

ONDERZOEK

Master's programme

Science Business and Innovation

Vrije Universiteit Amsterdam

Report of the limited programme assessment

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Executive summary

The outcome of the external assessment of the master's programme Science Business and Innovation (SBI) of the Vrije Universiteit Amsterdam by an NVAO-approved panel is positive.

The SBI master is a two-year programme with a total study load of 120 European Credits (EC). The programme's mission is to integrate scientific and business expertise to provide students with unique interdisciplinary training and practical insights into valorisation of scientific knowledge and innovation of science-based products and organisations. The panel appreciates the programme's aim to contribute to society by enabling students to use their knowledge and skills in the specialisation areas Energy & Sustainability (E&S) or Life & Health (L&H).

The programme translated the goals into a convincing set of eleven intended learning outcomes (ILOs) which clearly reflect the level that may be expected of graduates of an academic master's programme in the field of innovation science.

The curriculum is well-structured, attractive for students and features a good combination of theoretical courses in the different disciplines. In addition, students gain experience to integrate natural science, business, and innovation science in different empirical settings: in a R&D context (during the Science Project) and in a real-life business context (during the SBI Project & Master Thesis). The programme uses multiple teaching methods including lectures, group, and individual assignments, working groups, paper discussions, interactive lectures, literature study, tutorials, and consultancy sessions. The students are positive about the programme's content and structure. They appreciate the broad orientation of the programme and the mix between the natural-science subjects and business subjects.

The programme is embedded in a strong interdisciplinary academic environment. The teaching staff is enthusiastic, well-qualified and knowledgeable in their respective areas. Students are less satisfied with the communication with teachers. The panel encourages the programme to explore how the communication between students and teachers could be improved.

The programme has a solid set of documents and procedures in place which secure an adequate assessment system. The panel appreciates the range of assessment modes used, including written exams, papers, essays, individual assignments and group assignments, and presentations. Students feel sufficiently prepared for exams through lectures and assignments. Students are less satisfied with the feedback they receive from their teachers. The panel was pleased to note that the programme management recognises this and recently took measures to improve this in several courses and has plans to further improve this.

The panel concludes that graduates achieve the ILOs by the end of the programme. The master theses showed that graduates can integrate knowledge in the natural sciences, business, and social sciences and can apply this knowledge in an empirical setting in the E&S domain or the L&H domain. The panel was impressed by the enthusiasm of the alumni and their confidence in their career potential and professional development.



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: 25 January, 2023

Wiebe Bijker
(chair)

Esther Poort
(secretary)



1. Introduction

1.1 Administrative data

Name of institution:	Vrije Universiteit Amsterdam
Status of institution:	Publicly funded
Result institutional quality assurance assessment:	Positive, June 2020
Name of the programme:	M Science Business and Innovation
CROHO number:	69320
Level of the programme:	Master
Orientation of the programme:	Academic
Study load:	120 EC
Location:	Amsterdam
Variant:	Full-time
Programme tracks	Energy & Sustainability Life & Health
Language of instruction	English
Submission deadline:	1 May 2023

1.2 Introduction

This report focuses on the assessment of the master's programme Science Business and Innovation (SBI) of the Vrije Universiteit Amsterdam (VU). 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 13 September 2022.

1.4 Working method

Preparation

The programme drew up a self-evaluation report describing the programme's strengths and weaknesses. This self-evaluation report included a chapter in which the students reflected on the programme. The panel members prepared the assessment by analysing the self-evaluation report and the appendices provided by the institution. An overview of these materials can be found in Appendix B.

The panel also studied a selection of fifteen master theses and the accompanying assessment forms from the programme. The thesis 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 2 November, 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 the bachelor's programme SBI and the master's programme SBI took place on 10 November 2022 (see Appendix C for the schedule). During the preparatory meeting, the panel discussed 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 Board. 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 the 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 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 master's programme Science Business and Innovation (SBI) is offered by the Faculty of Science (BETA) in close collaboration with the Faculty of Social Sciences (FSW) and the School of Business & Economics (SBE). The programme's mission is to integrate scientific and business expertise to provide students with unique interdisciplinary training and practical insights into valorisation of scientific knowledge and innovation of science-based products and organisations. Students choose to focus on innovation process in either Energy & Sustainability (E&S) or Life & Health (L&H).

