NDERZOEKERIJ

Bachelor's programme

Innovation Sciences

Eindhoven University of Technology

Report of the limited programme assessment

De Onderzoekerij
Vondellaan 58
2332 AH Leiden

Email: info@onderzoekerij.nl
Internet: www.onderzoekerij.nl

Contents

Executive summary

The outcome of the external assessment of the bachelor's programme Innovation Sciences (IS*)* of the Eindhoven University of Technology by an NVAO-approved panel is positive.

The IS bachelor is a three-year English-taught programme, with a total study load of 180 European Credits (EC). The programme aims to train students who can bridge the gap between technical solutions and their application by end-users, thus contributing to the effective implementation of (new) technology. The panel values the programme's unique relevant profile that is achieved by integrating technological and social sciences perspectives in the field of innovation. The panel encourages the programme to further solidify its own profile and make more explicit what the unique position of the TU/e bachelor is in the landscape of innovation sciences in the Netherlands. This would also be helpful to clarify to students what their specific added value is in the professional field.

The programme's intended learning outcomes (ILOs) meet the level and orientation that can be expected of a bachelor's programme in the field of innovation sciences.

According to the panel, the programme equips students to become the envisioned bridge builders between the different disciplines. The curriculum provides students with a solid foundation in both the social sciences and the technological sciences. Students can tailor the programme to their interests. The panel values the integration of the learning line on professional skills.

Students are satisfied with the content and structure of the programme but are less satisfied with the overlap between several courses. The panel advises investigating the possibilities to reduce this repetition and to sufficiently challenge students in courses.

The programme is embedded in a strong academic environment. The teaching staff is enthusiastic, well-qualified and knowledgeable in their respective areas. The programme offers intensive study-related guidance, and students appreciate the approachability of the lecturers.

The panel appreciates that the programme has a solid set of documents and procedures in place which secure a valid, transparent, and reliable system of assessment. The panel values the separate assessment of professional skills which is integrated into assignments within various mandatory courses. The Examination Committee does an excellent job of safeguarding the quality of assessment and the final attainment level of the bachelor's graduates.

The panel established that graduates achieve the ILOs by the end of the programme. The final reports (theses) of the Bachelor End Project (BEP) demonstrate that graduates acquired a scientific basis of innovation sciences, understand the relevant methods in this field, and can analyse a socio-technical problem. The panel encourages the programme to further strengthen the quality of the theses by making the multidisciplinary focus more visible in the theses. In addition, the panel would welcome more critical reflection within the theses on the research methods and the theoretical framework.

The chair and the secretary of the panel hereby declare that all panel members have studied this report and agree with the judgements in the report. They confirm that the assessment has been conducted in accordance with the requirements relating to independence.

Date: 14 February, 2023

Wiebe Bijker	Esther Poort
(chair)	(secretary)

1. Introduction

1.1 Administrative data

Name of the programme:	B Technische Innovatiewetenschappen (Innovation Sciences)
CROHO number:	56265
Level of the programme:	Bachelor
Orientation of the programme:	Academic
Study load:	180 EC
Location:	Eindhoven
Variant:	Full-time
Submission deadline:	1 May 2023

1.2 Introduction

This report focuses on the assessment of the bachelor's programme Innovation Sciences *(Technische Innovatiewetenschappen)*. This assessment forms part of a cluster assessment of six programmes at three universities. Appendix A provides an overview of the six participating programmes.

The assessment is based on the standards and criteria described in the NVAO Assessment framework for the higher education accreditation system of the Netherlands 2018 (limited framework).

1.3 Panel composition

The panel that assessed this bachelor's programme consisted of the following members:

- Prof. Wiebe Bijker (chair), emeritus professor of Technology & Society, Maastricht University;
- Prof. Magnus Klofsten, Professor in innovation and Entrepreneurship, Linköping University, Sweden;
- Dr. Lotte Krabbenborg, Associate Professor Public participation in the development of science and technology, Radboud University;
- Dr. Pieter Heringa, Strategic advisor research policy, Hogeschool Inholland;
- Iris Brugmans MSc (student member), student M Healthcare policy innovation and management, Maastricht University.

