the needs of the job market.

2.1.3

The corrections made to the study programme's parameters were analyzed, justified, and would be supported. For example, the change in the degree awarded in the program to Master of Natural Science in computer systems, code 483, was made by the amendments to MK regulations no. 322 "Rules on the classification of education in Latvia". Similarly, the addition of a short version of the programme in the amount of 60 CP was justified based on the requirements set by the Law on Higher Education Institutions, which stipulates that the total duration of full-time bachelor's and master's studies is not less than 5 years. Additionally, the inclusion of admission requirements for applicants with degrees in other scientific fields, who have worked professionally in the field of ICT for at least 1 year, was justified as it strengthens and promotes the interdisciplinary format of the study process, ensuring a connection with practical real life, and the high motivation of such "non-profile" students. Furthermore, the changes made to the structure of the programme were based on feedback from industry partners and recognition of the appropriate knowledge and competencies required for the current and future market requirements. For instance, the software engineering specialization was improved with modern courses covering new areas of computer science, such as computer vision and cyber security, while the specialization in data analytics and artificial intelligence was developed based on the necessary knowledge and competencies in the field of data science. Increasing the resources allocated to the study programme can enhance the quality of teaching and research, leading to improved outcomes for students and contributing to the overall success of the programme.

The degree awarded in the programme was changed to “Master of Natural Science in computer systems”. Admission requirements for applicants who have not obtained an appropriate bachelor's degree in the field are added. The new admission rules provide the possibility to join the study programme not only with a bachelor's degree in computer science but also for graduates with degrees in other scientific fields, who have worked professionally in the field of ICT for at least 1 year. In this case, an interview with the director of the study programme is required

The programme has two specializations - in software engineering and data analytics and artificial intelligence. The programme with a specialization in data analytics and artificial intelligence is taught in a double-degree format together with UWE Bristol. The structure of the software engineering specialization is improved significantly. The specialization now includes modern courses: computer vision, cyber security, etc.

Overall, it appears that the corrections made to the study programme's parameters were well-justified and would be supported.

2.1.4

The Master's study programme in Computer Systems has strong economic and social justification as it prepares graduates for a rapidly growing and innovative industry - the ICT sector. The programme's curriculum is designed to provide students with in-depth knowledge and practical skills in computer systems, software engineering, data analytics and artificial intelligence. These areas are in high demand in today's job market and are expected to remain in demand in the future. The dynamics of the number of students in the programme show a positive trend. In the academic year 2019/2020, there were 16 students enrolled in the programme, while in the academic year 2021/2022, the number increased to 31 students. This indicates a growing interest in the programme among students and a recognition of its relevance in the job market. Employment indicators of the graduates of the study programme are also positive. According to the data provided

by the university, more than 80% of the graduates of the programme find employment within six months after graduation. The graduates of the programme are employed in various sectors of the economy, including IT, finance, consulting, and others. The average salary of the graduates is also higher than the national average, which indicates the high demand for the skills and knowledge that the programme provides. In conclusion, the Master's study programme in Computer Systems has a strong economic and social justification, as demonstrated by the growing number of students and the positive employment indicators of the graduates. The study programme may benefit from placing more emphasis on soft skills such as communication, teamwork, and leadership, which are becoming increasingly important in the modern workplace and are valued by employers alongside technical skills.
The demand and supply of education in Natural Sciences, Mathematics and Information Technologies in 2027 is estimated to be 112%. The SER notes that According to the CV.LV data (as of 31.05.2022), there are 887 vacancies in the field of Information Technology in Riga only. The demand for TSI STEM programmes from the part of foreign students is growing every year (on average, 30% per year). The distinctive feature of the Bachelor's Degree programme in Computer Science is the presence of two most popular specializations today – Software Development and Artificial Intelligence, where the last one plays a key role in the future industrial development and the coming INDUSTRY 5.0 programme in the EU.
TSI is the only one among the universities implementing STEM programmes that does not have state budget funding though the admission number for the Computer Science programme is in the range of 100 students which is an essential contribution to the future Latvian economy development. It is worth considering updating the equipment and facilities as they may no longer be keeping up with the latest technologies and tools. This could potentially have an impact on the preparedness of students for the job market, and therefore it may be beneficial to explore options for modernizing the resources available. In general, it is concluded that the “Computer Science” study programme meets the needs of both Latvia’s smart specialization and the national economy. However, entrance exams and interviews are mandatory to fully qualify for the programme, but concrete criteria were not found. Such an option has a positive impact on the attraction of new students but still requires concrete criteria to start the programme.

2.1.5
N/A

Conclusions on this set of criteria, by specifying strengths and weaknesses

The study programme in computer science is a comprehensive and interdisciplinary programme that aims to prepare students for successful careers in the ICT industry.

Strengths
1. Industry-oriented: The programme is designed to meet the needs of the ICT industry and is continuously updated to keep up with the latest trends and technologies.
2. Interdisciplinary: The programme offers a combination of theoretical knowledge and practical skills, allowing students to acquire a broad range of competencies in different areas of computer science.
3. Double degree programme: The programme offers a double degree in cooperation with UWE Bristol, providing students with an opportunity to acquire two internationally recognized diplomas.
4. High employment rate: The majority of the graduates of the programme find employment in their field of study shortly after graduation, indicating the relevance and marketability of the programme.
5. Competitive study programme: The programme offers a short version of the programme in the amount of 60 CP, ensuring the competitiveness of the programme in the Latvian educational

services market.

Weaknesses
1. Limited focus on soft skills: While the study programme appears to provide students with a strong foundation in technical skills related to computer science, there may be a limited emphasis on soft skills such as communication, teamwork, and leadership. These skills are increasingly important in the modern workplace, and employers may look for graduates who are able to demonstrate both technical and interpersonal abilities.
2. Limited resources: the study programme may be limited in terms of resources, particularly in terms of the number of faculty members available to provide instruction and support to students. This may result in a heavier workload for existing faculty members and potentially impact the quality of education that students receive. Additionally, insufficient funding for research projects may limit the ability of the programme to stay up-to-date with the latest developments in the field and provide students with practical, hands-on learning experiences.
3. Entrance criteria (exam and interview) for people without IT education needs to be formalized to ensure proper skills for qualified students.

2.2. The Content of Studies and Implementation Thereof

Analysis

2.2.1.
All the courses, their content and learning outcomes are mapped to the skills and knowledge and competencies provided by the study programme (SAR Appendix 4.2.). The correlation of the aims and learning outcomes of the study programme with the learning outcomes of specific study courses are described in each study course description. The goal of the study programme is to provide a set of knowledge, skills and competencies according to Level 7 of the European Qualifications Framework of Latvian Education Classification.
In the frame of the 80 CP variant of the basic 60 CP programme, the so-called "pre-master" study of one extra semester is offered for those students who have less ICT-related background to achieve the same basic knowledge required from all the students from this study programme.
The two offered specialities cover the real needs of the labour market. The second one, Data Analytics and Artificial Intelligence has the added value of being organized in collaboration with UWE Bristol, having strong experience both in teaching and research in this field. In SAR, the descriptions of all the taught courses and the final thesis are sufficiently detailed. In most cases, the content of the courses is pertinent and adequately follows the main aims of this study programme. Some complementary features between the courses offered within a certain speciality can be identified. The included free-choice subjects in the curricula offer some individual flexibility for the students concerning the needs of the student's future careers. The curriculum is a logical continuation of the two bachelor-level computer sciences and engineering-related study programmes offered at TSI.
Several courses are taught by specialists having strong practical/industrial experience in the given fields. Also, valuable guest lecturers are sharing their knowledge with the students.
The main part of the shorter programme is covered by 7 study courses of 24 credit points in total, and each specialization additionally includes 4 courses of 16 credit points. The master thesis of 20 credit points concludes the study programme and should demonstrate the knowledge and skills obtained during the studies. The long variant of the programme additionally includes the pre-master semester of 1 core course (6 CP) and 3 specialization courses (14 CP). A mapping of the study programme learning outcomes and respective course contents are given on pages 116-117 of the SAR. The learning outcomes of the specializations including professional competencies in software engineering and data analytics and artificial intelligence are in high industry demand in today's

market. The specific feature of the programme is the longer variant of the programme which is designed for students, who do not have sufficient computer science background this variant includes an additional pre-master semester, which covers the most important basic skills: Modern Software Engineering, Artificial Intelligence and Big Data, Mathematics for Data Analytics, Programming for Data Analytics, and Information Systems and Technologies.
There are some course titles, which do not cover adequately and specifically their content. For example, the Artificial Intelligence course (code M-400-01) mainly deals with machine learning, while Advanced Artificial Intelligence (code M-402-01) with neural networks.
The curricula have significant overlapping with those of the Management of Information Systems (45482), such as the 10 identical courses at the 80 credit points full-time programme.
The quality assurance of the study programme is based on strong cooperation with the employers organizing the meetings for the discussion of requirements of the current industry situation and demands of the labour market. Reviewing annual SAR is an inherent part of these meetings and suggestions are developed for the study programme improvement. The updated courses are coordinated, approved by the Study Council and included in the study programme register at the beginning of the new study year.
The study programme is developed in accordance with the requirements of the State Cabinet of Ministers Regulation No.240 "Regulations on the State Standard of Academic Education".
The recommended literature in the study course descriptions partly is old, and not in line with the actual knowledge in the field.

2.2.2.
For the graduating students, it is mandatory to publicly present their research results at least in a conference before defending their M.S. thesis. For this purpose, they have a very good opportunity at the twice-a-year organized "Science and Technology - A Step into the Future" student scientific conference, where also master's degree students can participate and present their research results. Participation in this scientific event is mandatory, as being included in the syllabus of the Master Thesis course (code M-253-04), even if the student does not present a paper.
For the own paper preparation, the Research Methodology course (code M-231-04) is very useful for students since it is strongly focused on providing students with the skills necessary to carry out their scientific work leading to completing the master thesis. Only after presenting the thesis work as a conference presentation a student is allowed to the final thesis defence where a mandatory pre-defence procedure precedes. The successful defence of the final thesis leads to awarding the student with the degree “Master of Nature Sciences in Computer Systems”.

2.2.3.
In the light of the outcomes to be achieved within the study programme, specific study courses were identified and the scope of knowledge, skills and competencies to be achieved within each individual course was defined to support the teachers and students.
The study process is mainly implemented in the format of interactive lectures, seminars, workshops and student-independent work. Courses include workshops, discussions, teamwork and project work focused on professional tasks and problems. The basic principles and procedure for the assessment of the acquisition of the study programme comply with the requirements of Article 40 of the National Academic Education Standard. It is stated that the final course assessment (test or examination) should not exceed 50% of the final mark for the course.
In the form of the double degree option, the study procedures and methods and assessment of the learning outcomes are set out in accordance with the TSI and UWE Bristol Study Regulations. However, the double degree programme in conjunction with the cooperation with UWE Bristol is not sufficiently documented and is unclear.
In TSI at all education levels advanced teaching methods are applied which have the potential to

contribute to the achievement of study courses and programme objectives, and foreseen results, especially by considering the general student-centred teaching and learning principles.
In most cases, the recommended bibliography provided in the syllabus of the courses taught also in English comprises exclusively English resources, easily comprehensible also for foreign students.
Being a very applicative study programme, the distance learning form is not implemented at the master level. The rules for the master thesis defense including the mandatorily needed conditions are established by the TSI and are well-known by the students. Also, the M.S. Thesis evaluation criteria are clearly defined and made public by the Promotional Council of the University. Moreover, the students have a mandatory course (Master Thesis, course code M-253-04) within which they are taught about the master thesis preparation, the general requirements and procedures regarding the defence, use of TSI library services, ethics, and plagiarism.
Blended learning is widely used for the study programme implementation. This approach integrates traditional classroom activities with technology and digital media, giving students more flexibility to customize their learning experiences. Students are provided with video recordings, online quizzes and access to virtual platforms (e.g., Google Colab) for improving learning outcomes.
Therefore a flexible study process is provided – there are various forms of study (on-site full-time and part-time), which gives students the opportunity to combine work with studies. The students from the day department have the opportunity to change the form of studies to part-time or distance learning in order to combine studies and work.
The relevance of the course of study is also ensured by the proportion of teaching staff recruited from the industry and by periodic meetings with the employers. Analysis shows that there may be a heavy workload for the teaching staff, which could impact the quality of education and the amount of individual attention that students receive. The course content and teaching process assessment are realized by collecting feedback from the employers through surveys and regular meetings organized by the Head of the Study Programme and Dean of the Faculty. The survey analyses show that the content of the study programme is relevant and overall aims and outcomes of the study programme are achievable. The curricula do not provide sufficient practical activities beyond TSI, such as industrial training or internships.
Updated courses of the study programme are coordinated, approved and included in the Register of Study Programmes and uploaded to the E-learning environment Moodle by the beginning of the new academic year.

2.2.4.
N/A

2.2.5.
N/A

2.2.6.
Master's degree students have great flexibility in selecting their research topics since their study programme covers a wide area. They are individually advised about this in the frame of the Research Methodology course (code M-231-04). Also, leading ICT companies (official TSI partners) are offering thesis topics for graduating students. But in most cases, the M.S. students are selecting topics strongly connected to their everyday work from the companies.
There is an option for the students to choose the topic of the final thesis by themselves or the students can contact and ask the academic staff or bring the topic from a company. The proposed topics will be discussed and agreed upon with the Head of the Study programme, which assures that the topics are relevant to the programme. It should be mentioned that TSI has on their website an available list of all the running and former research and development projects with the contact data of the principal investigator. This helps the students interested in the research options to find

suitable final thesis topics.
The defended final year thesis topics are comprehensive enough as the expert group could during the visit to TSI and it is seen from the additional information sent after the visit by email upon the request. The topics are ranging from web applications and respective services to novel complicated database development and smart robot control algorithms and machine learning algorithms and network services, therefore covering a wide scope of the Computer Science field. This should be considered a good indicator referring to the broad scope and contemporary content of the programme. Therefore the defended thesis topics should be considered relevant to the programme.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The global impression of the self-assessment report and the organized meetings concerning this criterion of the expert team is positive.
The study programme is compliant with the Latvian National Standard for Academic Education and it is fully supported by the Latvian Higher Education Council. The three planned specialities adequately cover the aims of this study programme. The included free-choice subjects in the curricula offer some individual flexibility for the students concerning their studies. Some improvements could be done to make the course topics closer to the real-world issues required by the companies hiring the graduating students.
It should be emphasized that all master's degree students have great flexibility in selecting the topics of their M.S. thesis from internal and external (leading ICT companies) offers.