The panel noted with appreciation that the SBI master's programme is an important player in the VU's priority theme 'Science for Sustainability'. The programme contributes to this theme by integrating the different aspects of the development of technological innovation for sustainability. In addition, the programme prepares students to guide the process from a scientific idea to real innovation, including knowledge of (growing) organisations, market research, competitive studies, stakeholders, and investments. Furthermore, the panel values the programme's alignment with VU's vision to educate critical, societally and scientifically engaged and broader-thinking students who can integrate their disciplinary and cross-disciplinary knowledge in proactively approaching concrete problems and solving these with sustainable solutions.

The panel highly values the relevant and interdisciplinary master's programme. The involvement of three different faculties allows for a synthesis of the natural sciences as well as the social sciences and business and economic perspectives. The panel also appreciates the programme's aim to contribute to society by enabling students to use their knowledge and skills in the two specialisation areas (E&S and L&H). These areas are well aligned with the expertise of the teaching staff and further strengthen the programme's profile.

In close collaboration with the programme directors of the affiliated programmes at Utrecht University and the Eindhoven University of Technology, 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. As stated in the self-evaluation report, the VU master's programme SBI has a unique position in this cluster as it is positioned in the Science Faculty, enabling the students to gain in-depth knowledge in chemistry and physics needed to understand the depth and breadth of science-based, R&D-induced innovation. The panel appreciates this explicit positioning of the programme within the framework.

The programme translated the goals into a convincing set of eleven intended learning outcomes (ILOs) which are linked to the Dublin descriptors. In the eyes of the panel, the ILOs clearly reflect the



level that may be expected of graduates of a master's programme. In addition, the ILOs meet the DSRF and, therefore, are well aligned with the international standards set for the discipline.

The programme has a Professional Advisory Board that provides a critical external perspective on the SBI programme. The Board advises the programme director on the connection with the professional field and the content of the study programme, the alignment of the ILOs to the needs of the professional field. The Professional Advisory Board comprises senior academics from the discipline and professionals who are in a position to judge what the research and job markets require from SBI 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 master's programme SBI is a two-year programme, with a total study load of 120 European Credits (EC). A complete outline of the curriculum can be found in Appendix E.

All students follow three compulsory courses on business and innovation (18 EC in total) and the compulsory course SBI Research Methodology (6 EC). In addition, students take several courses depending on their specialisation (E&S or L&H). For both specialisations, this includes one compulsory integration course (6 EC) and two electives (12 EC in total) from a predefined list of courses for the specific specialisation. Next to the electives within the specialisation, students can choose 18 EC of free elective courses from other master's programmes at the VU, or from other universities in the Netherlands or abroad. These electives must first be approved by the Examination Board.

In the first year, students follow the Science Project (24 EC) in which they learn to design and execute a research project on Research & Development (R&D), both from a science perspective as well as from a business and innovation perspective. The students familiarise themselves with several aspects of scientific knowledge, management literature and methodical approaches to be able to study the topic of their choice related to L&H or E&S practices. Students can choose to do a Science Project based on an internship. This needs to be approved by the teacher.

Students finish with the SBI Project & Master Thesis (36 EC). This final project consists of an internship in a science-based, tech-driven and/or R&D-induced organisation, preparing the students for a career in either the energy-science sector or the life-science sector. SBI has an internship coordinator who maintains close contact with various innovative companies, to support students in finding an environment to do their internships. The research is focused on studying (from a scientific perspective) the valorisation of scientific research into findings with marketable, societal, and social value. In response to the recommendations of the previous assessment, the SBI Project & Master Thesis trajectory has been restructured to explicitly include methodological approaches and analytical methods. In this revised structure, students develop their research plan as part of the Research



Methodology course in the first semester. In addition, students make four assignments and attend three lectures in which the assignments are explained.