The panel was supported by Esther Poort, who acted as secretary.

All panel members and the secretary have signed a declaration of independence and confidentiality. In this declaration, they affirm not to have had any business or personal ties with the programme in question for at least five years prior to the review.

The NVAO approved the composition of the panel on 16 September 2022.

1.4 Working method

Preparation

The assessment process was development oriented. Before the site visit, the panel received the relevant documentation from the programme, consisting of an extensive set of current documentation pertaining to the four standards of the NVAO framework. The programme also provided an analysis of the programme's strengths and weaknesses, a separate and independent student chapter (movie), and a reading guide. The reading guide was structured along the lines of the four standards. The reading guide described the main characteristics of the standards. In addition, it provided a table with references to relevant documents, web pages, or online information. An overview of these materials can be found in Appendix B. The panel members prepared the site visit by analysing the documents provided by the programme.

The panel also studied a selection of fifteen bachelor's theses and the accompanying assessment forms from the programme. The theses selection was made by the panel's secretary based on a provided list of theses of the most recent years. In the selection, consideration was given to a variation in specialisations, assessments (grades) and topics.

The panel members individually formulated their preliminary findings and a number of questions they wanted to raise during the site visit. The secretary made an overview of these preliminary findings and questions and sent these to the panel members. On 18 October 2022, the panel held an online preliminary meeting. In this meeting, the panel discussed the programme's preliminary findings and discussed the most important topics they wanted to touch upon during the site visit.

Visit

The site visit of both the bachelor's and master's programme Innovation Sciences took place on 8 November 2022 (see Appendix C for the schedule). During the preparatory meeting on November 7, the panel decided which questions to raise in their meetings with the programme representatives. During the visit, the panel spoke with representatives of the management, students, lecturers, alumni, and the Examination Committee. Everybody involved in the programme had the opportunity to inform the panel in confidence about matters they consider important to the assessment. No one made use of this opportunity. The panel used the last part of the visit to evaluate the interviews and had a second meeting with the programme's management to receive answers to any remaining questions. At the end of the visit, the chair presented the panel's preliminary findings and impressions of the programme.

Report

The secretary drew up a draft report based on the panel's findings. This draft report was presented to the members of the panel and adjusted based on their feedback. After adoption, the draft report was sent to the institution for verification of factual inaccuracies. The secretary discussed the programme's comments with the chair, after which the secretary drew up the final report and circulated it to the panel for a final round of comments.

The report follows the four standards such as specified in the NVAO's Assessment Framework 2018 (limited framework): 1) the intended learning outcomes, 2) the teaching-learning environment, 3) assessment, and 4) achieved learning outcomes. Regarding each of the standards, the assessment

panel gave a substantiated judgement on a three-point scale: meets, does not meet, or partially meets the standard. The panel subsequently gave a substantiated final conclusion regarding the quality of the programme, also on a three-point scale: positive, conditionally positive, or negative.

Development dialogue

Although separated from the process of the programme assessment, the assessment panel members and programme representatives conduct a development dialogue, to discuss future developments of the programme in light of the outcomes of the assessment report.

2. Review

2.1 Intended learning outcomes

The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Findings, analysis, and considerations

The bachelor's programme Innovation Sciences (IS) is a 180 EC programme offered by the School of Innovation Sciences within the Department of Industrial Engineering & Innovation Sciences (Department of IE & IS) at the Eindhoven University of Technology (TU/e).

The IS bachelor is a multidisciplinary programme combining social sciences and technology. In the programme, students learn about the various aspects of sustainability (invention, innovation, diffusion, use, administration, governance, and societal implications), the interaction between technological, economic, and societal developments, transitions, and global developments, including sustainability in developing countries. The programme aims to train students who can bridge the gap between technical solutions and their application by end-users, thus contributing to implementing (new) technology effectively.