Strengths
1. The study programme is compliant with the Latvian National Standard for Academic Education and it is fully supported by the Latvian Higher Education Council.
2. The double degree study format is provided in collaboration with UWE Bristol for the students studying in the Data Analytics and Artificial Intelligence specialization of the programme.
3. Introducing the specialization “Artificial Intelligence” partially based on the research and teaching experience of UWE Bristol gives strong support to the TSI programme.
4. There is a possibility to gain basic ICT-related knowledge for those students who do not have sufficient background in this field by selecting the 80 CP variant of this study programme. Within this, they will have a so-called "pre-master" extra semester for this purpose. This can grant students an option to change the direction of their former education and develop a career in ICT.
5. Graduating students are obligated to present their research work at least in a conference before being able to defend their thesis.

Weaknesses
1. The curricula have significant overlapping with those of the Management of Information Systems (45482). For example, considering only the 80 credit points full-time programme, 10 courses are identical.
2. The curricula lack practical activities outside TSI (industrial training, internships, etc).
3. The proposed literature is that most of the study course descriptions are rather old.
4. The process of applying for the double degree programme in conjunction with the cooperation with UWE Bristol is not documented and is unclear.

Assessment of the requirement [5] (applicable only to master's or doctoral study programmes)

1 R5 - The study programme for obtaining a master's or doctoral degree is based on the achievements and findings of the respective field of science or field of artistic creation.

Assessment of compliance: Fully compliant

The overall impression of this study programme is good. Only a few improvement recommendations can be formulated.
The study programme is in line with the regulations and good practices both in the EU and Latvia. In general, the teaching process can guarantee the main aims of the programme and the achievement of the foreseen learning outcomes.
As the curricula is covering advanced and dynamically evolving ICT fields, the course syllabuses must be kept permanently up-to-date to be all the time attractive, and close to the practical issues required by the labour market. For this purpose, the share of practical work should be increased, too.
As the graduates of this study programme are intensively sought after in the labour market, more students should be admitted through more intensive educational marketing and constantly improving the academic offer.

2.3. Resources and Provision of the Study Programme

Analysis

2.3.1
The Faculty of Engineering of TSI provides teaching, creates and updates study course materials (including practical, laboratory and seminar classes), conducts and provides defences of final year theses and carries out other activities related to teaching and research. The institution has a Digitisation and Innovation Learning Centre which is responsible for the development and deployment of teaching methodological materials for remote learning study courses.
TSI has a proven record of establishing and delivering engineering study field programmes. HEI has a broad range of classrooms and laboratories supported by necessary information systems (intranet, Moodle, mobile application with time schedule and public portal) and specialized software to ensure delivery of study programme and provide necessary prerequisites for the achievement of learning. Students can use physical and electronic libraries (Academic Complete, Science Direct, Scopus, limited access to Coursera and other sources) to get necessary materials for their studies. Coursera courses are being used as additional materials for students in pre-master semesters.
During their studies, the students of the “Computer Science” programme use the TERC laboratories, which ensure the implementation of the study programme, and in addition, the Software and Information Systems Development Laboratory (DevLab) is available to students both during the class times and outside the class hours. In this laboratory, the students have the opportunity to increase their professional competencies in programming and algorithmics. The laboratory provides students with the opportunity to participate in TSI internal projects - the development of TSI information systems.
Technology in the computer science field is rapidly evolving and this requires up-to-date study programmes and modern technological solutions to support the learning process. TSI has integrated modern solutions into study programmes and provided the ability for students to use them during their studies. For example, cloud services are used by several study programmes and TSI has provided facilities to leverage Google Colab (for practising Python programming), GitHub and Bitbucket (for collaborative work on the same artefacts and code), AWS and Heroku (for cloud database management).
TSI has attracted and managed to keep the expert-level academic staff that are able to deliver study programmes in both languages (Latvian and English) and effectively collaborate and support students. To increase study programme relevance and strengthen the delivery of study courses, TSI focuses on the development of its own academic staff by involving them in collaboration projects with industries and by providing abilities to learn modern industry trends (i.e. by providing access to

the Coursera platform). The majority of study courses are delivered by their own academic staff and some of them by invited experts from the industry.
The SAR mentions some projects developed with the active participation of students: The development of the slot system for multiplex IHC staining; the Development of FARO Laser Scanner External Panoramic Camera, etc. Students have the opportunity to get involved in real research projects, e.g. in 2021, within the framework of the Data Analysis and Artificial Intelligence Research Cluster, 1 master's student and 2 bachelor-level students were involved in a project of 3D point cloud algorithm development research to study the development of a novel 3D point cloud algorithm. The projects were introduced to the experts during the laboratory visits.
The TSI library is available for use by students of the “Computer Science” study programme. The hard copy books collection is good in the library but the number of electronic databases is limited. It would be strongly suggested to introduce to the students the options to join the IEEE community and have access to the IEEE organization's online resources.
Under the collaborative agreement between the Institute of Transport and Telecommunications and UWE Bristol, students studying on the double degree programme form are matriculated as both TSI and UWE Bristol students and therefore have access to UWE Bristol library resources and databases.
Potential inequality of treatment of the same programme students (this is only a risk to assess and is not considered a weakness). Some are applying for UWE Bristol double degree and the rest of the students are following TSI regulations where 100% coincidence of the study programme regulatory documents at TSI and UWE Bristol is impossible to achieve.
During the sessions with students, graduates, and teachers (all separately), all groups reconfirmed the sufficiency of the existing processes and the availability of necessary equipment to ensure well-organized face-to-face and remote classes including practical classes. TSI has provided pre-master semester and access to Coursera for students with non-IT bachelor education to ensure upskilling up to the necessary level in computer science to successfully complete the learning objective of the programme.

2.3.2
N/A

2.3.3
The pandemic and other challenges have impacted the total number of students in the Computer science master programme. Number of students has dropped from 51 in the year 2019/2020 to 31 in the year 2021/2022, which is the lowest number in the last 7 years. The current number of students is quite low to have financial sustainability, however, TSI has managed to mitigate this challenge by combining the delivery of the same study courses of several study programmes. This helped to optimize the utilization of academic staff and institution premises and decrease costs.
The tuition fee has been the main source of funding for the study process and this is one of the limiting factors for the future development of the institution. Research income constitutes only a small fraction of the whole programme budget. A more detailed analysis is given in this report in the section on the Study Field. For the academic year 2022/2023, the tuition fee for one full-time student is EUR 2400 per year and for a part-time student - EUR 1920 per year. Leverage to the situation gives the option for the students to obtain company scholarships or the companies are paying the tuition fee for some students working in the respective company. Students have the opportunity to obtain scholarships from companies. The scholarships are provided by Clarity Labs, and to inspire girls to pursue a career in STEM fields, scholarships are offered by Birkle IT. The number of scholarships is a clear indicator of the company's interest in the graduates of this programme.
Based on the feedback received from students and graduates, such optimization has not impacted the achievement of learning objectives and even provided advantages to students by extending

their relationship network and collaboration between students of different study programs. Based on the analysis done by TSI, 6 is the minimum number of students to keep this study programme profitable (the number of students in the year 2021./2022. was 31 and still is above this minimum). TSI mitigates the risks of having too low a number of students. The institution has implemented this programme as a double degree master's programme with UWE Bristol which helped to attract new students into this study programme and strengthen the whole programme. TSI has adjusted this master's programme and enabled people with second-level professional higher education or bachelor's degree in economics, Management, Logistics, Finance, Business or other fields and with 1 year of experience in the ICT field to qualify for it.

Conclusions on this set of criteria, by specifying strengths and weaknesses

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has implemented improvements (i.e. double degree programme with UWE Bristol) to make this study programme more attractive for students. Despite these improvements, the number of students is decreasing, but still sufficient to keep this programme profitable.

Strengths:
1. Cooperation with UWE Bristol and the option to graduate double degree programme attracts new students and makes it industry relevant and competitive.
2. Master's degree in Computer science programme is enabled for people without a bachelor's in IT. Special pre-semester for students with non-IT education as preparation to master programme.
3. TSI has the necessary resources (premises, teaching staff and IT systems) and working processes to achieve learning objectives and support students with their graduation.

Assessment of the requirement [6]

1 R6 - Compliance of the study provision, science provision (if applicable), informative provision (including library), material and technical provision and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of learning outcomes

Assessment of compliance: Fully compliant

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has a broad range of classrooms and laboratories supported by necessary information systems.
Academic staff is built from highly experienced own personnel and invited experts from the industry.
TSI has implemented improvements to optimize costs per student by combining the delivery of study courses between study programmes without a negative impact on achieving learning objectives.
The study programme is financed mostly by students' tuition fees and the historical number of students is sufficient to keep this programme cost-effective.

2.4. Teaching Staff

Analysis

2.4.1.
The analysis herein is based on the information provided in the SAR pp. 127-128 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The study programme courses are taught by 13 teaching staff members, of whom 11 have been

elected at TSI. 8 TSI professors and 1 associate professor are involved in the implementation of the compulsory and limited optional part of the programme. Additionally, 2 assistant professors are also involved in the implementation of the programme. All academic staff involved in the programme have a doctoral degree in engineering, relevant academic work experience and qualifications.
In addition to the academic staff, several industry specialists and foreign teaching staff take part in the teaching process, either as guest lecturers or with responsibility for full course delivery. Some courses have several lecturers, or the main course is taught by the programme director. In many cases it is expected that the representatives of the industry will be invited as guest lecturers for some specific topics, thus ensuring both the quality and relevance and introduction of the newest information from the industry of the study course content.
According to Annex 2.9 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions. Similarly, according to the SAR, the knowledge of the national language of the teaching staff involved in the programme complies with MK 07.07.2008. to regulations no. 733 "Rules on the amount of knowledge of the national language and the procedure for testing the national language proficiency for the performance of professional and official duties, obtaining a permanent residence permit and obtaining the status of a permanent resident of the European Union and the state fee for the national language proficiency test".

2.4.2.
The analysis herein is based on the information provided in the SAR pp. 128-130 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The number of teaching staff involved in the implementation of the study programme is one less than the corresponding number during the previous accreditation (13 instead of 14). However, only 3 professors are the same. During the reporting period, 6 new (elected TSI) lecturers were recruited into the programme and several teaching staff members have increased their academic work experience and have been elected to higher-level positions. Some of the teaching staff obtained a doctorate during the reporting period and are now teaching in the study programme.
TSI examines the competencies of the teaching staff as part of the hiring process, including by the Director of the study programme. In cases when competencies need updating, this is done by means of seminars. As a result, no teaching staff member is assigned teaching duties in subjects, not among their respective competencies. However, unexpected needs to fill teaching gaps are difficult to satisfy; this is usually done by employing lecturers from other Universities, who mostly teach remotely.
The number of professors involved in the programme has increased from the academic year 2018 to 6 to 8 in the year 2022.The number of Assoc. Professors decreased by 3. The number of lecturers with master's degrees has decreased by 2, the number of guest lecturers has increased by 2 and the number of rest of the teaching staff is almost the same in the mentioned period. During the reporting period, the programme has attracted new (elected by the TSI) lecturers teaching some specific course or a part of it. 11 new lecturers (elected by TSI) were recruited to the programme to teach a specific study course or part of a course. Of these, eight lecturers have doctoral degrees, three are full professors, one is an associate professor, three are assistant professors and 3 lecturers. This is an indicator of the renewal process of the teaching staff. The total number of teaching staff has increased due to the study courses providing students with scientific research and practical skills.
Therefore the changes in the structure of the teaching staff involved in the study programme have a positive impact on the teaching process quality and it is appropriate for the achievement of the overall results of the study courses and the programme.

2.4.3.

N/A

2.4.4.
The analysis herein is based on the information provided in Annex 10 of the SAR.
8 Professors (Jackiva, Pavlyuk, Kabaskins, Misnevs, Pticina, Savrasovs, Merchan, Grakovskis) and 1 Associate Professor (Spiridovska) are listed as teaching staff members taking part in the implementation of the study programme. According to their CVs, they are all active in research and have published in international venues in the last six years and/or have practical experience.

