

Assessment report
Limited Programme Assessment

Master Science and Innovation

Utrecht University

Contents of the report

1. Executive summary	2
2. Assessment process	4
3. Overview of the programme.....	6
3.1 Basic information about the programme	6
3.2 Main facts about the institution	7
3.3 Intended learning outcomes.....	7
3.4 Outline of the curriculum	8
4. Overview of assessments.....	10
5. Findings, considerations and assessments per standard	11
5.1 Standard 1: Intended learning outcomes	11
5.2 Standard 2: Teaching-learning environment	13
5.3 Standard 3: Assessment.....	16
5.4 Standard 4: Achieved learning outcomes	18
6. Recommendations	19
Annex 1: Site visit schedule	20
Annex 2: Documents reviewed	21
Annex 3: Theses reviewed	22
Annex 4: Assessment panel composition.....	23

1. Executive summary

In this executive summary, the panel presents the main considerations which have led to the external assessment of the quality of the programme Master Science and Innovation of Utrecht University. The programme has been assessed according to the NVAO Assessment Framework.

The panel observed programme management followed up on the recommendations made in the previous assessment in 2012. Programme management, among others, extended the canon of the programme to include methods and academic and professional skills, improved the programme's connection to real-world problems and practices and implemented the examination and assessment policies.

The programme offers three specialisations. These are *Innovation Sciences*, *Sustainable Business and Innovation* and *Energy Science*. The *Innovation Sciences* specialisation is being offered for about 25 years. The *Sustainable Business and Innovation* specialisation is rather new and is offered since 2013. The *Energy Science* specialisation has been transferred from the Faculty of Science of Utrecht University where the programme started in 2005. It is offered by the Faculty of Geosciences since 2013.

The panel very much welcomes the efforts of management of the Vrije Universiteit, Utrecht University and Eindhoven University of Technology programmes to draft the domain-specific framework of reference. Through this framework, the programme is definitely linked to international concepts, notions and trends in the innovation sciences domain.

The programme goals to educate students to master innovation processes and systems and to address important societal and business challenges in innovation systems and in organisations, are valid. The objectives of the specialisations may be regarded to be consistent with these goals. The *Energy Science* specialisation objectives, however, differ from the programme goals and the other two specialisations' objectives and are not entirely consistent with the domain-specific framework of reference. Therefore, the panel supports the plan of programme management to apply for the separate registration for this specialisation.

The panel is very positive about the canons of the *Innovation Sciences* and *Sustainable Business and Innovation* specialisations, since these are an important means to delineate the domain of these two specialisations and to list the theories, methods and skills being included in these domains. In addition, the panel applauds the level of the intended learning outcomes, the degree of detail achieved in them and the way in which these have been matched with the domain-specific framework of reference and the Dublin-descriptors for master programmes.

The Advisory Board of the programme offers programme management a broad window on trends in the professional field.

The number of incoming students is satisfactory for the *Sustainable Business and Innovation* and *Energy Science* specialisations. The panel shares the concerns of programme management about the diminishing influx of students in the *Innovation Sciences* specialisation and recommends to raise this inflow.

For the panel, the admission requirements and processes are well designed. Only students are admitted who may be regarded to have the capacities to complete the programme. The panel is positive about the pre-master programme for Dutch students with deficiencies.

The curriculum reflects all of the intended learning outcomes of the programme adequately and evenly. The panel considers the curriculum to be well designed, addressing the theories and the methodologies inherent to the specialisation chosen. The panel is positive about the *Consultancy projects*, as these allow students to link their knowledge and understanding to real-life problems and to address these problems in an integrative way. The coherence of the curricula within each of the specialisations is appropriate. As the interaction between the specialisations is less intensive, the panel recommends to exchange best practices among the specialisations and to consider increasing the overlap between these. The panel regards the international dimension of the programme to be adequate.