Based on the documents and the interviews with the staff and students, the panel considers the curriculum of both specialisations to be an appropriate reflection of the ILOs. The curriculum is well-structured, attractive for students and features a good combination of theoretical courses in the different disciplines. The panel highly appreciates that students gain experience to integrate natural science, business, and innovation science in different empirical settings: in an R&D context (during the Science Project) and in a real-life business context (during the SBI Project & Master Thesis).

The panel values the programme's broad scope and the integration of the natural sciences, the social sciences, and business and innovation sciences. In response to the previous assessment, the programme expanded the range of social science education in the programme by introducing two new compulsory courses. The panel established that the current curriculum offers a good balance between the different disciplines. However, it was not fully transparent to the panel on which specific subdomains of the social sciences the programme focuses. It advises the programme to make this more explicit and it suggests using the DSRF for this. In addition, the panel advises to create more alignment between courses and teachers on the content of each other's courses, especially which forms of 'ethics' and social sciences are taught.

According to the panel, the student's ability to reflect critically upon the roles of science and technology in society is very important in this master's programme. During the site visit, both teachers and students convincingly indicated that critical thinking is a common thread throughout the mandatory courses, the Science Project and the SBI Project & Master Thesis.

The students with whom the panel met, were positive about the content and the structure of the programme. They appreciate the broad orientation of the programme and the mix between the natural-science subjects and business subjects. They value the possibility to choose one of the two specialisations (L&H or E&S) and the freedom to organise their own learning path within the specialisation. Students highly appreciate the exposure to the professional field and actual business community and like the possibility of doing two internships during the programme. As mentioned, one of these two internships is optional (Science Project). Students indicated during the interview that it can be challenging to do an internship during the Science Project. According to the students, this should be communicated more clearly to the students so that students can make a conscious choice.

Learning environment

The SBI programme's educational approach is inspired by the core values of the VU vision (personal, open, and responsible) and by the university's ambition to offer multi-disciplinary programmes focusing on balanced choices in research paradigms and well-argued research designs (methodology). Furthermore, the self-evaluation indicates that the programme is based on the principle of research-based education. The panel ascertained that this principle is clearly visible in the SBI programme. The programme is embedded in a strong academic environment and the programme offers ample opportunities for students to design and execute research. Furthermore, the panel noted with appreciation that the programme received a European grant to explore and further develop "Science-based entrepreneurship education" as part of a collaboration between the VU and the University of Twente.

The panel is positive about the multiple teaching methods used by the programme. This includes lectures, group, and individual assignments, working groups, paper discussions, interactive lectures, literature study, tutorials, and consultancy sessions. In most courses, on-site lectures are combined



with online Q&A sessions, off-site assignments and on-site working groups. For example, in the course Business Innovation and Value Creation in the Life Sciences, field sessions are divided into online, offline and hybrid sessions which work on theoretical concepts in a flipped classroom teaching method. Furthermore, the panel values the role that external experts from companies and institutes play in a variety of courses. This may include the handling of specific casework gleaned from the actual business and application settings in the courseware. In the conversations with students, it appeared that they highly appreciate this interaction with the real world.

There is a lively student association, *Subliem*, which organises study as well as informal events, often in cooperation with the programme. *Subliem* organises, for example, symposia, study trips abroad, and a career day where companies attend and speak with students about career opportunities. *Subliem's* activities also include the first-year weekend, drinks, a magazine, and news blogs.

Study load and study guidance

According to the students, the workload is in line with what can be expected of a full-time study. According to the students, some courses were very challenging. During the interview, the students explained that this was mainly due to the poor structure of the course and that this has been improved recently. Overall, students consider the programme sometimes challenging, yet feasible. They are also satisfied with the distribution of courses across the year. The panel established that most students receive their diplomas within two years and almost all of them in three years.

The self-evaluation report describes that the Science Project and the SBI Project & Master Thesis are organised in such a way, that coaching is an integral part of these courses. However, the student chapter mentions that some students experienced difficulties to contact their supervisor for feedback during the Science Project and/or SBI Project & Master Thesis. According to the students, more guidance and proper feedback during these projects are needed. During the visit, students indicated that the extent of guidance and feedback depends on the individual supervisor. The panel advises the programme to find ways to ensure that all students receive sufficient guidance and feedback during both the Science Project and the SBI Project & Master Thesis.