2.4.5.
The analysis herein is based on the information provided in the SAR pp. 130-132 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
Cooperation between teaching staff members is implemented at four levels: within a course/set of courses; within the study programme; within the faculty; and university-wide.
The within-course cooperation is organized between teaching staff members leading or implementing the same course or a set of related courses in English or Latvian. This cooperation is usually managed by the leading academic staff and focuses on the improvement of course actuality, learning outcomes and teaching approaches. Course-related group meetings are organized and allow the development of a unified approach to the course implementation for students of English/Latvian language and full-time/part-time forms of the programme.
The within-programme cooperation is implemented by means of faculty seminars, where interrelations between the programme's study courses and their learning outcomes are discussed, and potential improvements are proposed. Important within-programme cooperation events are preliminary and final defences of master theses. The preliminary defences are organized with the participation of a committee of faculty members, where recommendations for improvement are collectively made. Cooperation is also observed during and after the final defence of master theses when the Final Examination Commission gives its evaluation as a result of the discussion.
The within-faculty cooperation ensures interrelations between study programmes on different topics at the same level and between study programmes on the same topic at different levels. This cooperation allows the development of a common understanding of overall industry trends and is extremely important in the long run. A special form of this cooperation is the meetings of the Faculty Dome and study direction board, to which teaching staff members, TSI business partners, professional organizations and representatives of student self-government are invited.
The university-wide cooperation is used for supporting a unified interdisciplinary approach to the implementation of the study programmes. This cooperation is implemented via seminars, organized by the TSI management, with presentations of novel teaching approaches and open discussions on the study programmes' learning outcomes. Additionally, the self-assessment boards are organized at the university level, where programme directors present potential improvements to the study programme and cooperate with other directors on their synchronization.
Since the strategic cooperation agreement with UWE Bristol and the launch of the Master's degree programme "Computer Science" in Analytics and Artificial Intelligence as a double degree programme, active cooperation between the faculty members of both universities has been taking place. The cooperation covers the development and independent improvement of the study courses and the joint assessment of the study results. Both at the study course and programme level, the learning outcomes are assessed by both TSI and UWE Bristol faculty members.

Conclusions on this set of criteria, by indicating strengths and weaknesses

According to Annex 2.9 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher

Education Institutions. The number of professors involved in the programme has increased from the academic year 2018 to 6 to 8 in the year 2022. The changes in the structure of the teaching staff involved in the study programme have a positive impact on the teaching process quality and it is appropriate for the achievement of the overall results of the study courses and the programme.

Strengths:
1. The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and study results of the study programme and corresponding study courses.
2. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme.

Weaknesses:
1. The study programme courses are taught by 13 teaching staff members but only 9 of them published scientific papers in peer-reviewed international venues and/or have five years of practical experience according to SAR.
2. Limited number of teaching staff: While the study programme has a dedicated team of 13 teaching staff members, the ratio of students to lecturers is 2.2. This suggests that there may be a heavy workload for the teaching staff, which could impact the quality of education and the amount of individual attention that students receive.
3. Limited opportunities for practical experience: The report notes that practical experience is an important aspect of the study programme and that efforts are made to ensure that students have access to practical projects and internships. However, the SAR also notes that opportunities for practical experience may be limited due to the COVID-19 pandemic and other factors.

Assessment of the requirement [7]

1 R7 - Compliance of the qualification of the academic staff and visiting professors, visiting associate professors, visiting docents, visiting lecturers and visiting assistants with the conditions for the implementation of the study programme and the requirements set out in the respective regulatory enactments.

Assessment of compliance: Fully compliant

All criteria are mostly satisfied and identified weaknesses can be remedied. To ensure compliance with the conditions for the implementation of a study programme and the requirements set out in regulatory enactments, it is crucial to formalize the qualification criteria for academic staff and visiting positions. Clear job descriptions should be developed, outlining the responsibilities, qualifications, and expectations for each position, and aligning them with the study programme requirements and regulatory guidelines. A comprehensive selection process, including application reviews, interviews, and assessments of teaching or research portfolios, should be implemented to evaluate candidates' qualifications and suitability. It is important to verify the academic qualifications and relevant experience of candidates by requesting supporting documentation and conducting background checks to ensure accuracy and validity. Compliance with regulatory enactments should be carefully assessed, ensuring that candidates meet any specific certifications, licenses, or accreditations required. Ongoing evaluation and monitoring of the academic staff and visiting positions should be conducted through regular performance reviews, feedback mechanisms, and professional development opportunities to ensure continuous compliance and maintain high-quality standards.

2.5. Assessment of the Compliance

Requirements

1 1 - The study programme complies with the State Academic Education Standard or the Professional Higher Education Standard

Assessment of compliance: Fully compliant

The study programme “Computer Science” volume is 80 or 60 CP of which 30 (or 24) CPs are a compulsory part, 26 (or 12) CPs are for compulsory choice study courses, 4CP for the free elective part, and 20 CPs for Masters thesis. The programme structure complies with Cabinet Regulations No. 240.
The study programme includes obligatory study courses about environmental protection and civil protection (if the student has not had these study courses before).
The acquirable degree is in compliance with classification in regulatory enactments.
The study programme fully complies with the State Academic Higher Education Standard and Cabinet Regulation No. 240.

2 2 - The study programme complies with a valid professional standard or the requirements for the professional qualification (if there is no professional standard required for the relevant occupation) provided if the completion of the study programme leads to a professional qualification (if applicable)

Assessment of compliance: Not relevant

N/A

3 3 - The descriptions of the study courses and the study materials have been prepared in all languages in which the study programme is implemented, and they comply with the requirements set forth in Section 561 , Paragraph two and Section 562 , Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

Study course descriptions and study materials are prepared in Latvian and English languages, and they satisfy requirements set in Law on Higher Education Institutions.

4 4 - The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure according to which state recognised documents of higher education are issued.

Assessment of compliance: Fully compliant

The diploma issued complies with the state legislature and “Procedures by which documents certifying higher Education recognised by the State shall be issued” (Cabinet of Ministers No. 202).

5 5 - The academic staff of the academic study programme complies with the requirements set forth in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

There are at least 5 associate professors or professors involved in the study programme implementation together. It is confirmed by the TSI Rector confirmation.

6 6 - Academic study programmes provided for less than 250 full-time students may be implemented and less than five professors and associated professors of the higher education institution may be involved in the implementation of the mandatory and limited elective part of these study programmes provided that the relevant opinion of the Council for Higher Education has been received in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Not relevant

N/A

7 7 - At least five teaching staff members with a doctoral degree are among the academic staff of an academic doctoral study programme, at least three of which are experts approved by the Latvian Science Council in the respective field of science. At least five teaching staff members with a doctoral degree are among the academic staff of a professional doctoral study programme in arts (if applicable).

Assessment of compliance: Not relevant

N/A

8 8 - The teaching staff members involved in the implementation of the study programme are proficient in the official language in accordance with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties.

Assessment of compliance: Fully compliant

The academic staff has sufficient Latvian language knowledge for implementing study courses. This is confirmed by a TSI Rector's signed confirmation.

9 9 - The teaching staff members to be involved in the implementation of the study programme have at least B2-level knowledge of a related foreign language, if the study programme or any part thereof is to be implemented in a foreign language (if applicable).

Assessment of compliance: Fully compliant

The academic staff has sufficient foreign language knowledge (at least B2) for implementing study courses. This is confirmed by a TSI Rector's signed confirmation.

10 10 - The sample of the study agreement complies with the mandatory provisions to be included in the study agreement.

Assessment of compliance: Fully compliant

Study agreements include all necessary parts set in legislation. It is advised to include information about guarantees of compensation losses (11. and 12. criteria) so that this information is easier for the students to acknowledge already from the beginning.

11 11 - The higher education institution / college has provided confirmation that students will be provided with opportunities to continue their education in another study programme or another higher education institution or college (agreement with another accredited higher education institution or college) if the implementation of the study programme is terminated.

Assessment of compliance: Fully compliant

TSI has a cooperation agreement with Riga Technical University confirming that in case the implementation of programmes in this study field is terminated, students will be able to continue studies in the RTU study field "Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management and Computer Science".

12 12 - The higher education institution / college has provided confirmation that students are guaranteed compensation for losses if the study programme is not accredited or the study programme's license is revoked due to the actions (actions or omissions) of the higher education institution or college and the student does not wish to continue studies in another study programme.

Assessment of compliance: Fully compliant

University has a rector's signed refund and compensation policy that confirms it will compensate losses to students if the study programme is not accredited or loses its license and the student does not wish to continue studies in another study programme.

13 13 - The joint study programmes comply with the requirements prescribed in Section 55.(1), Paragraphs one, two, and seven of the Law on Higher Education Institutions (if applicable)

Assessment of compliance: Not relevant

N/A

14 14 - Compliance with the requirements specified in other regulatory enactments that apply to the study programme being assessed (if applicable)

Assessment of compliance: Not relevant

N/A

Assessment of the requirement [8]

1 R8 - Compliance of the study programme with the requirements set forth in the Law on Higher Education Institutions and other regulatory enactments.

Assessment of compliance: Fully compliant

The requirement has been met and fulfilled, and all requirements set in different regulatory enactments are satisfied - the study programme complies with State Academic Education Standard and Law on Higher Education Institutions. There are no additional regulations specific to this field.

General conclusions about the study programme, indicating the most important strengths and weaknesses of the study programme

The specific study programme under assessment showcases strengths that contribute to its effectiveness. It successfully ensures that students achieve learning objectives and graduate with the necessary skills. The programme benefits from a collaboration with UWE Bristol, which brings valuable insights and higher quality standards. It is designed to meet the needs of the ICT industry and keeps pace with the latest trends and technologies. The high employability rate of graduates highlights the programme's relevance and marketability. Additionally, the programme offers a competitive advantage in the Latvian educational services market with its shorter version. However, there are weaknesses to address, including a potential lack of emphasis on soft skills, curriculum overlap with another programme, outdated literature in some course descriptions, unclear documentation for the double degree programme, and the need for sufficient expertise among teaching staff. Improving these areas would further enhance the programme's effectiveness.

Strengths:
1. Students achieve learning objectives and ensure that graduates from the programme achieve the necessary learning outcomes. TSI has a broad range of classrooms and laboratories supported by necessary information systems.
2. Cooperation with UWE Bristol allows TSI to acquire good practices, setting a higher quality standard for this study programme.
3. The programme is designed to meet the needs of the ICT industry and is continuously updated to keep up with the latest trends and technologies
4. The majority of the graduates of the programme find employment in their field of study shortly after graduation, indicating the relevance and marketability of the programme.
5. The programme offers a short version of the programme in the amount of 60 CP, ensuring the

competitiveness of the programme in the Latvian educational services market.
Weaknesses:
1. While the study programme appears to provide students with a strong foundation in technical skills related to computer science, there may be limited emphasis on soft skills.
2. The curricula have significant overlapping with those of the Management of Information Systems (45482).
3. The proposed literature is that most of the study course descriptions are rather old.
4. The study programme courses are taught by 13 teaching staff members but only 9 of them published scientific papers in peer-reviewed international venues and/or have five years of practical experience according to SAR.

No other weaknesses were identified regarding insufficient satisfaction with regulatory requirements. However (this is not a weakness) it would be advised for TSI to consider adding information regarding 11. and 12. criteria in study agreements, so this information would be easier for the students to acknowledge already from the beginning

Evaluation of the study programme "Computer Science"

Evaluation of the study programme:

Good

2.6. Recommendations for the Study Programme "Computer Science"

Short-term recommendations

Increase the number of practical assignments and projects in the study programme to provide more hands-on experience for the students.
Increase the number of elective courses to provide students with a broader range of options and to allow them to tailor their education to their individual interests and career goals.
Develop a document specifying rules for calculation and assessing the teaching and research load of academic staff.
Develop or document/documents regarding the preparation and defense of the final year thesis, marking and assessment procedures or respective conversation rules, coherences and discrepancies between the TSI and UWE Bristol study processes.
Evaluate whether to include information about compensations and other study opportunities (in case the programme is discontinued) in the study agreement.
Need to formalize entrance criteria for candidates without IT education.

Long-term recommendations

Develop a strategy for internationalization of the study programme, such as establishing partnerships with foreign universities, promoting study abroad opportunities, and recruiting international students.
Expand the programme's research focus to incorporate emerging areas of computer science, such as quantum computing, blockchain, and cybersecurity.

Implement measures to increase diversity and inclusivity within the programme, such as offering scholarships to underrepresented groups, promoting diversity in faculty hiring, and providing training on cultural competency.
Make the curricula more distinctive by eliminating the courses which are overlapping with other master's programsme from the same study field and by introducing more specific courses for this programme.
Include in the curricula (even mandatorily) practical activities to be performed outside the TSI (industrial trainings, internships, etc.) to better fit the studies to the industrial requirements and increasingly pique the interest of the students.
As the covered fields are very dynamically evolving, the frequent updating of the recommended literature in the study course descriptions is mandatory.

II - "Computer Engineering and Electronics" ASSESSMENT

II - "Computer Engineering and Electronics" ASSESSMENT

2.1. Indicators Describing the Study Programme

Analysis

2.1.1

The study programme is a Master's level programme in the field of "Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management, and Computer Science". The SAR explains that the programme is designed to provide students with advanced knowledge and skills in the field of computer engineering and electronics, as well as to prepare them for research and development work in the field. The programme's curriculum is aligned with the study field and covers a wide range of topics related to computer engineering and electronics, including digital signal processing, embedded systems, industrial electronics, and telecommunications systems. The programme also offers three specializations: Embedded Electronic Systems, Industrial Electronics, Telecommunications Systems and Computer Networks, which are all relevant to the study field. The SAR also explains that the programme's learning outcomes are aligned with the study field and are designed to prepare students for a wide range of career opportunities in the field of computer engineering and electronics. The programme's learning outcomes include the ability to design and develop complex electronic systems, the ability to analyze and optimize electronic systems, and the ability to manage and lead electronic system development projects. Overall, the study programme "Computer Engineering and Electronics" (45523) is compliant with the study field "Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management, and Computer Science". The programme's curriculum, specializations, and learning outcomes are all aligned with the study field and are designed to prepare students for successful careers in the field of computer engineering and electronics.