The educational principles and the study methods of the programme allow for intensive, small-scale teaching and learning. The study load is substantial, making the programme challenging. The study guidance is appropriate for a master programme.

The panel is very positive about the lecturers' research track records as well as about their educational track records. The Copernicus Institute of Sustainable Development, at which all of them are employed as researchers, has a very strong reputation as a research institute. The educational capabilities are equally impressive, to be deduced from the very high proportion of 87 % of lecturers having obtained the BKO-certificate and 37 % of them being in possession of the SKO-certificate. The lecturers discuss the curriculum on a regular basis.

The examination and assessment rules and regulations of the programme meet university and Faculty of Geosciences policies. The panel considers the *Memorandum for Assessments* and the implementation thereof to be an important step to ensure the quality of the examinations and assessments in the programme. The panel is positive about the position and activities of the Board of Examiners. The Board has the responsibilities and works along the lines, as intended by Dutch applicable law. The examinations are regularly inspected by the Committee of Assessments. In the panel's view, the examination methods are in line with the course contents and the validity and reliability of examinations and assessments are satisfactory. Supporting the plans of programme management, the panel advises to draft a comprehensive assessment matrix to relate course goals and contents to the intended learning outcomes and to implement an examinations repository to document the goals, contents and examinations of the courses. The panel also advises to continue the plans of the Committee of Assessments to improve identifying individual results in group assignments. The panel regards the processes of supervision and assessment for the *Master thesis* as satisfactory and is positive about the adoption of rubrics scoring models in this respect.

The examinations are regarded by the panel to be in line with the contents of the courses. The *Master theses* are of good quality and the level achieved by the students in the theses is generally high. The panel recommends to intensify the supervision of the theses, as this may raise the already high and much appreciated level of the theses. The panel is very positive about the career perspectives of the graduates of the programme. They tend to find suitable positions rather soon after their graduation.

The panel assesses the programme Master Science and Innovation of Utrecht University to be good and recommends NVAO to grant re-accreditation to this programme.

Rotterdam, 14 April 2017

Panel chair
Prof. dr. ir. P.C. de Weerd-Nederhof

Secretary
drs. W. Vercouteren RC

2. Assessment process

Certiked VBI received a request to conduct a limited programme assessment for the re-accreditation of the academic degree programme Master Science and Innovation. This request was submitted by Utrecht University.

The panel composition was as follows (for more detailed information please refer to Annex 4: Assessment panel composition).

- Prof. dr. ir. P.C. de Weerd-Nederhof, Professor Organizational Studies and Innovation and chair of NIKOS, University of Twente (panel chair);
- Prof. dr. A.M. Bergek, Professor Innovation Systems and Technology Policy, Chalmers University of Technology (panel member);
- Prof. dr. M.S. van Geenhuizen, Professor of Innovation and Innovation Policy in the Urban Economy, Delft University of Technology (panel member);
- E.E.M. Leo BSc, student Master Educational Sciences, University of Amsterdam (student member).

On behalf of Certiked, drs. W. Vercouteren RC was responsible for the process coordination and for drafting the panel's report. All panel members and the secretary signed a statement of independence and confidentiality.

Certiked requested the approval by NVAO of the proposed panel of experts to conduct this assessment. NVAO have given their approval.

The panel conducted this assessment on the basis of the NVAO Assessment Framework of 19 December 2014 (Staatscourant nr. 36791). The final products or theses studied by the panel were selected according to the NVAO Guidelines for the assessment of final projects during external assessments of 18 February 2015.

The following procedure was adopted. The panel members studied the documents presented beforehand by programme management, including a number of theses (please refer to Annex 2: Documents studied and Annex 3: Final products reviewed).

Before the date of the site visit, the panel chair and the panel secretary met to discuss the assessment procedures. On 2 February 2017, the panel had a meeting to discuss the preliminary findings concerning the quality of the programme.

During the meeting on 2 February 2017, the findings of the panel members, including those concerning the theses, were discussed. On the basis of the input of the panel, the secretary summarised the questions, which served as a starting point for the discussions with the programme representatives during the site visit.