The panel appreciates the multidisciplinary programme with a unique relevant profile in the Netherlands. This unique profile is achieved by integrating technological and social sciences perspectives. Students are trained as π-shaped professionals with one leg in the social sciences and humanities (SSH) and the other in the technical sciences. The panel endorses the importance and relevance of these π-shaped professionals who can build bridges between these disciplines and thus will become change agents who can contribute to solving sustainability issues. Based on the documents and the interviews with the students, it appears that students find it difficult to formulate their professional identity. Therefore, the panel advises the programme to communicate the programme's highly relevant professional profile more explicitly to the students.

The programme formulated a set of intended learning outcomes (ILOs). The ILOs are divided into general ILOs (common to all bachelor's programmes of TU/e) and domain-specific ILOs that are characteristic of the bachelor Innovation Sciences. The general ILOs include academic qualifications in the domain of engineering and technology, research and design skills, judgmental skills, planning skills, cooperative and communicative skills (also in a multidisciplinary context), and societal awareness. The domain-specific ILOs include knowledge of the core concepts of Innovation Sciences, research skills in the domain of Innovation Sciences, and the ability to translate these results into design, policy or strategy recommendations, and awareness of the social and technical implications of the recommendations. The domain-specific ILOs also concern knowledge of technological systems, where students choose one of the engineering domains: Sustainable Energy or Sustainability for Urban Planning and Mobility.

The panel studied the ILOs and concluded that they form a convincing and well-structured overview of the main goals of the programme. The use of the Meijers' criteria in designing the ILOs guarantees that they meet the bachelor's level and academic orientation, as well as comply with general engineering skills required by the academic and professional field. Moreover, the alignment of the ILOs with the Meijers' criteria ensures are eligible to start a master's degree at TU/e. Overall, the

panel is of the opinion that the ILOs fulfil all requirements in terms of content, level, and orientation. The panel understands the choice of the programme to particularly focus on two engineering domains (Sustainable Energy and Sustainability for Urban Planning and Mobility) because these reflect the expertise of the Departments providing the engineering education. Nevertheless, the panel suggests broadening the scope of the programme by also focusing on other sustainability domains, such as sustainability in healthcare or the sustainable fashion industry (by linking with the Design Academy in Eindhoven).

In close collaboration with the programme directors of the affiliated programmes at Utrecht University and VU University Amsterdam, a domain-specific reference framework (DSRF) was established in 2021, in which the respective bachelor's and master's programmes were included that educate students in the field of innovation sciences. The panel was impressed by this joint effort and considers the framework to be a coherent description of the international academic field of innovation sciences and the identity of the innovation sciences programmes in the Netherlands. The panel established that the ILOs of the TU/e bachelor meet the DSRF and, therefore, are well aligned with the international standards set for the discipline. However, the panel advises to explicate more clearly how the IS bachelor programme of TU/e relates to the framework and what the unique position of the TU/e bachelor is in the landscape of innovation sciences in the Netherlands. This would also be helpful to strengthen the formulation of the ILOs and to clarify to students what their specific added value is in the professional field.

The programme has multiple connections to industry, among which the Societal Council. In the Societal Council, which is shared for all IE&IS programmes, various types of companies and government-related organizations are represented. The Societal Council functions as a sounding board for the department's research and education. According to the panel, the programme could benefit more from this Societal Council, for example by involving them in defining the unique profile of the IS graduates.

Conclusion

The panel concludes that the programme meets standard 1.

2.2 Teaching-learning environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Findings, analysis, and considerations

Curriculum

The bachelor Innovation Sciences is a three-year English-taught programme, with a total study load of 180 European Credits (EC). The programme is embedded in the framework of the Bachelor College of Eindhoven University of Technology. This means that it follows the same structure as other bachelor's programmes in the university: 95 EC major courses (programme-specific), 25 EC basic courses, 15 EC courses in the societal USE learning line on User, Society and Enterprise, and 45 EC of free elective space.

During the previous accreditation, the IS bachelor offered two different majors: Psychology & Technology (P&T) and Sustainable Innovation (SI). Recently, The P&T major has become an independent bachelor's programme. Currently, the bachelor's programme Innovation Sciences only offers one major (Sustainable Innovation).