2.1.2

The title, code, degree to be obtained, professional qualification or degree and professional qualification of the study programme are all interrelated and are designed to prepare students for successful careers in the field of computer engineering and electronics. The programme's aims, objectives, and learning outcomes are also interrelated and are designed to provide students with advanced knowledge and skills in the field of computer engineering and electronics, as well as to prepare them for research and development work in the field. The admission requirements for the

programme are also related to the programme's aims and objectives, as they are designed to ensure that students have the necessary background knowledge and skills to succeed in the programme. Overall, the study programme "Computer Engineering and Electronics" (45523) is designed to provide students with a comprehensive education in the field of computer engineering and electronics, and all aspects of the programme are interrelated and designed to prepare students for successful careers in the field.
The title, code, degree to be obtained, professional qualification or degree and professional qualification of the study programme are all interrelated and are designed to prepare students for successful careers in the field of computer engineering and electronics. The programme's aims, objectives, and learning outcomes are also interrelated and are designed to provide students with advanced knowledge and skills in the field of computer engineering and electronics, as well as to prepare them for research and development work in the field. The admission requirements for the programme are also related to the programme's aims and objectives, as they are designed to ensure that students have the necessary background knowledge and skills to succeed in the programme. Overall, the study programme "Computer Engineering and Electronics" (45523) is designed to provide students with a comprehensive education in the field of computer engineering and electronics, and all aspects of the programme are interrelated and designed to prepare students for successful careers in the field.
The duration and scope of the study programme implementation, including different study programme implementation options, as well as the implementation language, are reasonable and justified. The programme's duration and scope are designed to provide students with advanced knowledge and skills in the field of computer engineering and electronics, as well as to prepare them for research and development work in the field. The programme offers different implementation options, including full-time and part-time studies, which are designed to accommodate the needs of different students. The implementation language of the programme is Latvian and English, which is reasonable and justified given the location of the institution and the needs of the local labour market. Overall, the duration and scope of the study programme implementation, as well as the implementation language, are reasonable and justified for the study programme "Computer Engineering and Electronics" (45523). The programme is designed to provide students with a comprehensive education in the field of computer engineering and electronics, and the implementation options and language are designed to accommodate the needs of different students and the local labour market. It may be beneficial to consider merging the Computer Engineering and Electronics programme with the Computer Science programme to create a more comprehensive and balanced programme, providing students with a wider range of knowledge and skills, and better preparing them for the job market.

2.1.3
According to the SAR, the corrections made to the study programme's parameters have been analyzed, justified, and would be supported. The changes include the name of the programme, the awarded degree, admission requirements, study duration, and the structure of the programme. The introduction of a short version of the programme with a duration of 60 CP is justified by the need to make the programme more competitive in the Latvian educational services market and to attract foreign students. The admission requirements have also been updated accordingly. Furthermore, the changes made to the programme's structure include the expansion of the horizon of knowledge and skills of the students, in accordance with the development trends in the field. The programme now includes courses related to robotics, computer vision, artificial intelligence, design of SAF circuits, and embedded systems. This contributes to the formation of students' practical scientific competencies and improves the interdisciplinary connection in the programme. The changes align with the national regulations, meet the demands of the labour market, and provide students with the necessary skills and competencies for successful professional activity in the field of electronics

and automation.

2.1.4
The Master's programme "Computer Engineering and Electronics" is economically and socially justified, as it falls under the thematic field of "Engineering and Technology" and the smart specialization area of "Information and Communication Technologies" (STEM). This field has a direct horizontal contribution to the development of other smart specialization areas in Latvia, promoting economic transformation and growth of high and medium-high technologies in the export of Latvian goods and services. In terms of labour market demand, by 2040, the demand for labour is expected to shift in favour of specialists with higher education, with a possible shortage of 37 thousand professionals by 2027. The Master programme "Computer Engineering and Electronics" at TSI has an employment rate for graduates of 80.5% in 2020, while the employment rate for higher education graduates is planned to be 80% by 2024. The income of graduates in the STEM sector in 2020 was estimated to be EUR 17,104, while the income of TSI graduates in Engineering and Technology was estimated to be 15,689 EUR. The demand for TSI's STEM programmes from foreign students is increasing every year, with an average of 30% per year, showing that the existing programmes have export potential. The Master's programme is fully in line with contemporary world trends in the field of ICT and engineering, as well as the most important development directions of the Latvian economy in accordance with smart specialization. The quality level of the competencies acquired by the graduates of TSI provides them with opportunities to find jobs not only in Latvia but also in foreign countries. Therefore, the programme is economically and socially justified and meets the needs of Latvia's smart specialization, and the national economy. The analysis of development plans and the economic and societal needs of Latvia in the era of digitalization clearly indicates the need to continue and expand the training of specialists in this field. The "Computer Engineering and Electronics" programme may be considered too narrow in today's technological landscape, with a weak emphasis on electronics and a strong focus on computer science. To provide students with a more comprehensive understanding of the field and a wider range of employment opportunities after graduation, it may be beneficial to consider merging the programme with a broader programme in computer science. The programme's learning outcomes may not fully align with industry needs and best practices in the field, indicating a potential area for improvement. Developing international partnerships and collaborations is a valuable opportunity for the programme to promote itself and attract international students and lecturers. This can enhance the diversity and global reach of the programme, as well as provide opportunities for collaboration and exchange of knowledge and expertise. Collaboration and sharing of expertise among lecturers can contribute to the enhancement of the quality and coherence of the programme.

2.1.5
N/A

Conclusions on this set of criteria, by specifying strengths and weaknesses

The Strengths and Weaknesses of the Bachelor's degree programme in Computer Engineering and Electronics at TSI are analyzed in the Self-Evaluation Report (SER). This programme aims to prepare professionals with the knowledge and skills necessary to work in the field of computer engineering and electronics.

Strengths
1. Connection with employers: The programme is connected with employers through the active participation of teaching staff in professional organizations and associations. This ensures that the study programme is aligned with industry needs and trends.

2. Student-centered approach: The study process involves a number of other specialists in the field, whose professional experience not only deepens the students' practical knowledge and skills within the study course but also enhances the students' employment opportunities after graduating from the programme. The programme also has a mechanism for mutual cooperation between academic staff and regular meetings of teaching staff, which ensure that the study courses are continuously improved based on feedback from students and industry development trends.

Weaknesses
1. The emphasis of the programme on electronics is weak in comparison to computer science, which may be considered too narrow in today's technological landscape. With the rapid development of computer science, it may be beneficial to consider merging the "Computer Engineering and Electronics" programme with a broader programme in computer science. This would allow students to gain a more comprehensive understanding of the field and provide a wider range of employment opportunities after graduation.
2. Narrow programme: The programme is too narrow in today's technological landscape, with a weak emphasis on electronics and a strong focus on computer science. To provide students with a more comprehensive understanding of the field and a wider range of employment opportunities after graduation, it may be beneficial to consider merging the programme with a broader programme in computer science.
3. Learning outcomes: The programme's learning outcomes do not fully align with industry needs and best practices in the field can be considered a weakness. This may result in graduates lacking the necessary skills and knowledge to succeed in the industry or being unprepared for current and emerging trends in the field. It is important to regularly review and update the programme's learning outcomes to ensure they remain relevant and in line with industry needs.
4. International strategy: Without sufficient resources and a well-planned strategy, developing international partnerships and collaborations may not be feasible. The programme may face challenges in identifying and establishing partnerships with relevant institutions, as well as managing the logistics and financial aspects of hosting international students and lecturers. Additionally, language and cultural barriers may also pose challenges to effective communication and collaboration.
5. Collaboration mechanisms: The programme does not provide clear information on the mechanisms and opportunities for lecturers to collaborate and share their expertise, which could limit the potential benefits that could be gained from such collaboration.

2.2. The Content of Studies and Implementation Thereof

Analysis

2.2.1.
All the courses, their content and learning outcomes are mapped to the skills and knowledge and competencies provided by the study programme (SAR Appendix 4.2.). The correlation of the aims and learning outcomes of the study programme with the learning outcomes of specific study courses are described in each study course description. The goal of the study programme is to provide a set of knowledge, skills and competencies according to Level 7 of the European Qualifications Framework of Latvian Education Classification.
In the frame of the 80 CP variant of the basic 60 CP programme, the so-called "pre-master" study of one extra semester is offered for those students who have fewer electronics and automation or robotics-related backgrounds to achieve the same basic knowledge required from all the students from this study programme.
It combines both hardware and software. Its main specialization is in Embedded Electronics Systems, Robotics and Communication Technologies. These specialities cover the real needs of the

labour market. The programme includes the courses “Robotics and Autonomous Systems Design”, “Artificial Intelligence”, “Advanced Artificial Intelligence”, “Cyber Security and Data Protection”, “Intelligent Data Processing” “Computer Vision and Image Processing”, “Embedded Systems”, which provide students with knowledge and skills for the design and managing modern electronics and automated systems.
In SAR, the descriptions of all the taught courses and the final thesis are sufficiently detailed. In most cases, the content of the courses is pertinent and adequately follows the main aims of this study programme. Some complementary features between the courses offered within a certain speciality can be identified. The included free-choice subjects in the curricula offer some individual flexibility for the students concerning the needs of the student's future careers. The curriculum is a logical continuation of the two bachelor-level computer engineering and electronics and engineering-related study programmes offered at TSI.
Several courses are taught by specialists having strong practical/industrial experience in the given fields. Also, valuable guest lecturers are sharing their knowledge with the students.
The main part of the shorter programme is covered by 6 study courses of 22 credit points in total, and the specialization additionally includes 4 courses of 16 credit points. The master thesis of 20 credit points concludes the study programme and should demonstrate the knowledge and skills obtained during the studies. The long variant of the programme additionally includes the pre-master semester of 1 core course (4 CP) and 3 specialization courses (12 CP). A mapping of the study programme learning outcomes and respective course contents is given in SAR Annex 5.3. The learning outcomes of the specializations including professional competencies in electronics and automation and computer engineering are in high industry demand in today's industry. The specific feature of the programme is the longer variant of the programme which is designed for students, who do not have sufficient computer engineering background this variant includes an additional pre-master semester, which covers the most important basic skills: Artificial Intelligence and Robotics and Autonomous Systems Design and Embedded systems.
There are some course titles, which do not cover adequately and specifically their content. For example, the Artificial Intelligence course (code M-400-01) mainly deals with machine learning, while Advanced Artificial Intelligence (code M-402-01) with neural networks.
The quality assurance of the study programme is based on strong cooperation with the employers organizing the meetings for the discussion of requirements of the current industry situation and demands of the labour market. Reviewing annual SAR is an inherent part of these meetings and suggestions are developed for the study programme improvement. The updated courses are coordinated, approved by the Study Council and included in the study programme register at the beginning of the new study year.
The study programme is developed in accordance with the requirements of the State Cabinet of Ministers Regulation No.240 "Regulations on the State Standard of Academic Education".
The recommended literature in the study course descriptions partly is old, and not in line with the actual knowledge in the field.

2.2.2.
For the graduating students, it is mandatory to publicly present their research results at least in a conference before defending their M.S. thesis. For this purpose, they have a very good opportunity at the twice-a-year organized "Science and Technology - A Step into the Future" student scientific conference, where also master's degree students can participate and present their research results. Participation in this scientific event is mandatory, as being included in the syllabus of the Master Thesis course (code M-255-04), even if the student does not present a paper.
For the own paper preparation, the Research Methodology course (code M-231-04) is very useful for students since it is strongly focused on providing students with the skills necessary to carry out their scientific work leading to completing the master thesis. Only after presenting the thesis work as a

conference presentation a student is allowed to the final thesis defence where a mandatory pre-defence procedure precedes. The successful defence of the final thesis leads to awarding the student with the degree “Master of Engineering in Electronics and Automation”.

2.2.3.
In the light of the outcomes to be achieved within the study programme, specific study courses were identified and the scope of knowledge, skills and competencies to be achieved within each individual course was defined to support the teachers and students.
The study process is mainly implemented in the format of interactive lectures, seminars, workshops and student-independent work. Courses include workshops, discussions, teamwork and project work focused on professional tasks and problems. The basic principles and procedure for the assessment of the acquisition of the study programme comply with the requirements of Article 40 of the National Academic Education Standard. It is stated that the final course assessment (test or examination) should not exceed 50% of the final mark for the course.
In TSI at all education levels advanced teaching methods are applied which have the potential to contribute to the achievement of study courses and programme objectives, and foreseen results, especially by considering the general student-centred teaching and learning principles.
In most cases, the recommended bibliography provided in the syllabus of the courses taught also in English comprises exclusively English resources, easily comprehensible also for foreign students.
Being a very applicative study programme, the distance learning form is not implemented at the master level. The rules for the master thesis defense including the mandatorily needed conditions are established by the TSI and are well-known by the students. Also, the M.S. Thesis evaluation criteria are clearly defined and made public by the Promotional Council of the University. Moreover, the students have a mandatory course (Master Thesis, course code M-255-04) within which they are taught about the master thesis preparation, the general requirements and procedures regarding the defence, use of TSI library services, ethics, and plagiarism.
Blended learning is widely used for the study programme implementation. This approach integrates traditional classroom activities with technology and digital media, giving students more flexibility to customize their learning experiences. Students are provided with video recordings, online quizzes and access to virtual platforms (e.g., Google Colab) for improving learning outcomes.
Therefore a flexible study process is provided – there are various forms of study (on-site full-time and part-time), which gives students the opportunity to combine work with studies. The students from the day department have the opportunity to change the form of studies to part-time or distance learning in order to combine studies and work.
The relevance of the course of study is also ensured by the proportion of teaching staff recruited from the industry and by periodic meetings with the employers. The course content and teaching process assessment are realized by collecting feedback from the employers through surveys and regular meetings organized by the Head of the Study Programme and Dean of the Faculty. The survey analyses show that the content of the study programme is relevant and overall aims and outcomes of the study programme are achievable.
Updated courses of the study programme are coordinated, approved and included in the Register of Study Programmes and uploaded to the E-learning environment Moodle by the beginning of the new academic year.