Admission and intake

Based on the documents, the panel established that the programme's admission procedure ensures that students who are admitted to the programme have the right knowledge and skills to successfully complete the programme.

The influx in the programme is about 40 to 55 students per year. Around half of the students come from the VU SBI bachelor's programme, who can directly enter the programme after their graduation. The programme is also directly open to students with a degree from the Utrecht University bachelor's programme *Natuurwetenschappen en Innovatiemanagement* [Natural Sciences and Innovation Management].

Students from a variety of other bachelor programmes can apply for the master's programme SBI. These students need to fulfil strict requirements that are formulated in terms of knowledge, acquired skills and academic level. The faculty has installed an Admission Committee with the Programme Director and Programme Coordinator SBI as members to investigate whether applicants meet the admission criteria.



The SBI programme is also open to students who hold a bachelor's degree from a Higher Vocational Training School or Polytechnic (hbo in Dutch). The Admission Committee decides on their admittance based on their profile. If they have sufficient science and innovation sciences background, they are directly admitted to the programme. Others get the advice to enter the premaster's programme offered by SBI. The part-time premaster (30 EC) is a combination of courses in business and innovation. The premaster's programme is also conditional for students with a (professional) bachelor's degree in Physics or Chemistry. Based on the interviews with students and alumni, the panel established that the premaster programme prepares students effectively for the SBI master's programme.

International students register at the Internationalisation Office (IO) of the VU. IO coordinates the admissions of international students, in close cooperation with the Programme Director and Coordinator SBI, and the specialists in the section SBI. The Admissions Committee checks eligibility. Bachelor transcripts are screened on science and business/innovation courses. Each year 20-30 international students apply, of which approximately 5- 6 qualify and are admitted.

Staff

The panel noted that the programme is embedded in a strong interdisciplinary academic environment. The disciplinary courses in the area of natural sciences of the master's programme are offered by the departments Chemistry & Pharmaceutical Sciences and Physics & Astronomy. The School of Business and Economics (SBE) and the Faculty of Social Sciences (FSS) offer business and social-science disciplinary courses. The panel established that the teaching staff is didactically skilled: all lecturers are required to have the University Teaching Qualification (UTQ). In addition, several SBI lecturers also hold a senior teaching qualification (STQ), or a diploma from the educational leadership course. The academic staff for the SBI bachelor's amounts to 22 staff members (5 full professors, 7 associate professors, and 8 assistant professors). Most of the assistant, associate, and full professors, as well as guest lecturers involved in the SBI section, also participate in other accredited fields of academic education, either at or outside the VU.

The interviews during the site visit gave the panel a positive view of the teaching staff. The teaching staff is enthusiastic, well-qualified and knowledgeable in their respective areas. The panel noted that the programme relies on a small group of key staff members to realise the core identity of the programme. These key SBI lecturers and supporting officers meet once each month to exchange information about operational affairs concerning the programme. Twice a year all lecturers are invited for a meeting about the SBI programme. During the visit, the management indicated that it is difficult to get all lecturers to participate in the meetings. Since these meetings are key to making SBI a multi-disciplinary yet coherent and integrated programme, the panel recommends to create more alignment between the teachers and the courses, e.g. by encouraging all involved lecturers to attend the meetings.

Students are not satisfied with the communication with teachers. According to the students, teachers deal with a (too) large number of students, which can be the reason why teachers respond late or with vague emails. The panel encourages the programme to explore how communication between students and teachers could be improved.