Within the 95 EC of the major, SI major students choose one of the two engineering domains: Sustainable Energy or Sustainability for Urban Planning and Mobility. These technical courses are provided by the Department of Mechanical Engineering or the Department of Architecture, Urbanism and Building Sciences. The 95 EC major courses are built on five learning lines: a) Economics of Innovation, b) Sustainable Technology in Society, c) Research Methodology, d) Engineering courses (within one of the two engineering domains), and e) Integration courses. A learning line consists of three to four courses at different levels, including an application-oriented project course.

The 25 EC basic courses provide the foundation for moulding the 'Eindhoven Engineer'. These courses include Mathematics, Physics, Data Engineering, Design, and Professional Skills. The learning line Professional Skills (5 EC) consists of five skills themes: communication (writing and presenting), cooperation, reflection, planning and organizing, finding, and processing (scientific) information. The training of these skills is fully integrated into the major courses.

Students compose their own study, by choosing a USE learning line (15 EC) and by choosing 45 EC of elective courses that suit their interests and ambitions. The USE learning line focuses on the context of technology in a wide range by looking at engineering from different perspectives: the User perspective, the Society perspective, and the Entrepreneurial perspective. In 2021-2022, the Bachelor College offered fifteen USE packages. Each package is organized around a theme and consists of an exploratory subject (5 EC), an in-depth subject (5 EC), and an applied subject/project (5 EC).

Within the 45 EC free electives, students can choose any course of the Bachelor College relevant to the student's learning path. They can opt for coherent elective packages or separate elective courses. A teacher coach advises students on their choice of electives. Students submit their proposals for the elective space to the Examination Committee (EC). The EC evaluates the proposal based on coherence, depth, and overlap.

The Bachelor End Project (BEP, 10 EC) is the last course of the programme and is part of the major courses (learning line Integration courses). During the BEP students need to demonstrate that they can analyse - under the guidance of a supervisor - a socio-technical problem in the field of Sustainable Innovation, and that they can communicate the set-up and findings both in a presentation and in a written report. Students are assigned to a supervisor. The supervisor coaches the student on content and process and has regular meetings with the student. The student and supervisor determine the topic together. If a student wants to do an external BEP (at a company), it is the student's responsibility to initiate this.

The panel is of the opinion that the programme successfully translated the ILOs into a well-designed curriculum. The panel established that all students acquire a solid foundation in both the social sciences and technological sciences and are therefore well equipped to become the envisioned bridge builders between these two disciplines. The curriculum provides a good balance between developing an academic 'mindset' (reading, discussing relevant literature, setting up and evaluating research projects) and focusing on real-world sustainability problems. The USE packages, the electives, and the BEP provide lots of freedom and opportunities for students to shape their own learning path.

The panel is pleased that the programme has taken the recommendation of the previous assessment panel by heart by developing a clearly defined learning line on professional skills. It appreciates the way this learning line is integrated into the courses of the major. This integration in the major courses

ensures that all students receive training on a broad range of professional skills within the domain of Innovation Sciences. Furthermore, the panel was pleased to learn from the documents that critical reflection is regarded as a meta-cognitive skill and plays a role in all courses and assignments on which students work during their education. This was confirmed in the interviews with both lecturers and students who indicated that critical reflection is a substantial part of all major courses.

The students with whom the panel met, were very positive about the content and the structure of the programme. Students highly appreciate the freedom to select electives and to shape their own programme and learning path. Students are pleased with the approachability of their lecturers. Furthermore, they indicated that lecturers respond well to their suggestions for improvements to their courses. Students are less satisfied with the overlap between several courses. During the interviews, both students and lecturers explained that some courses address the same theories, with one course focusing on explaining the theoretical framework and the other on applying the theory. The panel understands that some overlap is inevitable to accommodate students from other majors who can choose SI major courses as electives. The panel nevertheless advises the programme to investigate the possibilities to reduce this repetition for students and to sufficiently challenge SI major students in all SI major courses.