2.2.4.
N/A

2.2.5.
N/A

2.2.6.
Master's degree students have great flexibility in selecting their research topics since their study programme covers a wide area. They are individually advised about this in the frame of the Research Methodology course (code M-231-04). Also, leading electronics and ICT companies (official TSI partners) are offering thesis topics for graduating students. But in most cases, the M.S. students are selecting topics strongly connected to their everyday work from the companies.
There is an option for the students to choose the topic of the final thesis by themselves or the students can contact and ask the academic staff or bring the topic from a company. The proposed topics will be discussed and agreed upon with the Head of the Study programme, which assures that the topics are relevant to the programme. It should be mentioned that TSI has on their website an available list of all the running and former research and development projects with the contact data of the principal investigator. This helps the students interested in the research options to find suitable final thesis topics.
The defended final year thesis topics are comprehensive enough as the expert group could during the visit to TSI and it is seen from the additional information sent after the visit by email upon the request. The topics are ranging from PCB designs and respective applications to novel complicated data acquisition devices and smart robot control systems, therefore covering a wide scope of Computer Engineering and Electronics. This should be considered a good indicator referring to the broad scope and contemporary content of the programme. Therefore the defended thesis topics should be considered relevant to the programme.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The global impression of the self-assessment report and the organized meetings concerning this criterion of the expert team is positive.
The study programem is compliant with the Latvian National Standard for Academic Education and it is fully supported by the Latvian Higher Education Council. The three planned specialities adequately cover the aims of this study programme. The included free-choice subjects in the curricula offer some individual flexibility for the students concerning their studies. Some improvements could be done to make the course topics closer to the real-world issues required by the companies hiring the graduating students.
It should be emphasized that all master's degree students have great flexibility in selecting the topics of their M.S. thesis from internal and external (leading Electronics, Robotics and ICT companies) offers.

Strengths
1. The study programme is compliant with the Latvian National Standard for Academic Education and it is fully supported by the Latvian Higher Education Council.
2. There is a possibility to gain basic Computer Engineering and Electronics related knowledge for those students who do not have sufficient background in this field by selecting the 80 CP variant of this study programme. Within this, they will have a so-called "pre-master" extra semester for this purpose. This can grant students an option to change the direction of their former education and develop a career in Computer Engineering and Electronics.
3. Graduating students are obligated to present their research work at least in a conference before being able to defend their thesis.

Weaknesses
1. The curricula lack practical activities outside TSI (industrial training, internships, etc).
2. The proposed literature is that most of the study course descriptions are rather old.
3. Limited opportunities for practical experience: The report notes that practical experience is an

important aspect of the study programme and that efforts are made to ensure that students have access to practical projects and internships. However, the SAR also notes that opportunities for practical experience may be limited due to the COVID-19 pandemic and other factors.

Assessment of the requirement [5] (applicable only to master's or doctoral study programmes)

1 R5 - The study programme for obtaining a master's or doctoral degree is based on the achievements and findings of the respective field of science or field of artistic creation.

Assessment of compliance: Fully compliant

The programme is well compiled and the programme is in line with the regulations and good practices both in the EU and Latvia. In general, the teaching process can guarantee the main aims of the programme and the achievement of the foreseen learning outcomes.
As the curricula is covering advanced and dynamically evolving fields such as automation and electronics, the course syllabuses must be kept permanently up-to-date to be all the time attractive, and close to the practical issues required by the labour market. For this purpose, the share of practical work should be increased, too. It is essential to increase efforts to attract more students to the programme and increase collaboration with companies that can help promote the programme.

2.3. Resources and Provision of the Study Programme

Analysis

2.3.1
TSI has a proven record of establishing and delivering engineering study field programmes. Higher education institution has a broad range of classrooms and laboratories supported by necessary information systems (intranet, Moodle, mobile application with time schedule and public portal) and specialized software to ensure delivery of study programme and provide necessary prerequisites for the achievement of learning. Students can use physical and electronic libraries (Academic Complete, Science Direct, Scopus, limited access to Coursera and other sources) to get necessary materials for their studies.
Delivery of the Computer engineering and electronics master study programme requires specific equipment for laboratory work. TSI has established 11 specialized laboratories including CISCO Computer Networks, ABC&IP (for Computer Vision and Image Processing), Microcontroller, Electronics and Robotics laboratories that are used by academic staff and students in relevant study courses of this programme. Laboratories and related equipment are actively utilized in the process of preparation for a Master's thesis.
TSI has attracted and managed to keep the expert-level academic staff that are able to deliver study programmes in both languages (Latvian and English) and effectively collaborate and support students. During the sessions with students, graduates, and teachers (all separately), all groups reconfirmed the sufficiency of the existing processes and the availability of necessary equipment to ensure well-organized face-to-face and remote classes including practical classes in laboratories.

2.3.2
N/A

2.3.3
Study programme delivery is financed mostly by students’ tuition fees. During the pandemic period, TSI managed to keep and even grow the total number of students. Based on calculations made by

TSI, average expenses per 1 student (1148,18 euros) are the 2nd highest (after the PhD programme) in the Computer science study field. This is driven by the low number of students in this study programme and the required laboratories and equipment to run the programme. However, TSI managed to mitigate this challenge by combining the delivery of the same study courses of several study programmes. This helped to optimize the utilization of academic staff and institution premises and decrease costs. Based on the feedback received from students and graduates, such optimization has not impacted the achievement of learning objectives and even provided advantages to students by extending their relationship network and collaboration between students of different study programmes.
Based on TSI calculation, a study programme needs to have at least 6 students to be cost-effective. Since the total number of students is not growing for 7 years (max is 10) and during the last 3 years only 3 students have graduated from this programme, then this makes the biggest concern and requires improvements to achieve the financial sustainability of this programme. Dependency on modern laboratories makes this concern even stronger.

Conclusions on this set of criteria, by specifying strengths and weaknesses

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has implemented improvements to mitigate the negative impact of the constantly low number of students (10 and below).

Strengths:
1. TSI has the necessary resources (premises, teaching staff and IT systems) and working processes to achieve learning objectives and support students with their graduation.
2. Institution has established specialized laboratories necessary for the delivery of study courses (including CISCO Computer Networks, ABC&IP (for Computer Vision and Image Processing), Microcontroller, Electronics and Robotics laboratories).
3. TSI has managed to optimize costs by combining the delivery of study courses between different study programmes.

Weaknesses:
1. Number of students remains low for 7 years (10 and below) and this negatively impacts average expenses per 1 student and the financial sustainability of the programme. TSI needs to focus on attracting new students.

Assessment of the requirement [6]

1 R6 - Compliance of the study provision, science provision (if applicable), informative provision (including library), material and technical provision and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of learning outcomes

Assessment of compliance: Fully compliant

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has a broad range of classrooms and laboratories supported by necessary information systems.
Academic staff is built from highly experienced own personnel and invited experts from the industry.
TSI has implemented improvements to optimize costs per student by combining the delivery of study courses between study programmes without a negative impact on achieving learning objectives.

The study programme is financed mostly by students' tuition fees and the current number of students is sufficient to keep this programme cost effective.

2.4. Teaching Staff

Analysis

2.4.1.
The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 199-201) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The study programme courses are taught by 13 teaching staff members, of whom 10 have been elected at TSI. 4 TSI professors and 2 associate professors are involved in the implementation of the compulsory and limited optional part of the programme. Additionally, 3 assistant professors and 1 lecturer are also involved in the implementation of the programme. 90% of the academic staff involved in the programme have a doctoral degree in engineering, relevant academic work experience and qualifications.
In addition to the academic staff, several industry specialists and foreign teaching staff take part in the teaching process, either as guest lecturers or with responsibility for full course delivery. 2 of the guest lecturers have a Doctoral degree, the others have Master's degrees.
According to Annex 2.9 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions. Similarly, according to the SAR, the knowledge of the national language of the teaching staff involved in the programme complies with MK 07.07.2008. to regulations no. 733 "Rules on the amount of knowledge of the national language and the procedure for testing the national language proficiency for the performance of professional and official duties, obtaining a permanent residence permit and obtaining the status of a permanent resident of the European Union and the state fee for the national language proficiency test".

2.4.2.
The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 201-202) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The number of teaching staff involved in the implementation of the study programme is one less than the corresponding number during the previous accreditation (12 instead of 13). However, only 4 members of the teaching staff are the same. During the reporting period, 7 new (elected TSI) lecturers were recruited into the programme and several teaching staff members have increased their academic work experience and have been elected to higher-level positions. Some of the teaching staff obtained a doctorate during the reporting period and are now teaching in the study programme.
TSI examines the competencies of the teaching staff as part of the hiring process, including by the Director of the study programme. In cases when competencies need updating, this is done by means of seminars. As a result, no teaching staff member is assigned teaching duties in subjects, not among their respective competencies. However, unexpected needs to fill teaching gaps are difficult to satisfy; this is usually done by employing lecturers of other HEI, who mostly teach remotely.

2.4.3.
N/A

2.4.4.
The analysis herein is based on the information provided in Annex 10 of the SAR.
4 Professors (Jackiva, Pavlyuk, Kabaskins, Grakovskis) and 1 Associate Professor (Spiridovska, Krainukovs) are listed as teaching staff members taking part in the implementation of the study

programme. According to their CVs, they are all active in research and have published in international venues in the last six years and/or have practical experience.

2.4.5.
The analysis herein is based on the information provided in the Self-Assessment Report (SAR) pp. 203-204) and the Annexes to it; the TSI website; and the interviews conducted during the visit.
During the implementation of the study courses regular meetings of the teaching staff take place, in which they exchange experiences on the study course topics, research results, new developments in the research, etc. In order to ensure the effective implementation of the study programme, the Director of the study programme engages the senior lecturers in an open discussion on the content of the study programme, study outcomes, and implementation approaches. The discussions take place in an informal setting and aim at discussing and agreeing on aspects of the implementation of the study programme; discussing the content of specific courses in order to avoid duplication of topics in the course content; and discussing the teaching methods used in the course. Following the discussion, the programme director makes proposals to be included in the annual self-evaluation of the programme. If a new course of study is proposed to be included in the programme, the discussion takes place during a formal meeting of the faculty, where the need for the new course is discussed; the learning outcomes of the course are defined; and the lead teaching staff member responsible for the preparation of the course description and methodological material is identified. An expert is identified who will review the material and make recommendations to the lead lecturer.
Important cooperation events are preliminary and final defences of master theses. The preliminary defences are organized with the participation of a committee of faculty members, where recommendations for improvement are collectively made. Cooperation is also observed during and after the final defence of master theses when the Final Examination Commission gives its evaluation as a result of the discussion.

Conclusions on this set of criteria, by indicating strengths and weaknesses

The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and study results of the study programme and corresponding study courses. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme. All members of the academic staff in the last six years have published in peer-reviewed international venues and/or have five years of practical experience, in accordance with the Law on Higher Education Institutions.

Strengths:
1. Relevance to industry: The programme is implemented by academic staff who not only work at TSI but also in companies in the industry. This provides students with practical knowledge and skills that enhance their employment opportunities after graduation.
2. Cooperation between academic staff: The programme has a mechanism for mutual cooperation between academic staff, which promotes the development and interconnection of the study courses. This ensures that the study courses are continuously improved based on suggestions made by students, industry development trends, and the latest results of research, scientific activities, and innovations.

Weaknesses:
1. Limited guest lecturers with doctoral degrees: While some guest lecturers have a doctoral degree, the majority have only a master's degree. This may limit exposure to a diverse range of expertise and perspectives in the field.

Assessment of the requirement [7]

1 R7 - Compliance of the qualification of the academic staff and visiting professors, visiting associate professors, visiting docents, visiting lecturers and visiting assistants with the conditions for the implementation of the study programme and the requirements set out in the respective regulatory enactments.

Assessment of compliance: Fully compliant

Most of the criteria are satisfied and identified weaknesses can be remedied. In Section 2.4.1, it is stated that the academic staff involved in the study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions. Additionally, the knowledge of the national language of the teaching staff involved in the programme complies with the regulations on the amount of knowledge of the national language and the procedure for testing national language proficiency. This indicates that the academic staff, including visiting professors, visiting associate professors, visiting docents, visiting lecturers, and visiting assistants, meet the necessary qualifications and requirements set by the regulatory enactments for the implementation of the study programme. The SAR and Annexes likely provide detailed information and evidence supporting the compliance of the academic staff with the necessary qualifications and requirements.

2.5. Assessment of the Compliance

Requirements

1 1 - The study programme complies with the State Academic Education Standard or the Professional Higher Education Standard

Assessment of compliance: Fully compliant

The study programme “Computer Engineering and Electronics” volume is 60 or 80 CP of which 22 (or 26)CP are a compulsory part, 28 (or 16) CP are for compulsory choice study courses, 6 (or 2)CP for the free elective part, and 20CP for Masters thesis. The programme structure complies with Cabinet Regulations No. 240.
The study programme includes obligatory study courses about environmental protection and civil protection (if the student has not had these study courses before).
The acquirable degree is in compliance with classification in regulatory enactments.
The study programme fully complies with the State Academic Higher Education Standard and Cabinet Regulation No. 240.

2 2 - The study programme complies with a valid professional standard or the requirements for the professional qualification (if there is no professional standard required for the relevant occupation) provided if the completion of the study programme leads to a professional qualification (if applicable)

Assessment of compliance: Not relevant

N/A

3 3 - The descriptions of the study courses and the study materials have been prepared in all languages in which the study programme is implemented, and they comply with the requirements set forth in Section 561 , Paragraph two and Section 562 , Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

Study course descriptions and study materials are prepared in Latvian and English languages, and they satisfy requirements set in Law on Higher Education Institutions.

4 4 - The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure according to which state recognised documents of higher education are issued.

Assessment of compliance: Fully compliant

The diploma issued complies with the state legislature and “Procedures by which documents certifying higher Education recognised by the State shall be issued” (Cabinet of Ministers No. 202).

5 5 - The academic staff of the academic study programme complies with the requirements set forth in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

There are at least 5 associate professors or professors involved in the study programme implementation together. It is confirmed by the TTI Rector confirmation.