On 3 February 2017, the panel conducted the site visit at the Utrecht University campus. The site visit was conducted in accordance with the schedule drawn up beforehand (please refer to Annex 1: Site visit schedule). Prior to the site visit, programme management communicated the open office hours to the students in the programme and the staff of the programme. No one called on the panel.

A draft version of this report was finalised by the secretary, having taken into account the information presented as well as the findings and considerations of the panel. The panel members studied the draft report and made a number of changes. Thereupon, the secretary drew up the final report. This report was presented to programme management to be corrected for factual inaccuracies. After having been corrected for these factual inaccuracies, the report was sent to the institution's Board to accompany their request for re-accreditation.

3. Overview of the programme

3.1 Basic information about the programme

Administrative information about the programme:

Name programme CROHO:	Master Science and Innovation
Orientation, level:	Academic Master
Grade:	MSc
Number of credits:	120.0 EC
Specialisations:	Innovation Sciences, Energy Science, Sustainable Business and Innovation
Location:	Utrecht
Mode of study:	Full-time (English-taught programme)
Registration in CROHO:	60709

Administrative information about the institution:

Name of institution:	Utrecht University
Status of institution:	Government-funded university
Institution's quality assurance:	Approved

Quantitative data about the programme

Percentage of students who completed the programme in three years (n+1)

Cohort	2012	2013	2014
Percentage of students	71 %	72 %	

The figure for 2012 refers only to the Innovation Sciences specialisation. The figure for 2013 includes all three specialisations. The figures should be interpreted with some care.

Lecturers' qualifications

Qualification	Master	PhD	BKO*
Percentage of lecturers	100 %	90 %	87 %

* BKO means having obtained Dutch University Teaching Qualification. Additionally, about 13 % of staff is in the process of acquiring the BKO-certificate.

The student-to-staff ratio is 31.1 : 1 (study year 2014 – 2015). The contact hours are 8.9 hours per week in the first year and 2.8 hours per week in the second year.

3.2 Main facts about the institution

The degree programme Master Science and Innovation is a programme of the Faculty of Geosciences of Utrecht University. Utrecht University was founded in 1636. According to the website, the university's mission is working to contribute to a better world. Graduates are trained to make a substantial contribution to society. Research at the university is meant to be ground-breaking and focused on solving major global issues. The collaborative culture of the university is to foster innovation, new insights and societal impact. The core values of Utrecht University are ambition, inspiration, commitment and independence. The aims of the university as stated in the strategic plan 2016 – 2020 are, among others, to achieve innovation in the teaching model, to renew research facilities, to increase interdisciplinary collaboration, to strengthen the international position of the university, to reinforce the university's reputation and to contribute visibly to solve problems in society.

The Faculties of Utrecht University are the Faculties of Geosciences, Humanities, Law, Economics and Governance, Medicine, Science, Social and Behavioural Sciences and Veterinary Medicine. In addition, the university houses three teaching institutes, being University College Roosevelt, University College Utrecht, and Centre for Education and Learning. University Utrecht offers 45 bachelor programmes and 138 master programmes. Nearly 30,000 students are enrolled in the programmes of the university. About 6,700 staff are employed by Utrecht University.

3.3 Intended learning outcomes

The intended learning outcomes of the programme are as follows.

- Graduates of the programme have advanced knowledge and understanding of the dynamics and challenges of Science and Innovation in the context of both organisations and society at large.
- Graduates of the programme are able to conduct research of the dynamics and challenges of Science and Innovation in a creative and independent way.
- Graduates of the programme have the abilities to apply knowledge and research methods, and problem-solving abilities in broader contexts related to the dynamics and challenges of Science and Innovation.
- Graduates of the programme have insight into the complex interactions between science, innovative technology and society and are able to reflect critically upon the roles of science and technology in society.
- Graduates of the programme have professional and academic skills, in particular in relation to the dynamics and challenges of Science and Innovation.
- Graduates of the programme are able to apply knowledge and understanding in such a way that they demonstrate a professional approach to their work.
- Graduates of the programme are able to communicate conclusions, as well as knowledge, reasons and considerations underlying these conclusions, to an audience of specialists and non-specialists alike.