Language

The programme is taught in English. The programme management substantiates this choice by explaining that the SBI programme follows the faculty's policy to address global issues and attract students from abroad. The cases that are discussed with the students are from various parts of the world, and the challenges in those cases often have a cross-border component. Most of the students conduct their research during the Master Thesis in organisations with an international orientation. In addition, many alumni find positions in the international labour market. Furthermore, SBI has many international and internationally educated professors and lecturers. The SBI programme follows the central rule at the VU that lecturers in master's programmes must have a C1 English proficiency. The programme management further substantiates the choice for English by indicating that the international component enriches the programme significantly since teaching draws not only on cross-disciplinary and interdisciplinary perspectives but also on international comparisons. It also gives the professors and lecturers the opportunity to follow the 'mixed classroom' principle and thus build on diversity to enrich the learning experience of the students. 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. Based on the VU-wide Assessment Framework, the Faculty of Science has formulated an assessment policy that describes the roles and responsibilities of all stakeholders in the assessment process following the quality assurance cycle of the faculty. The Faculty Board establishes the assessment policy, and the Examination Board (EB) assures its implementation by the Programme Director and the examiners. The Assessment Plan for SBI describes, among other things, how the programme works towards its ILOs, why certain types of assessment take place and how the programme guarantees quality assurance. The SBI Assessment Plan comprises an assessment matrix that relates the ILOs to the various courses and examinations. The panel verified that the assessments cover and thoroughly assess all ILOs of the master's programme.

The panel appreciates the range of assessment modes used, including written exams, papers, essays, individual assignments and group assignments, casework, and oral presentations. Most courses use multiple assessment types in order to stimulate the active learning process of students. The panel noted with appreciation that each course is designed to address the learning outcomes according to the principle of constructive alignment.



Students indicated both in the self-evaluation report and in the interview that they feel sufficiently prepared for exams through lectures and assignments. The study guide gives an overview of and rationale for the content, objectives, programme schedule, required reading and exam. In addition, courses often start with an introductory lecture to explain how the course is set up, how grading works, along with other necessary information to complete the course.

Students are less satisfied with the feedback they receive. Many courses in the first year rely on peer-to-peer feedback and students would like to have more in-depth feedback from teachers. The panel was pleased to note that the programme management recognises this and recently took measures to improve this in several courses. According to the self-evaluation report, the programme management also has plans to further invest in providing more formative feedback. The panel supports this and encourages the programme to implement these plans soon.

Furthermore, students indicated in the student chapter that grading can vary across teachers. During the site visit, the students explained that this occurs mainly in the Science Project. According to the students, this variation in grading is caused by the broad scope of the programme because of which teachers are not always familiar with the subject chosen by the student. The panel understands that this is inevitable due to the opportunity for students to choose their own topic. However, the panel recommends looking for ways to calibrate the assessment of the Science Project.

Assessment of the SBI Project & Master Thesis

The SBI Project & Master Thesis is an individual and independent research project in the professional field, within the chosen specialisation. The internship coordinator of the SBI programme is responsible for monitoring the process across the master project from start to finish and ensures that the entire course process is organised properly. The internship coach, employed by the organisation where the student performs the research project, is responsible for daily supervision and provides input for a grade on 'work execution'.

The SBI project & Master Thesis is assessed on the basis of four assignments, the work execution during the internship, and a presentation. Each student is assigned one first supervisor/assessor who gives feedback on the first three assignments. Rubrics for these assignments are available for both students and supervisors. Students receive feedback to further improve the first version of each assignment via the assessment forms. The first supervisor grades the final version of the first three assignments as 'insufficient', 'sufficient' or 'good'. Students can attend three Question & Answer (Q&A) sessions to ask questions about the process and methodology. A panel, consisting of the internship coordinator and one of the supervisors, is present to answer these process and methodology questions. Each first supervisor is present during one of these three Q&A sessions.

The fourth assessment (the final thesis) is assessed by the first supervisor and a second independent supervisor with a grade on a scale 1-10. When this grade of the two supervisors differs more than 1.5 points, the internship coordinator will step in as a third reader and determine the final grade (based on her own judgement and input from the two supervisors). The panel highly values the involvement of this third assessor but suggests involving the third assessor in case of a discrepancy of more than one point.

After completing the internship work and the thesis, the student gives a final presentation of approximately twenty minutes plus twenty minutes of discussion between the internship coach(es), supervisors and the student. The final oral presentation is assessed by the two supervisors and determines 15% of the final grade. When the student scores lower than a 5.5 on this grade, the student has one opportunity to present again, using the detailed feedback from VU assessors.



As indicated in the self-evaluation report, the organisation of the SBI Project & Master Thesis trajectory is seen as exemplary within the Faculty of Science. This innovative format is now implemented faculty-wide and the SBI staff has been awarded a grant to help with this implementation.