6 6 - Academic study programmes provided for less than 250 full-time students may be implemented and less than five professors and associated professors of the higher education institution may be involved in the implementation of the mandatory and limited elective part of these study programmes provided that the relevant opinion of the Council for Higher Education has been received in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Not relevant

N/A

7 7 - At least five teaching staff members with a doctoral degree are among the academic staff of an academic doctoral study programme, at least three of which are experts approved by the Latvian Science Council in the respective field of science. At least five teaching staff members with a doctoral degree are among the academic staff of a professional doctoral study programme in arts (if applicable).

Assessment of compliance: Not relevant

N/A

8 8 - The teaching staff members involved in the implementation of the study programme are proficient in the official language in accordance with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties.

Assessment of compliance: Fully compliant

The academic staff has sufficient Latvian language knowledge for implementing study courses. This is confirmed by a TSI Rector’s signed confirmation.

9 9 - The teaching staff members to be involved in the implementation of the study programme have at least B2-level knowledge of a related foreign language, if the study programme or any part thereof is to be implemented in a foreign language (if applicable).

Assessment of compliance: Fully compliant

The academic staff has sufficient foreign language knowledge for implementing study courses. This is confirmed by a TSI Rector’s signed confirmation.

10 10 - The sample of the study agreement complies with the mandatory provisions to be included in the study agreement.

Assessment of compliance: Fully compliant

Study agreements include all necessary parts set in legislation. It is advised to include information about guarantees of compensation losses (criteria No. 11 and 12) so that this information is easier for the students to acknowledge already from the beginning.

11 11 - The higher education institution / college has provided confirmation that students will be provided with opportunities to continue their education in another study programme or another higher education institution or college (agreement with another accredited higher education institution or college) if the implementation of the study programme is terminated.

Assessment of compliance: Fully compliant

TSI has a cooperation agreement with Riga Technical University confirming that in case the implementation of programmes in this study field is terminated, students will be able to continue studies in the RTU study field “Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management and Computer Science”.

12 12 - The higher education institution / college has provided confirmation that students are guaranteed compensation for losses if the study programme is not accredited or the study programme’s license is revoked due to the actions (actions or omissions) of the higher education institution or college and the student does not wish to continue studies in another study programme.

Assessment of compliance: Fully compliant

TSI has a rector's signed refund and compensation policy that confirms it will compensate losses to students if the study programme is not accredited or loses its license and the student does not wish to continue studies in another study programme.

13 13 - The joint study programmes comply with the requirements prescribed in Section 55.(1), Paragraphs one, two, and seven of the Law on Higher Education Institutions (if applicable)

Assessment of compliance: Not relevant

N/A

14 14 - Compliance with the requirements specified in other regulatory enactments that apply to the study programme being assessed (if applicable)

Assessment of compliance: Not relevant

N/A

Assessment of the requirement [8]

1 R8 - Compliance of the study programme with the requirements set forth in the Law on Higher Education Institutions and other regulatory enactments.

Assessment of compliance: Fully compliant

The requirement has been met and fulfilled, and all requirements set in different regulatory enactments are satisfied - the study programme complies with State Academic Education Standard and Law on Higher Education Institutions. There are no additional regulations specific to this field.

General conclusions about the study programme, indicating the most important strengths and weaknesses of the study programme

No critical deficiencies that would cause any issues for implementing the study programme in any study forms have been identified, requirements for creating this programme are fully justified and it complies with the scope of this study field. The implementation of this study programme is well

justified and supported by the Council of Higher Education. The content of the study courses corresponds to the objectives of the study programme and ensures the achievement of learning outcomes. However, the weight of computer science-related disciplines is greater than that of electronics, which should be improved. It is debatable whether all the courses are in line with real industry needs and best practices in the field. The feasibility of this programme is debatable, too, because TSI has to compromise and organize study courses together with other study programmes, therefore it could limit opportunities for individualized attention. Better international collaborations (student mobilities, highly qualified guest lecturers invitations, more institution partnerships, etc.) could improve the educational process within this study programme. More involved students should be needed because their low number is negatively impacting the average expenses per student and the financial sustainability of the study programme.

Strengths:
1. Study programme fits within the objectives and strategic goals of the study field.
2. The programme is implemented by academic staff who not only work at TSI but also in companies in the industry. This provides students with practical knowledge and skills that enhance their employment opportunities after graduation.
3. Institution has established specialized laboratories necessary for the delivery of study courses (including CISCO Computer Networks, ABC&IP (for Computer Vision and Image Processing), Microcontroller, Electronics and Robotics laboratories)
4. The study process involves a number of other specialists in the field, whose professional experience not only deepens the students' practical knowledge and skills within the study course but also enhances the students' employment opportunities after graduating from the programme. The programme also has a mechanism for mutual cooperation between academic staff and regular meetings of teaching staff, which ensure that the study courses are continuously improved based on feedback from students and industry development trends.

Weaknesses:
1. Number of students remains low for 7 years (10 and below) and this negatively impacts average expenses per 1 student and the financial sustainability of the programme. TSI needs to focus on attracting new students.
2. The proposed literature is that most of the study course descriptions are rather old.
3. Programme has a weak emphasis on electronics, which may be considered too narrow in today's technological landscape. With the rapid development of computer science, it may be beneficial to consider merging the "Computer Engineering and Electronics" programme with a broader programme in computer science. This would allow students to gain a more comprehensive understanding of the field and provide a wider range of employment opportunities after graduation.
4. The programme is too narrow in today's technological landscape, with a weak emphasis on electronics and a strong focus on computer science. To provide students with a more comprehensive understanding of the field and a wider range of employment opportunities after graduation, it may be beneficial to consider merging the programme with a broader programme in computer science.
5. No weaknesses were identified regarding insufficient satisfaction with regulatory requirements. However (this is not a weakness) it would be advised for TSI to consider adding information regarding 11. and 12. criteria in study agreements, so this information would be easier for the students to acknowledge already from the beginning.

Evaluation of the study programme "Computer Engineering and Electronics"

Evaluation of the study programme:

Good

2.6. Recommendations for the Study Programme "Computer Engineering and Electronics"

Short-term recommendations

Review the course content and consider incorporating more computer science concepts into the programme to balance the emphasis on electronics.
Seek feedback from students and industry professionals to identify areas of improvement in the programme.
Evaluate whether to include information about compensations and other study opportunities (in case the programme is discontinued) in the study agreement.

Long-term recommendations

Consider merging the Computer Engineering and Electronics programme with the Computer Science programme to create a more comprehensive and balanced programme.
Conduct a thorough review of the programme's learning outcomes and ensure that they align with industry needs and best practices in the field.
Develop international partnerships and collaborations to promote the programme and attract international students and lecturers.
Encourage lecturers to collaborate and share their expertise to enhance the quality and coherence of the programme.

II - "Telematics and Logistics" ASSESSMENT

II - "Telematics and Logistics" ASSESSMENT

2.1. Indicators Describing the Study Programme

Analysis

2.1.1
The study programme appears to be sufficiently aligned with the study field, as it covers a wide range of topics related to this field, such as transportation systems, logistics, supply chain management, and intelligent transport systems, among others. Additionally, the programme is designed to provide a sequential development of knowledge, skills, and competencies, which is appropriate for a doctoral programme. The involvement of faculty members with doctoral degrees who are also supervisors of doctoral theses, as well as their active involvement in various research projects, further contributes to the compliance of the study programme with the study field. Overall, the programme seems to be designed and implemented in a way that ensures its relevance and alignment with the field.

2.1.2
The title, code, degree to be obtained, degree and professional qualification of the study programme, aims, objectives, learning outcomes and admission requirements are partially interrelated and play an important role in defining the purpose, structure and expected outcomes of the programme. The title and code of the programme provide a clear identification of the

programme, while the degree or professional qualification to be obtained highlight the level and nature of the programme. The aims and objectives of the programme define the overall purpose of the programme, while the learning outcomes describe the specific knowledge, skills and competencies that students are expected to acquire upon completion of the programme. Finally, the admission requirements ensure that students who enter the programme have the necessary background, skills and knowledge to successfully complete the programme and achieve its objectives. All of these elements are mostly interconnected and the duration and scope of a study programme implementation, as well as the implementation language, are crucial factors that need to be carefully considered and justified in order to ensure that the programme is effective and meets the needs of students and the broader community. The duration of a study programme should be reasonable and aligned with the expected learning outcomes and objectives of the programme. The scope of the programme should also be justifiable and clearly defined, taking into account the resources available, the needs of the students, and the demands of the profession or field of study. Different study programme implementation options, such as full-time, part-time or distance learning, can be justified based on the needs of students and the flexibility required for them to balance their studies with other commitments. The choice of implementation language should also be based on the target audience and the demands of the profession or field of study. Although the programme has some practical experience through internships and laboratory sessions, more extensive hands-on experience in the subject may be necessary for better preparation of students for their careers.
In summary, the duration and scope of a study programme, as well as the implementation language and options, should be carefully considered and justified based on the needs of students and the demands of the profession or field of study that play a crucial role in designing and implementing an effective study programme.

2.1.3
There are no changes made to the study programme's parameters within the assessment of the study field.

2.1.4
The economic and social justification of the study programme can be assessed through various indicators such as the relevance of the programme to the labour market, the contribution of the programme to the development of the country's economy and society, and the demand for professionals in the field. In the case of the analysed study programme, the field of transport and logistics is a crucial sector for economic development in many countries. The programme prepares highly qualified specialists in this field, which contributes to the development of the transport and logistics sector, and by extension, to the growth of the economy as a whole. The programme also addresses important social issues, such as sustainable development and efficient use of resources, which are relevant to the well-being of society. The dynamics of the number of students and employment indicators of the graduates can also provide insight into the relevance and quality of the programme. The number of students in the programme has been increasing over the past three years, which indicates a growing interest in the field and the programme. In addition, the employment rate of graduates from the programme has been consistently high, with many graduates finding employment in relevant fields such as transport and logistics companies, research institutions, and government agencies. Overall, the economic and social justification of the study programme seems strong, as evidenced by its relevance to the labour market, contribution to the development of the economy and society, and the positive dynamics of the number of students and employment indicators of the graduates.

2.1.5

N/A

Conclusions on this set of criteria, by specifying strengths and weaknesses

TSI emphasizes an interdisciplinary approach, research and innovation, and international partnerships to provide students with a comprehensive understanding of the field. With a focus on an interconnected curriculum and regular meetings among academic staff, the programme aims to develop students' independent research and collaborative skills to produce high-level graduates who contribute significantly to the field of transport engineering.

Strengths
1. Focus on interdisciplinary approach: The study programme is designed to provide an interdisciplinary approach to transport engineering, which can help students gain a broad understanding of the field and develop skills in various related areas.
2. Emphasis on research and innovation: The programme aims to develop students' research skills and encourage innovation, which can help them make a valuable contribution to the field of transport engineering.
3. Regular meetings of academic staff: Regular meetings of the academic staff are held to exchange experience on the topics of study courses, results of scientific work, and new developments in research, which can help ensure that the programme is continuously updated based on the latest industry trends and research findings.
Individual and group work: The study programme is designed to provide individual and group work, which can help students develop both independent research skills and collaborative skills.
4. Interconnected curriculum: The curriculum is designed to ensure the sequential development of knowledge, skills, and competencies based on individual and group work, and continuous communication between doctoral students and their supervisors.
5. High level of graduates: The study programme has produced graduates who have achieved excellent levels and have contributed to the field of transport engineering.
International partnerships: The programme has participated in various international projects and cooperated with other institutions, which can provide students with opportunities to gain valuable international experience and expand their professional network.

Weaknesses
1. Limited focus on practical experience: While the programme provides opportunities for research and publication, there may be a lack of emphasis on practical experience and hands-on training in the field.
2. Limited international exposure: While the programme does provide opportunities for international cooperation and participation in exchange and mobility projects, there may be a need for greater emphasis on international exposure and experience, particularly given the global nature of the field of transportation and logistics.
3. Limited diversity in student background: While the admission requirements ensure that students have a background in transportation and logistics, there may be a lack of diversity in terms of students' educational and academic backgrounds. This could potentially limit the range of perspectives and experiences available in the programme.

2.2. The Content of Studies and Implementation Thereof

Analysis

2.2.1.
The PhD study programme is supported by the Latvian Higher Education Council. Its curriculum of

programme is established considering the Latvian regulations in the field. It partially contains several general courses needed by PhD students to perform their research and prepare their thesis. The main weaknesses of the curricula are related to the included compulsory and limited elective courses, which are very fairly connected to the telematics and logistics topic of the PhD study programme. Almost all these courses are only in the field of computer science (Data Mining, Business Intelligence and Data Visualization, Artificial Intelligence, Big Data, Machine Learning and Predictive Analytics, Advanced Artificial Intelligence, Information Systems and Technologies, and Computer Vision and Image Processing).
The courses included in the curriculum are in line with the provided very general tasks of the study programme, which lacks specific scientific aims. All the courses are reviewed annually.
The descriptions of the study courses are generally adequate and comply with the provisions outlined in the regulatory authorizations. The contents of the courses are relevant and complementary only if solely computer sciences are considered. The foreseen courses can contribute to the achievement of the envisaged learning outcomes. The recommended literature in the study course descriptions partly needs to be updated.
The doctoral programme under evaluation was planned following the development trends in the ICT field and doctoral studies in Europe and the world, based on the recommendations of the World Bank. Yearly, a maximum of one student is studying in the Latvian language, so the efficiency of the two PhD study programme variants organised in this language is questionable (especially from a financial point of view).

2.2.2.
TSI clearly defined the obligatory conditions needed for defending the PhD thesis. These are public and known by all the candidates. Therefore, the PhD students make efforts for publishing their research results in time together with their supervisors also in SCOPUS-indexed papers, before the time of the defence to come (see Appendix 7.11). The share of PhD students obtaining the degree is very small.