3.4 Outline of the curriculum

In the table below, the programme curricula of the specialisations are presented.

Courses Innovation Sciences specialisation	Credits
Technology Related Venturing	7.5 EC
Innometrics	7.5 EC
Quantitative Innovation Analytics	7.5 EC
Innovation Systems and Processes	7.5 EC
Societal Challenges and Innovation Theory	7.5 EC
Qualitative Innovation Analytics	7.5 EC
Consultancy Project	15.0 EC
First year Innovation Sciences specialisation	60.0 EC
Electives	15.0 EC
Master Thesis	45.0 EC
Second year Innovation Sciences specialisation	60.0 EC
Total credits Innovation Sciences specialisation	120.0 EC
Courses Sustainable Business and Innovation specialisation	
Technology Related Venturing	7.5 EC
Business and Sustainability Challenges	7.5 EC
Sustainable Entrepreneurship	7.5 EC
Toolbox 1: Environmental Assessment and Management Approaches	7.5 EC
Organisational Change Management for Sustainability	7.5 EC
Toolbox 2: Socio-organisational Methods for Corporate Sustainability	7.5 EC
Consultancy Project	15.0 EC
First year Science and Business Innovation specialisation	60.0 EC
Electives	15.0 EC
Master Thesis	45.0 EC
Second year Sustainable Business and Innovation specialisation	60.0 EC
Total credits Sustainable Business and Innovation specialisation	120.0 EC
Courses Energy Science specialisation (Systems Analysis variant)	
Energy in the Context of Sustainability	7.5 EC
Energy Conversion Technologies I	7.5 EC
Advanced Energy Analysis	7.5 EC
Elective	7.5 EC
Energy Systems Modelling	7.5 EC
Energy Conversion Technologies II	7.5 EC
Consultancy Project	15.0 EC
First year Energy Science specialisation (Systems Analysis variant)	60.0 EC
Internship Energy Science (22.5 EC) and/or additional electives	30.0/37.5 EC
Master Thesis	30.0 EC
Second year Energy Science specialisation (Systems Analysis variant)	60.0 EC
Total credits Energy Science specialisation (Systems Analysis variant)	120.0 EC

Courses Energy Science specialisation (Natural Science variant)	
Energy in the Context of Sustainability	7.5 EC
Energy Conversion Technologies I	7.5 EC
Advanced Energy Analysis	7.5 EC
Electives or Natural Science courses (two courses)	15.0 EC
Energy Systems Modelling	7.5 EC
Energy Conversion Technologies II	7.5 EC
Natural Science Research Project	30.0 EC
First year Energy Science specialisation (Natural Science variant)	60.0 EC
Elective or Natural Science course	7.5 EC
Master Thesis	30.0 EC
Second year Energy Science specialisation (Natural Science variant)	60.0 EC
Total credits Energy Science specialisation (Natural Science variant)	120.0 EC

4. Overview of assessments

Standard	Assessment
Standard 1. Intended learning outcomes	Good
Standard 2: Teaching-learning environment	Good
Standard 3: Assessment	Satisfactory
Standard 4: Achieved learning outcomes	Good
Programme	Good

5. Findings, considerations and assessments per standard

5.1 Standard 1: Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to contents, level and orientation; they meet international requirements.

Findings

The programme offers three specialisations. These are Innovation Sciences, Sustainable Business and Innovation and Energy Science. The Innovation Sciences specialisation is being offered for about 25 years. The Sustainable Business and Innovation specialisation is rather new and is offered since 2013. The Energy Science specialisation has been transferred from the Faculty of Science of Utrecht University and is offered by the Faculty of Geosciences since 2013 as well.