The panel is positive about this carefully designed assessment procedure. The panel values the combination of comprehensive assessment per assignment with the possibility to receive personalised feedback. However, as mentioned before, the panel noted that students are not fully satisfied with the guidance and feedback they receive during the trajectory and the panel welcomes the plans to further improve this.

Examination Committee

The SBI programme shares an Examination Board (EB) with several other bachelor's and master's programmes of the Faculty of Science. The SBI sub-committee, which consists of three members, is responsible for the quality of assessment and the end level of the bachelor's programme and master's programme SBI. Since the SBI programme doesn't only consist of courses and projects offered by the Faculty of Sciences but also comprises courses by other faculties, the SBI sub-committee contacts the EBs of the partner faculty to discuss findings and possibly implement improvements if needed. Every year the SBI sub-committee does a random check of at least three master's theses and at least three master programme courses. The SBI sub-committee writes a comprehensive report which is discussed with the programme directors.

The panel gathered from the discussion with representatives of the EB and SBI subcommittee that the quality assurance of student assessment is well organised. The panel noted with appreciation that the SBI subcommittee plays an important and active role in the quality assurance of both course assessments and the final thesis.

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

To judge whether students achieve the ILOs by the end of the programme, the panel studied a sample of master's theses and corresponding evaluation forms, completed in 2021 or 2022. The selection covered a balanced range of final marks and the two specialisations.

The theses the panel studied were of good quality. The subjects of the theses were very timely and relevant to the innovation field and the panel appreciates that all master projects were linked to a company or organisation. The theses showed that graduates can integrate knowledge in the natural sciences, business, and social sciences and can apply this knowledge in an empirical setting in the E&S domain or the L&H domain. The panel is also convinced that students can independently design and execute a research project and develop strategic insight into innovation processes. Furthermore, the panel values that all theses comprise a technical sciences chapter, in line with the ILOs of the



programme. The panel concludes that the theses are of the level and quality that may be expected from a master's thesis in the field of innovation science. It considers the theses' quality to be in line with the grades given.

In addition to verifying the quality of the final qualifications, the labour market performance of graduates is another way to establish whether students achieve the ILOs upon completion of the programme. The panel noted that students find employment in a variety of positions, including management consultant, technical consultant/specialist, researcher/analyst, project manager, marketing and sales consultant, business development trainee, and product development manager. During the visit, alumni reported that they were very satisfied with their education and felt well-prepared for a job in the field of innovation science. The panel was impressed by their enthusiasm and confidence in their career abilities and their professional development.

The programme stays in contact with the alumni through the LinkedIn alumni page, and the annual organisation of an alumni symposium. During the symposium, four to six alumni, who graduated more than 2 years ago, give presentations to the students about their current positions. Moreover, the symposium offers students the opportunity to network with alumni.

After reading the theses and speaking to alumni of the master's programme, the panel concluded that graduates demonstrated that they had met the ILOs at the expected level.

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:

- Relevant profile - The interdisciplinary programme has a relevant profile in the innovation sciences enabling the students to gain in-depth knowledge in chemistry and physics needed to understand the depth and breadth of science-based, R&D-induced innovation;
- Empirical context - Students learn to integrate natural science, business and innovation science in a research and development (R&D) context (during the Science Project) and in a real-life business context (during the SBI Project & Master Thesis);
- Teaching team - The teaching staff is enthusiastic, well-qualified and knowledgeable in their respective areas;
- Assessment system - The programme has a solid set of documents and procedures in place which secure an adequate assessment system;
- Design master's project - The master's project is linked to a real-world assignment for a firm or organisation. The carefully designed assessment procedure combines a comprehensive assessment with personalised feedback.

3.2 Recommendations

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

- Social sciences domains - Be more explicit about which social science subdomains the programme focuses on and create more alignment between courses and teachers on the content of each other's courses, especially which forms of 'ethics' and social sciences are taught;
- Communication - Explore how the communication between students and teachers can be improved;
- SBI teacher meetings - Encourage all lecturers involved in the programme to attend the SBI teacher meetings;
- Guidance and feedback - Ensure that all students receive sufficient guidance and feedback during the Science Project and the SBI Project & Master Thesis. In addition, implement the plans to further invest in providing more formative feedback during the courses;
- Assessment Science Project – Improve the calibration of the assessment of the Science Project.