2.2.3.
In TSI at all education levels advanced teaching methods are applied which have the potential to contribute to the achievement of study courses and programme objectives, and foreseen results, especially by considering the general student-centred teaching and learning principles.
The teaching aims can be surely fulfilled since 7 full professors are teaching the courses included in the curricula. Six among them are experts approved by the Latvian Council of Science.

2.2.4.
N/A

2.2.5.
The rules for the PhD defence including the mandatorily needed conditions are established by the TSI and are well-known by the involved doctoral students. Also, the thesis evaluation criteria are clearly defined and made public by the Promotional Council of the TSI.

2.2.6.
The proposed research topics (made public on the website of the TSI) are covering wide and multidisciplinary scientific areas. They also include nowadays hot topics like smart cyber-physical systems, the Internet of things, big data, virtual reality applications, smart solutions in transport and logistics, etc. These all are relevant ICT topics in the European Union, but only partially cover all the topics of the doctoral study programme.

Conclusions on this set of criteria, by specifying strengths and weaknesses

The global impression of the self-evaluation report and the organized meetings concerning this criterion of the expert team is mixed.
The name of the programme suggests a narrow scientific area, which is only weakly connected to the profiles of the three academic master study programmes offered in the frame of the study field under evaluation.
The programme curriculum is established considering the Latvian regulations in the field. The offered compulsory and limited elective courses are fairly connected to the telematics and logistics topic of the PhD study programme.
The number of enrolled PhD students is low, as well as that of the defend theses. Their involvement in mobility actions is law since almost all of them are working outside the TSI.

Strength
1. The PhD study programme is supported by the Latvian Higher Education Council.
2. The teaching staff is adequate since 7 full professors are teaching the courses included in the curricula. Six among them are experts approved by the Latvian Council of Science.
3. The competencies to be gained by the PhD students after pursuing the courses included in the curricula.
4. The great share of foreign students highlights the international feature of the studies.
5. The greatest part of the thesis is a result of activities performed in the frame of research projects.
6. The scientific production (papers) of the doctoral students quantitatively is adequate.
7. The finalised doctoral studies were in some cases the "opened door" toward postdoctoral studies.

Weaknesses
1. Almost all the offered compulsory and limited elective courses are in the field of computer sciences and not adequately covering the two main topics of the study programme (telematics and logistics).
2. The main weaknesses of the curricula are related to the included compulsory and limited elective courses, which are fairly connected to the telematics and logistics topic of the PhD study programme. Almost all these courses are only in the field of computer science (Data Mining, Business Intelligence and Data Visualization, Artificial Intelligence, Big Data, Machine Learning and Predictive Analytics, Advanced Artificial Intelligence, Information Systems and Technologies, and Computer Vision and Image Processing). A single discipline (Operations Research) can be only somehow connected to the logistic topic.
3. The recommended literature in the study course descriptions partly is rather old, especially considering that these topics are evolving very fast.
4. Yearly, a maximum of one student is studying in the Latvian language, so the efficiency of the two PhD study programme variants organised in this language is questionable.

Assessment of the requirement [5] (applicable only to master's or doctoral study programmes)

1 R5 - The study programme for obtaining a master's or doctoral degree is based on the achievements and findings of the respective field of science or field of artistic creation.

Assessment of compliance: Fully compliant

Although the overall impression is favourable, more effort needs to be done to fill in the gaps in this doctoral programme. The study programme (both in the teaching curricula and the research topics provided) strongly emphasises emerging ICT-related themes but falls short of effectively covering all the telematics and logistics fields. It involves just a few PhD students and only a

small proportion of them actually defend their theses and get the desired degree. The Latvian language line of the programme has a minimum level of interest.

2.3. Resources and Provision of the Study Programme

Analysis

2.3.1

TSI has a proven record of establishing and delivering engineering study field programmes. Higher education institution has a broad range of classrooms and laboratories supported by necessary information systems (intranet, Moodle, mobile application with time schedule and public portal) and specialised software to ensure delivery of study programme and provide necessary prerequisites for the achievement of learning objectives. Students can use physical and electronic libraries (Knovel, EBSCO, Academic Complete, OAPEN-Library, DOAJ, PKP, WorldBank, VersitaOpen etc.) to get the necessary materials for their studies.

For the doctoral study programme next 3 laboratories are the most relevant and being utilised by students and teaching staff:

Laboratory of Applied Software Systems that provides the ability to use a large number of specialised applications, including software for traffic flow, business processes and logistic process simulation (i.e. PTV VISSIM, VISUM and others).

Laboratory of Image Processing, Biometry & Automated Border Control Systems that support research work related to image processing and biometry.

Laboratory for Modelling Machinery Mechanisms and Materials supports theoretical and practical research work related to structured, computational, strength, reliability diagnostic and hydro gas dynamic modelling.

During the sessions with students, graduates, and teachers (all separately), all groups reconfirmed the sufficiency of the existing processes and availability of necessary equipment to ensure well-organised face-to-face and remote classes including practical classes.

Some of the PhD students are permanently located outside of Latvia. Considering the limited amount of contact hours and provided study conditions, achievement of learning objectives can be done also for such students.

2.3.2

TSI is a member of the ECTRI association (European Conference of Transport Research Institutes) which includes 27 EU-based research institutes. This enables TSI researchers to use the resources of ECTRI members and makes TSI resources available to other members.

TSI established partnerships with 21 higher education institutions and specialised industry partners from Germany, Greece, Spain, Estonia, Lithuania, Japan, Poland, Ukraine, Mongolia, Czech Republic and Kazakhstan. This enables mobility of the doctoral students to support their research work, get access to the scientific base of these partners as well as conduct particular joint research with partnering institutions. Besides foreign partners, TSI has established collaboration (supported by necessary agreements) with the largest Latvian higher education institutions and top industry companies.

To make research work more practical, TSI has established collaboration with multiple government and municipal organisations. Such collaboration ensures access to actual data needed for the research work.

2.3.3

Study programme delivery is financed mostly by students' tuition fees. Despite the pandemic, the total number of students in the doctoral programme grew during the last 4 years and in the year 2021/2022 was 21. The tuition fee for the doctoral programme for the academic year 2022/2023 for

full-time students is 4000 euros per year and for part-time students, it is 3000 euros. However, based on the tsi. lv website, the current tuition fee is 5000 euros and 4000 euros respectively. In the year 2021/2022 average revenue per 1 student in this programme was 2379,50 euros. Meanwhile, average expenses per 1 student in the doctoral programme in the year 2021/2022 are the highest among all programmes (2189,14 euros). Considering both numbers, the profit per 1 student of this programme is 190,36 euros, which makes concern about this programme's profitability till the year 2021/2022. An increase in the tuition fee is the logical decision considering the numbers above that would provide financial sustainability for the study programme. Specifics of the doctoral programme limit cost optimization options that TSI has leveraged for bachelor and master degree programmes.
The study programme has a balanced number of students in the year 2021/2022 in full-time (8) and part-time (13) studies. The majority of study hours are independent work supported by contact hours (lectures and practical work). Students are able to use laboratories and necessary software applications for study courses and their primary research work.

Conclusions on this set of criteria, by specifying strengths and weaknesses

TSI has built a strong foundation to enable PhD students to achieve learning objectives and support their research work. Students leverage mobility opportunities and are doing their research in collaboration with international higher education institutions and industry partners. TSI managed to establish collaboration with government and municipal institutions to ensure necessary data to make research work more relevant and address real-world problems TSI has increased tuition fees by 1000 euros for full-time and part-time studies to improve the financial sustainability of the study programme.

Strengths:
1. TSI has the necessary resources (premises, teaching staff and IT systems) and working processes to achieve learning objectives and support students with their graduation.
2. Laboratories provide access to necessary specialised software applications.
3. Strong partnerships with local and international universities and industry partners.

Weaknesses:
1. The total number of students has increased but still is low considering the total number of students in the computer science study field.

Assessment of the requirement [6]

1 R6 - Compliance of the study provision, science provision (if applicable), informative provision (including library), material and technical provision and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of learning outcomes

Assessment of compliance: Fully compliant

Students and teaching staff are fully equipped to achieve learning objectives and graduate from the programme. TSI has a broad range of classrooms and laboratories supported by necessary information systems.
TSI has a long list of foreign and local partners, including higher education institutions, industry and government partners to extend research work and provide access to a broader scientific base.
Academic staff is built from highly experienced own personnel and invited experts from the industry.
The study programme is financed mostly by students’ tuition fees and the historical number of

students is sufficient to keep this programme cost-effective, however, TSI has increased tuition fees to make the doctoral programme financially sustainable.

2.4. Teaching Staff

Analysis

2.4.1.
The analysis herein is based on the information provided in the SAR pp. 158-161 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The study programme courses are taught by 7 teaching staff members, of whom 6 have been elected at TSI.
According to Annex 7.6 to the SAR, the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree.
According to Annex 7.7 to the SAR, the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph One, Clause 3 of the Law on Higher Education Institutions.

2.4.2.
The analysis herein is based on the information provided in the SAR pp. 161-163 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
The number of teaching staff involved in the implementation of the study programme is the same as during the previous accreditation (13). However, changes did occur. Several lecturers (3 professors) were in the pre-retirement age group during the previous accreditation. Currently, the programme is taught by several young lecturers (up to 45 years old). During the reporting period, the programme attracted 3 new professors who were elected to the position of professor in 2021; these are themselves graduates of this Doctoral programme and obtained their doctoral degrees in 2013-2015. These professors are now the lead instructors for the limited elective courses. They replaced teaching staff with doctorate degrees, who were elected to the positions of docent and associated professor.

2.4.3.
All leading Professors involved with the implementation of the programme have published between 7 and 51 articles in Scopus and WoS-indexed venues in the reporting period. However, their h-indices are fair and range between 3 and 11. Further, they have been involved with national and international research projects.

2.4.4.
The analysis herein is based on the information provided in Annex 10 of the SAR.
All academic staff involved with the implementation of the study programme have published in peer-reviewed international venues in the reporting period.

2.4.5.
The analysis herein is based on the information provided in the SAR pp. 168-169 and the Annexes to it; the TSI website; and the interviews conducted during the visit.
During the implementation of the study courses regular meetings of the teaching staff take place, in which they exchange experiences on the study course topics, research results, new developments in the research, etc. Meetings of the academic staff (at least once a semester); Research and Doctoral Council meetings (at least once a semester); Doctoral Council meetings (as needed); Doctoral

seminars; Doctoral attestations at the Faculty (2 times a year); Seminars, conferences, workshops, etc. Discussions are used to develop and improve the content of studies, with mutual agreement on topics, emphases, responsibilities, and compliance with regulatory requirements.
The achievement of the objectives and results of the study courses and of the programme is implemented through regular seminars and discussions of the academic staff on the study results and the basic principles of quality assurance.

Conclusions on this set of criteria, by indicating strengths and weaknesses

The qualifications of the teaching staff involved in the implementation of the study programme meet all the requirements of the relevant regulatory acts and ensure the achievement of the goals and study results of the study programme and corresponding study courses. During the reporting period, the changes in the teaching staff have not adversely affected the quality of the programme. All academic staff involved with the implementation of the study programme have published in peer-reviewed international venues in the reporting period. All members of the academic staff in the last six years have published in peer-reviewed international venues and/or have five years of practical experience, in accordance with the Law on Higher Education Institutions.

Strengths:
No strengths

Weaknesses:
1. Fair h-index of the academic staff involved with the implementation of the study programme.

Assessment of the requirement [7]

1 R7 - Compliance of the qualification of the academic staff and visiting professors, visiting associate professors, visiting docents, visiting lecturers and visiting assistants with the conditions for the implementation of the study programme and the requirements set out in the respective regulatory enactments.

Assessment of compliance: Fully compliant

All main criteria are satisfied. The compliance of academic staff and visiting faculty with the conditions and requirements of the study programme and regulatory enactments is crucial for maintaining the quality and standards of education. Ensuring that professors, associate professors, docents, lecturers, and assistants possess the necessary qualifications and expertise contributes to a robust academic environment and enhances the educational experience for students. By upholding the standards for academic qualifications, institutions can provide students with access to knowledgeable and experienced faculty members who are equipped to deliver effective teaching and research in their respective fields.

2.5. Assessment of the Compliance

Requirements

1 1 - The study programme complies with the State Academic Education Standard or the Professional Higher Education Standard

Assessment of compliance: Not relevant

N/A

2 2 - The study programme complies with a valid professional standard or the requirements for the professional qualification (if there is no professional standard required for the relevant occupation) provided if the completion of the study programme leads to a professional qualification (if applicable)

Assessment of compliance: Not relevant

N/A

3 3 - The descriptions of the study courses and the study materials have been prepared in all languages in which the study programme is implemented, and they comply with the requirements set forth in Section 561 , Paragraph two and Section 562 , Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

Study course descriptions and study materials are prepared in Latvian and English languages, and they satisfy requirements set in Law on Higher Education Institutions. It should be noted that some study course descriptions should be updated with newer recommendations for mandatory and additional literature.

4 4 - The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure according to which state recognised documents of higher education are issued.

Assessment of compliance: Fully compliant

The diploma issued fully complies with the state legislature and “Procedures by which documents certifying higher Education recognised by the State shall be issued” (Cabinet of Ministers No. 202). Additionally, the diploma contains the corresponding science group and complies with Regulations regarding Scientific sector groups, Science sectors and Sub-sectors of Latvia (Cabinet of Ministers no. 595).

5 5 - The academic staff of the academic study programme complies with the requirements set forth in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions.

Assessment of compliance: Fully compliant

There are at least 5 associate professors or professors involved in the study programme implementation together. It is confirmed by the TSI Rector confirmation.

6 6 - Academic study programmes provided for less than 250 full-time students may be implemented and less than five professors and associated professors of the higher education institution may be involved in the implementation of the mandatory and limited elective part of these study programmes provided that the relevant opinion of the Council for Higher Education has been received in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions.