Furthermore, students indicated that they would welcome more attention to courses that are explicitly geared to Sustainable Innovation, such as the highly valued Industrial Ecology course. In addition, students would like the opportunity to acquire engineering hard skills such as Life Cycle Analysis (LCA). The panel was pleased to hear that the management sees good opportunities to address these issues in the redesign of the Bachelor College in 2023. This new design will offer more space for the major (125 EC instead of 90 EC) and the major SI will use the additional ECs to add learning lines on global sustainability and methods. The methods line will include major-specific techniques like LCA, Multiple-Criteria Decision Analysis (MCDA), and general qualitative and quantitative methods. The panel supports these plans.

Student intake

Admission to the programme is open to a) Dutch students with a vwo-degree including Mathematics B, b) Dutch students with a propaedeutic exam or bachelor's degree in applied sciences (hbo), a vwo-certificate in Mathematics B and proficiency in English at the vwo-level, and c) international students with a comparable degree and sufficient proficiency in English. The influx in the programme is about 50 students per year. This number is quite stable over the years. In 2021/2022 about 40% of the students were international students.

Teaching methods

The panel is positive about the diversity in different types of education (lectures, work groups, projects), fitting the learning objectives of the different courses. The combination of group work and individual work is balanced and prepares students for their work in a future professional setting. TU/e recently adopted Challenge-Based Learning (CBL) as their educational principle. Central to CBL at TU/e is that students acquire knowledge by engaging in real-life interdisciplinary challenges often defined in collaboration with external partners (challenge owners). While working on prototype solutions that contribute to these challenges, students seek out and apply knowledge, individually or in groups. This approach is under development, but several courses already use the CBL approach. In the student chapter, students indicated they value this approach and would appreciate more courses adopting

this method. The panel would support this because CBL provides good opportunities for students to develop their professional skills.

Furthermore, the panel was pleased to hear that the programme benefits from the digital skills the staff has acquired during the pandemic and the consecutive lockdowns. As described in the SWOT analysis, the quality and availability of digital and hybrid education tools and blended learning and assessment have improved.

Study load and study guidance

Students consider the programme sometimes as challenging, but feasible. The panel values that the programme provides intensive study-related support and guidance to students. The programmes' academic advisor is available for issues regarding planning, procedures, study progress and advice. All first-year bachelor's students are assigned a student mentor, which is a senior student who helps them to get acquainted with university life. In addition, a teacher coach can help students in making decisions regarding their elective courses. Students were very satisfied with the support they received from their teacher coach and the academic advisor in composing a coherent curriculum. Students also value the guidance they receive from their mentors. All in all, the students of the programme feel well-guided and supported.

Staff

The academic staff for the bachelor's programme Innovation Sciences and the master's programme Innovation Sciences amounts to 44 lecturers and researchers (5 full professors, 4 associate professors, 9 assistant professors and 26 PhD candidates). Lectures are taught by professors (full, associate, or assistant). Apart from the regular academic staff, external guest lecturers contribute to the courses. PhD candidates can contribute to group and thesis supervision after following the appropriate courses. In addition, teaching assistants (typically master students) provide tutoring in the bachelor programme. Of the academic staff (not including PhD candidates), 72% has passed the University Teaching Qualification (UTQ) and 6% are in the process of doing so. All new academic staff will follow the UTQ programme. The panel ascertained in the interviews with the teaching staff that there is a well-functioning system in place to help (new) staff members to further professionalise.

The panel has met with a team of enthusiastic lecturers. It is clear to the panel that students are part of a high-quality and committed teaching and research environment. All teaching staff members hold a doctorate, are active researchers and are very dedicated to teaching within the bachelor's programme.

The quantity of staff is mentioned as a point of attention in the documentation the panel received. This has to do with the flexibility students have in choosing their electives and the fact that students' preferences for projects and topics do not always align with staff availability. Typically, staff with profiles on climate, energy, and mobility innovation (the application domains) do experience a very high workload. The panel advises monitoring the workload of the lecturers to ensure that lecturers do not become overburdened. It also encourages the programme to investigate possibilities to distribute the workload more evenly and to support lecturers in their teaching duties, if necessary.