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

Self-evaluation report master's programme Science Business and innovation

Appendices:

- Teaching and Examination Regulations (TER) M SBI 2022-2023 Members of the Examination Board
- Domain specific framework of reference Innovation Sciences International benchmark
- Year schedule master SBI
- Example of electives
- Correspondence between Intended Learning Outcomes and Learning Objectives Overview of staff
- Admission criteria
- Minor & pre-master's Science, Business and Innovation
- Assessment plan master SBI
- Rubrics SBI Project and Master thesis
- Alumni SBI's positions: cohort 2017
- Assessment Policy Faculty of Science
- Rules and Guidelines Examination Board 2022-2023 Faculty of Science
- Course manual Master Project
- Assignments Master Project
- Rubrics incl. assessment endterms Master Project
- Study Guide M SBI 2022-2023
- Management information Factsheet 2021-2022
- Management information visitation report
- Results NSE 2021
- Overview Final Projects

In addition, the panel had access to:

- Canvas provides detailed information on several courses
- The assessment dossiers of three master's programme courses



Appendix C – Schedule of the visit

10 November, 2022

Time	Session
8:30 - 9:30	Welcome and preparation interviews by panel
9:30 - 10:15	Programme management
10:30 - 11:00	Bachelor students
11:00 – 11:30	Master students (including member programme committee)
11:45 - 12:30	Lecturers BSc, including member programme committee and thesis assessors
12:30 - 13:30	Lunch and consultation hour
13:30 - 14:15	Lecturers MSc, including members programme committee and thesis assessors
14:30 - 15:00	Examination Board
15:15 - 16:00	Alumni and professional field representatives (online)
16:15 - 16:30	Programme management
16:30 - 17:45	Deliberations panel
17:45	Presentation preliminary findings



Appendix D – Abbreviations

DSRF	domain-specific reference framework
EB	Examination Board
EC	European Credit
E&S	Energy & Sustainability
ILO	Intended Learning Outcomes
IO	Internationalisation Office
FSW	Faculty of Social Sciences
L&H	Life & Health
NVAO	<i>Nederlands-Vlaamse Accreditatieorganisatie</i>
SBE	School of Business & Economics
SBI	Science Business & Innovation
UTQ	University Teaching Qualification
STQ	Senior Teaching Qualification
VU	Vrije Universiteit Amsterdam
Vwo	<i>Vorbereidend wetenschappelijk onderwijs</i>



Appendix E – Curriculum

SBI Master's Curriculum, Energy and Sustainability						
	P1	P2	P3	P4	P5	P6
Year 1	Research Methodology (6EC)	Changing Org. Culture (6EC) or: Management of Sustainable Innovation (6EC) or: Digital Innovation (6EC)	Current Sustainable Energy Tech. (6EC)	Science Project (24EC)		Project Sustainable Future (6EC)
	Science elective (6EC per course)					
	Elective (6EC)	Elective (6EC)		Science Elective (6EC)		
Year 2	Science elective (6EC per course)	Changing Org. Culture (6EC) or: Management of Sustainable Innovation (6EC) or: Digital Innovation (6EC)	SBI Project & Master Thesis (36EC)			
	Elective (6EC)					

SBI Master's Curriculum, Life and Health						
	P1	P2	P3	P4	P5	P6
Year 1	Research Methodology (6EC)	Changing Org. Culture (6EC) or: Management of Sustainable Innovation (6EC) or: Digital Innovation (6EC)	Business, Innovation and Value Creation (6EC)	Science Project (24EC)		Science Elective (6EC)
	Science elective (6EC per course)					
	Elective (6EC)	Elective (6EC)				
Year 2	Science Elective (6EC per course)	Changing Org. Culture (6EC) or: Management of Sustainable Innovation (6EC) or: Digital Innovation (6EC)	SBI Project & Master Thesis (36EC)			
	Elective (6EC)					