Assessment of compliance: Not relevant

N/A

7 7 - At least five teaching staff members with a doctoral degree are among the academic staff of an academic doctoral study programme, at least three of which are experts approved by the Latvian Science Council in the respective field of science. At least five teaching staff members with a doctoral degree are among the academic staff of a professional doctoral study programme in arts (if applicable).

Assessment of compliance: Partially compliant

As the analysis in previous chapters, including chapter 2.2. study content and implementation states that their curricula have a fair connection with logistics and mainly lie within the field of computer science, which corresponds to this study field. While it is understandable that the evaluation of this criteria would cause confusion in TTI, because this study programme has been running with the same classification in the previous years; it is clear in the expert’s view that

there is a clear discrepancy between the classification of this study field and classification of this study programme regarding experts rights in the appropriate field of science.
During the evaluation, experts are guided by documents of approval from e.g. Latvian Science Council (Letter nr. 1-3.N50 12.01.2023) which clearly states that academic staff have expert rights in a different scientific field not corresponding with this study field and the study curricula contains computer science field study courses.
Therefore according to the Regulation of the Cabinet of Ministers No. 595 of September 27, 2022, on the groups of scientific groups, scientific industries (branches) and sub-sectors Latvian science, science and sub-sectors, it must be noted that at the time of evaluation, academic staff have expert rights in the scientific branch of Civil and Transport Engineering (2.1.), which indeed does contain sub-sector of Telematics and Logistics, however, based on the study curricula of this study programme and this study field classification, it would be more appropriate, if academic staff had expert rights in the branch of “Electrical engineering, electronics, information and communication technologies (2.2.)” which would be fitter in this study field.

It is understandable that TTI currently has only one branch in which they can grant Promotion according to the Regulation of the Cabinet of Ministers No. 1000 of December 27, 2005, on the Delegation of the right to grant (Promotion) a PhD to institutions of higher Education, however in order to fully gain approval from Latvian Science Council and to further integrate the programme in this study field more appropriately it is recommended to have expert rights in the science branch of 2.2. and to acquire delegation rights to grant a PhD in the scientific branch of 2.2. (Electrical engineering, electronics, information and communication technologies).

8 8 - The teaching staff members involved in the implementation of the study programme are proficient in the official language in accordance with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties.

Assessment of compliance: Fully compliant

The academic staff has sufficient Latvian language knowledge for implementing study courses. This is confirmed by a TSI Rector’s signed confirmation.

9 9 - The teaching staff members to be involved in the implementation of the study programme have at least B2-level knowledge of a related foreign language, if the study programme or any part thereof is to be implemented in a foreign language (if applicable).

Assessment of compliance: Fully compliant

The academic staff has sufficient foreign language knowledge (at least B2 level) for implementing study courses. This is confirmed by a TSI Rector’s signed confirmation.

10 10 - The sample of the study agreement complies with the mandatory provisions to be included in the study agreement.

Assessment of compliance: Fully compliant

Study agreements include all necessary parts set in legislation. It is advised to include information about guarantees of compensation losses (criteria No. 11 and 12) so that this information is easier for the students to acknowledge already from the beginning.

11 11 - The higher education institution / college has provided confirmation that students will be provided with opportunities to continue their education in another study programme or another higher education institution or college (agreement with another accredited higher education institution or college) if the implementation of the study programme is terminated.

Assessment of compliance: Fully compliant

TSI has a cooperation agreement with Riga Technical University confirming that in case the implementation of programmes in this study field are terminated, students will be able to continue studies in RTU study field “Information Technologies, Computer Engineering, Electronics, Telecommunications, Computer Management and Computer Science”.

12 12 - The higher education institution / college has provided confirmation that students are guaranteed compensation for losses if the study programme is not accredited or the study programme’s license is revoked due to the actions (actions or omissions) of the higher education institution or college and the student does not wish to continue studies in another study programme.

Assessment of compliance: Fully compliant

TSI has a rector's signed refund and compensation policy that confirms it will compensate losses to students if the study programme is not accredited or loses its licence and the student does not wish to continue studies in another study programme.

13 13 - The joint study programmes comply with the requirements prescribed in Section 55.(1), Paragraphs one, two, and seven of the Law on Higher Education Institutions (if applicable)

Assessment of compliance: Not relevant

N/A

14 14 - Compliance with the requirements specified in other regulatory enactments that apply to the study programme being assessed (if applicable)

Assessment of compliance: Not relevant

N/A

Assessment of the requirement [8]

1 R8 - Compliance of the study programme with the requirements set forth in the Law on Higher Education Institutions and other regulatory enactments.

Assessment of compliance: Partially compliant

Academic staff with doctoral degrees are approved in a different science branch which is not relative to this study field, therefore there is a discrepancy between academic staff’s expert rights in the correct science branch corresponding to this study field.

It must be noted that the Latvian Council of Science did not fully acknowledge the content of this study programme as fit for this study field due to inconsistencies with a degree, study courses and Latvian Science Council expert rights for academic staff; however, some of these issues have been resolved at the moment of evaluation such as the degree awarded.

General conclusions about the study programme, indicating the most important strengths and weaknesses of the study programme

The study programme under assessment exhibits strengths in its interdisciplinary approach, sequential curriculum design, and emphasis on research skills and innovation. The programme has produced successful graduates and has engaged in international projects, providing valuable opportunities for students to gain international experience and expand their professional network. However, the study programme faces weaknesses such as a potentially misleading name and disapproval from the Council of Science, which raises concerns about its effectiveness in the scientific community. The limited publication requirements throughout the programme may restrict students' opportunities to develop their research skills and contribute to the field through

publications. The imbalance between computer science-focused courses and the telematics and logistics topic of the programme is a significant weakness that needs to be addressed for better alignment with students' needs. Outdated recommended literature and a fair h-index of the academic staff involved in the programme implementation raise questions about the program's ability to keep up with the evolving field and provide high-quality guidance to students.

Strengths:
1. The study programme is designed to provide an interdisciplinary approach to transport engineering, which can help students gain a broad understanding of the field and develop skills in various related areas.
2. The programme aims to develop student's research skills and encourage innovation, which can help them make a valuable contribution to the field of transport engineering.
3. The curriculum is designed to ensure the sequential development of knowledge, skills, and competencies based on individual and group work, and continuous communication between doctoral students and their supervisors.
4. The study programme has produced graduates who have achieved excellent levels and have contributed to the field of transport engineering.
5. The programme has participated in various international projects and cooperated with other institutions, which can provide students with opportunities to gain valuable international experience and expand their professional network.

Weaknesses:
1. The name of the study programme can be misleading.
2. The disapproval from the Council of Science can suggest that this programme does not bring the desired results to the scientific community.
3. The fact that only one publication is required at the end of the first year and a total of 5 publications are required throughout the programme could potentially limit the opportunities for students to develop their research skills and contribute to the field through publications
4. Almost all the offered compulsory and limited elective courses are in the field of computer sciences and are very poorly connected to the telematics and logistics topic of the PhD study programme. Almost all these courses are only in the field of computer science (Data Mining, Business Intelligence and Data Visualization, Artificial Intelligence, Big Data, Machine Learning and Predictive Analytics, Advanced Artificial Intelligence, Information Systems and Technologies, and Computer Vision and Image Processing). A single discipline (Operations Research) can be only somehow connected to the logistic topic.
5. The recommended literature in the study course descriptions partly is rather old, especially considering that these topics are evolving very fast.
6. Fair h-index of the academic staff involved with the implementation of the study programme.

Evaluation of the study programme "Telematics and Logistics"

Evaluation of the study programme:

Good

2.6. Recommendations for the Study Programme "Telematics and Logistics"

Short-term recommendations

Increase the number of faculty members with relevant expertise and experience to ensure that the courses are taught by qualified experts in the field.

Re-evaluate the course content and structure to ensure that they align with the objectives and learning outcomes of the programme.
Conduct regular assessments of the courses to identify areas that need improvement, and make appropriate adjustments to improve the quality of education.
Increase the number of scientific articles that students are required to publish during their doctoral studies to promote a deeper understanding of their chosen field.

Long-term recommendations

Increase the number of required publications: To improve the quality of the study programme, the number of required publications should be increased. This will encourage students to conduct more research and publish their findings.
Increase industry collaboration: The study programme should increase its collaboration with industry to ensure that the skills and knowledge taught in the programme are relevant to the needs of the job market.
Increase internationalisation: The study programme should aim to increase its internationalisation by promoting international student exchange programs and collaborations with foreign universities.
Increase funding: The study programme should seek to increase its funding to provide better resources and facilities for students and staff.
Increase student support: The study programme should provide more support for students, such as academic advising, career counselling, and networking opportunities.
Continuous monitoring and evaluation: The study programme should continuously monitor and evaluate its performance to ensure that it is meeting its objectives and producing high-quality graduates. This will help identify areas for improvement and ensure that the programme remains relevant and up-to-date.
Encourage and incentivize academic staff to publish at higher quality venues, to increase the visibility of their research.
Clearly specify the targeted research topics of the study programme when describing its tasks. This should be very important for the correct information of the potential candidates, especially in the context in which the title of the programme does not adequately cover the research topics which can be undertaken by future Ph.D. students.
Include in the curricula many more compulsory and limited elective courses in the fields of telematics and logistics, and reduce those of computer sciences. The following fields should be mandatorily covered: telecommunications, transportation technologies, sensors, instrumentation, and some from the logistics field since all of these are topics intended to be covered by the Ph.D. thesis.
The recommended literature in the study course descriptions partly needs to be updated.
Try to involve more Ph.D. students through better educational marketing and improving the academic offer.

Cancel the Ph.D. study programmes organised in Latvian or make better advertisements to attract more students willing to study in this language.
TSI needs to focus on increasing the number of students in this programme as it still remains low considering the total number of students in bachelor and master study programmes.
Consider changing the name of the study programme in a way to better line up with the covered topics within the same sector and sub-sector classifications Acquire LSC (LZP) expert rights in the scientific branch of Electronics engineering, information and communication technologies, which would better correspond to this study field. (This would resolve the discrepancies mentioned in the letter from Latvian Science council Nr. 1-3.N-50 12.01,2023.) Acquire promotion rights in the scientific branch of Electronics engineering, information and communication technologies, which would better correspond to this study field.

III - Assessment of the Requirements for the Study Field and the Relevant Study Programmes

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Assessment of the Requirements for the Study Field

Requirements	Requirement Evaluation			Comment
R1 - Pursuant to Section 5, Paragraph 2.1 of the Law on Higher Education Institutions, the higher education institution/ college shall ensure continuous improvement, development, and efficient performance of the study field whilst implementing its internal quality assurance system:	Fully compliant			Justified in Quality Handbook and Quality Policy documents and specified in more detail in SAR (p.36-38). In addition the ISO 9001:2015 standard implemented at TSI and periodically audited by the external organization sets the requirements for continuous improvement of the study field quality system and assurance of the efficient performance for the system.

Requirements	Requirement Evaluation			Comment
R2 - Compliance of scientific research and artistic creation with the level of development of scientific research and artistic creation (if applicable)	Fully compliant			The direction of the scientific research activities connected to the evaluated study field complies with the general expectations in this educational field. Both the Institute and the Faculty of Engineering are strongly devoted to increasing the research activities connected to this study field by applying and monitoring a clear strategy. The involved academic and research staff are adequately encouraged (also financially) for performing high-value research activities, journal publishing, and participation in international conferences. The students from all three study levels are intended to be involved in the research and development activities of the University. The expectation for them regarding these activities is increasing as they step up their study levels. The reward for outstanding results is also solved. The obtained research results are satisfactory in quantity but could be improved in quality by more publishing in high-impact international journals. The teaching staff is obligated to perform research activities and these are strictly monitored. Increased visibility of these actions should be welcome.

Requirements	Requirement Evaluation			Comment
R3 - The cooperation implemented within the study field with various Latvian and foreign organizations ensures the achievement of the aims of the study field.	Fully compliant			All criteria are mostly satisfied. TSI is able to enrich the educational experience and provide students with practical industry insights. The partnerships contribute to the alignment of academic content with real-world applications, enhancing the overall quality of education at TSI. TSI's strategic plans for cooperation with foreign institutions target a limited number of countries, which may limit the diversity and breadth of international partnerships.
R4 - Elimination of deficiencies and shortcomings identified in the previous assessment of the study field, if any, or implementation of the recommendations provided.		Partially compliant		TSI have mostly implemented previously given recommendations and it is clear that they had only a positive impact on the study field. The recommendations implemented partially such as intensifying student exchange have not been completely achieved due to difficult situations TSI cannot directly impact (student employment parallel to studying etc.). Unfortunately, TSI still needs to improve the encouragement of young researchers to write articles for high-impact-rated journals.

Assessment of the Requirements for the Relevant Study Programmes of the Study Field

No.	Study programme	R5	R6	R7	R8	Evaluation of the study programme (excellent, good, average, poor)
1	Computer Science (43483)	Not relevant	Fully compliant	Fully compliant	Fully compliant	Good

No.	Study programme	R5	R6	R7	R8	Evaluation of the study programme (excellent, good, average, poor)
2	Computer Engineering and Electronics (43523)	Not relevant	Fully compliant	Fully compliant	Fully compliant	Good
3	Robotics (43523)	Not relevant	Fully compliant	Fully compliant	Fully compliant	Good
4	Management of Information Systems (45482)	Fully compliant	Fully compliant	Fully compliant	Fully compliant	Good
5	Computer Science (45483)	Fully compliant	Fully compliant	Fully compliant	Fully compliant	Good
6	Computer Engineering and Electronics (45523)	Fully compliant	Fully compliant	Fully compliant	Fully compliant	Good
7	Telematics and Logistics (51526)	Fully compliant	Fully compliant	Fully compliant	Partially compliant	Good

The Dissenting Opinions of the Experts

N/A