Language

The language of instruction is English. The programme management substantiates its choice by arguing that English is the dominant language in academia and the professional field of innovation sciences. This means that the English language is essential to be able to participate in the international field of innovation sciences. The direct environment, including the companies where students do internships, requires students to have good English-language skills. As the staff in the Department is very international, the use of English means that all staff members can participate in teaching. Due to the international context, all teaching staff works and communicates in English on a day-to-day basis. The panel agrees that an English-language programme, with an English programme name, is suitable because of the international character of the field and the goals of the programme.

Conclusion

The panel concludes that the programme meets standard 2.

2.3 Student assessment

The programme has an adequate system of student assessment in place.

Findings, analysis, and considerations

Assessment policy and assessment system

The panel established that the programme has a solid set of documents and procedures in place which secure an adequate assessment system. The Assessment Policy of the Department IE&IS describes the vision on assessment which is in line with the educational vision. It also describes the quality assurance of examinations, and the quality assurance of the final level of students. Important principles are, among others, that examiners (appointed by the EC) are competent in assessment, and that the grading of the exams and theses is checked by a second examiner. Validity is also assured by a prior check of exams and answer models by multiple content experts. Reliability is enhanced through rubrics in assignments and the thesis. The Assessment Plan relates the ILOs to the various courses and examinations. The panel verified that the Assessment Plan covers and thoroughly assesses all exit qualifications.

The specific form of testing within a course depends on the learning goals of the course and includes written examinations, individual assignments, group assignments, and presentations. The goals, grading and associated learning outcomes of each test are communicated to students beforehand. For all courses, a basic assessment matrix is available on Canvas, the electronic learning environment.

The panel appreciates that the programme does not only use assessment to evaluate the performance of the student but also uses assessment as a tool for learning. Therefore, examinations do not just mark the reaching of the final stage of education (summative examination) but also provide feedback on how much progress a student has made in the learning process (formative examination). This was confirmed in the interviews with students who indicated receiving ample and valuable qualitative feedback on their assignments.

The panel also appreciates the separate assessment of professional skills. These assessments are integrated into assignments or activities within various major courses. For example, the assessment of writing is integrated into an assignment in which students submit a report, and the assessment of

collaborating is integrated into an assignment in which students must work together. The panel applauds the programme that academic writing is assessed separately from the content and that lecturers can receive support in assessing and providing feedback on academic writing.

During the site visit, the panel discussed the assessment of group projects with both the students and the lecturers. The programme is aware of the risks of free riding and guides students in a well-considered way to avoid this as much as possible. However, the panel thinks that there could be a more structural embedding of individual assessment within group projects.

Assessment of the Bachelor End Project (BEP)

The BEP products are one intermediate report (20%) and one final report (80%). In addition, students write a topic outline, a plan of work (not assessed but needs to be sufficient) and give a presentation. The first supervisor assesses the intermediate report, the final report, and the presentation. Each project has a second supervisor who assesses the final report. The grading of the final report is based on a rubric that consists of criteria regarding a) the quality of the problem identification and theoretical framework, b) the quality of research methods, c) the quality of research execution, and d) the quality of the conclusion and discussion. Students are also assessed on their presentation skills and information skills, which must be sufficient to pass the BEP. To safeguard consistent grading, there is a user manual for the rubrics. The rubrics assessment form is also available to the students.

As part of its thesis review, the panel studied a sample of the final reports and corresponding evaluation forms, completed in 2020, 2021 or 2022. The panel established that the evaluation form allows for insightful assessments as it combines comprehensive and relevant assessment rubrics with room for personalised feedback. In most cases, assessors used the free space in the evaluation form to provide adequate narrative feedback, well supporting the grade.

Examination Committee

The EC of the School of IS operates independently of the programme management. The panel was impressed with the strong commitment of the EC to the bachelor's programme. It was also pleased to hear that the EC separates the roles of an examiner and that of a member of the EC to ensure the independence of both roles. The EC checks the assessment of courses every quarter. Observations and recommendations are discussed with the responsible examiner. In addition, every two years, the EC checks a sample of the final report of the BEP on the level and the grading quality. Based on the documents, as well as the interview with the chair of the EC, the panel concludes that the EC does an excellent job of safeguarding the quality of assessment and the final attainment level.

Conclusion

The panel concludes that the programme meets standard 3.

2.4 Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings, analysis, and considerations

Students demonstrate the achievement of their knowledge and skills on a bachelor's level by conducting the BEP (10 EC). To judge whether students achieve the ILOs by the end of the programme, the panel studied a selection of fifteen final reports of the BEP. The selection covered the two different engineering domains in comparable numbers and included a balanced range of final marks.

The panel concludes that the BEP demonstrates the realisation of the programme's ILOs. The theses are of the level and quality that may be expected from a bachelor's thesis in the field of innovation sciences. The theses showed that graduates acquired a scientific basis of Innovation Sciences, understand the relevant methods in the field, and can analyse a socio-technical problem in this field. The subjects of the theses were very timely and relevant to the innovation field. The panel considers the theses' quality to be in line with the grades given.

The panel is convinced that the multidisciplinary programme creates π-shaped professionals who can build bridges between the social sciences and technological sciences. However, the panel noted that the emphasis within the thesis lies on social sciences research. The panel encourages the programme to make the multidisciplinary focus more visible in the theses, for example by adding a required chapter on how the student made use of the technological sciences skills and knowledge acquired during the programme (or if the thesis is mostly natural science based, how the social sciences have been used). In addition, the panel would welcome more critical reflection within the thesis on the research methods and the theoretical framework. It encourages the programme to further strengthen the quality of the theses by focusing more explicitly on this specific kind of critical reflection, for example by a stronger focus on these specific skills in the learning line professional skills.

The programme gives students clear options to pursue a master's programme, depending on the electives they chose. Graduates have access to the domain-specific master programme in Innovation Sciences or more application domain-specific master programmes in energy, mobility, or built environment. About 25% continue with the master programme Innovation Sciences, another 25% with the master programme Sustainable Energy Technology, and the rest chooses a variety of master programmes.

Conclusion

The panel concludes that the programme meets standard 4.

3. Strengths and recommendations

3.1 Strengths of the programme

The panel is impressed by the following features:

- Unique profile - The multidisciplinary programme has a unique relevant profile in the Innovation Sciences in the Netherlands by integrating technological and social sciences perspectives;
- Curriculum structure - The programme provides a good balance between developing an academic 'mindset' and focusing on real-world sustainability problems;
- Professional skills - The integration of the learning line on professional skills ensures that all students receive training on a broad range of professional skills within the domain of Innovation Sciences;
- Teaching team - The teaching staff is enthusiastic, well-qualified and knowledgeable in their respective areas;
- Study guidance - The programme provides intensive study-related support and guidance to students;
- Assessment system - The programme has a solid system of assessment in place. The EC does an excellent job of safeguarding the quality of assessment.

3.2 Recommendations

For further improvement of the programme, the panel makes the following recommendations:

- Scope of the programme - Consider broadening the scope of the programme by also focusing on other sustainability domains, such as sustainability in healthcare or the sustainable fashion industry;
- Professional profile - Communicate the highly relevant unique profile and the specific added value of IS graduates for the professional field more explicitly to the students;
- Repetition - Explore possibilities to reduce repetition and to sufficiently challenge SI major students in all SI major courses;
- Workload - Monitor the workload of the lecturers, especially for lectures in the application domains. Find ways to divide the workload more evenly and to support heavily burdened lecturers in their teaching duties;
- BEP project – Further strengthen the BEP by making the multidisciplinary focus more visible in the theses and by focusing more on critical reflection on theory and research methods.

4. Conclusion

The panel has found that the intended learning outcomes (standard 1), the teaching-learning environment (standard 2), the assessment system (standard 3) and the achieved learning outcomes (standard 4) meet the criteria.

The intended learning outcomes reflect the programme's aims and vision and are in line with the discipline and international requirements. The curriculum, the teaching methods, the quality of the teaching staff and the assessment system enable the incoming students to achieve the intended learning outcomes.

Standard	Judgement
Standard 1	Meets the standard
Standard 2	Meets the standard
Standard 3	Meets the standard
Standard 4	Meets the standard
Final conclusion	**Positive**

Appendix A –Programmes of the cluster

The cluster Innovation Sciences consists of six programmes:

56265	B Technische Innovatiewetenschappen	Eindhoven University of Technology
66265	M Innovation Sciences	Eindhoven University of Technology
56982	B Natuurwetenschap en Innovatiemanagement	Utrecht University
60709	M Science and Innovation	Utrecht University
50670	B Science, Business & Innovation	Vrije Universiteit Amsterdam
69320	M Science, Business and Innovation	Vrije Universiteit Amsterdam

Appendix B – Documents studied

- Reading guide BSc Sustainable Innovation
- SWOT analysis BSc Sustainable Innovation
- Fifteen final reports of the BEP theses with assessment forms
- Student chapter (movie)
- The domain-specific framework of reference: Innovation Sciences
- BSc SI Learning outcomes and domain spec disciplines 2022
- Agendas and minutes of the Societal Council
- List of lecturers
- Minutes of semester evaluation and evaluation reports
- Assessment policy School of Industrial Engineering and School of Innovation Sciences
- Assessment Plan BSc IS
- Programme and Examination Regulations
- Examination Regulations of the EC
- Assessment dossier of three different courses
- Study Guide BEP
- List of thesis graduates 2020, 2021 and 2022 (until August 2022)
- Annual reports of the Examination Committee 2018-2019, 2019-2020, 2020-2021
- Annual reports School of IE&IS 2019-2020, 2020-2021
- Minutes of semester evaluation and evaluation reports
- Nationale Alumni Enquête 2017, Tabellenboek Technische Universiteit Eindhoven
- Report previous accreditation

In addition, the panel had access to:

- OSIRIS provides information on all courses: purpose and content, lecturer, assessment, and literature.
- Canvas provides detailed information on all courses, including the syllabus, and assignments.
- BI-portal provides, among others, statistical information on the inflow and outflow of students. It also includes the NSE.

Appendix C – Schedule of the visit

7 November, 2022

Time	Session
17:00-19:00	Preparatory meeting panel

8 November, 2022

Time	Session
8:30 - 9:15	Welcome and preparation interviews by panel
9:15 - 10:00	Meeting with the Management
10:15 - 10:45	Meeting with the BSc IS students
11:00 - 11:40	Meeting staff about BSc IS assessment
11:50 - 12:30	Meeting staff about BSc Teaching and learning environment
12:30 - 13:15	Lunch
13:15 - 13:45	Meeting with the BSc IS students
14:00 - 14:40	Meeting staff about MSc IS assessment
14:50 - 15:30	Meeting staff about MSc Teaching and learning environment
15:30 -15:45	Internal discussion panel
15:45 -16:15	Final interview management
16:15 -17:30	Internal discussion panel
17:30	Presentation preliminary findings

Appendix D – Abbreviations

BEP	Bachelor End Project
CBL	Challenge-Based Learning
DSRF	domain-specific reference framework
EC	Examination Committee
EC	European Credit
IE & IS	Industrial Engineering & Innovation Sciences
ILO	intended learning outcomes
IS	Innovation Sciences
LCA	Life Cycle Analysis
MCDA	Multiple-Criteria Decision Analysis
NVAO	*Nederlands-Vlaamse Accreditatieorganisatie*
SI	Sustainable Innovation
TU/e	Eindhoven University of Technology
UTQ	University Teaching Qualification
USE	User, Society & Enterprise
Vwo	*Voorbereidend wetenschappelijk onderwijs*