Regardless of the specialisation, the main goals of the programme are to train students to become academic professionals who master innovation processes and systems and may act as change agents in innovation systems or organisations and companies to address important societal and business challenges. The focus of the programme is on innovation, not so much as a means for companies to gain competitive advantage but, indeed, to address societal and broad business challenges.

Although the specialisations of the programme share the same goal, their objectives are more distinct and focused on different dimensions of innovation. In the Innovation Sciences specialisation, the students are educated to analyse innovation emanating from the introduction or development of new technology. The specialisation is directed towards the study of innovation systems and processes on macro-level. The Sustainable Business and Innovation specialisation focuses on innovation processes and systems within organisations and companies and is meant to educate students to assist these organisations to improve their sustainability. The Energy Science specialisation is somewhat different from the other ones, as it is focused entirely on energy systems. In this specialisation, students are taught to become highly skilled academic professionals who understand energy systems and have the capabilities to assist in the transition to more sustainable energy systems.

In 2016, the domain-specific framework of reference for the innovation sciences domain was drafted by programme management of this programme in collaboration with the innovation sciences programmes of Vrije Universiteit Amsterdam and of Eindhoven University of Technology. In this domain-specific framework of reference, the international domain of innovation sciences is delineated and research, education and study subjects in this domain are addressed.

Programme management drafted two so-called canons in which the theories, the scientific methods and the skills, to be mastered by the students of the Innovation Sciences and Sustainable Business and Innovation specialisations have been listed. These canons for both specialisations address these theories, methods and skills in considerable detail, thereby clearly delineating the domains of these specialisations.

Programme management drafted the intended learning outcomes for the programme (please refer to section 3.3 for an overview) and for each of the specialisations. The intended learning outcomes for the specialisations are specifications of the programme learning outcomes, addressing the characteristics of the specifications. Programme management showed the specialisations learning outcomes to be covered by the programme learning outcomes.

Programme management drafted a table, to show the correspondence of the intended learning outcomes of the programme to the Dublin-descriptors for master programmes. From this table may be deduced the programme intended learning outcomes match these Dublin-descriptors. In addition, programme management showed the learning outcomes to be consistent with the domain-specific framework of reference.

The Advisory Board of the programme with representatives of the professional field on a regular basis gives advice to programme management on the intended learning outcomes and the curriculum of the programme from the perspective of the professional practice.

Considerations

The panel very much welcomes the efforts of management of the Vrije Universiteit, Utrecht University and Eindhoven University of Technology programmes to draft the domain-specific framework of reference. Through this framework, the programme is definitely linked to international concepts, notions and trends in the innovation sciences domain.

In the panel's view, the goals of the programme to educate students to be able to master innovation processes and systems and to address important societal and business challenges in innovation systems and in organisations, are valid. The objectives of the specialisations may be regarded to be consistent with the programme goals. The objectives of the Energy Science, however, differ from the programme goals and the other two specialisations' objectives and are not entirely consistent with the domain-specific framework of reference. Therefore, the panel supports the intention of programme management to apply for a separate registration (so-called CROHO-registration) for this specialisation.

The panel is very positive about the canons of the Innovation Sciences and Sustainable Business and Innovation specialisations, since these are an important means to delineate the domain of these two specialisations and to list the theories, methods and skills, which are part of these domains.

The programme intended learning outcomes are considered by the panel to be consistent with the goals of the programme. The intended learning outcomes of the specialisations meet the programme learning outcomes, taking the remarks on the *Energy Science* specialisation into account. The panel ascertained the intended learning outcomes of the programme to match the Dublin-descriptors for master programmes and, therefore, to meet the requirements of a master level programme. In the panel's view, the programme learning outcomes are consistent with the domain-specific reference framework. The Dublin descriptors and the domain-specific framework of reference have been compared to the programme intended learning outcomes with substantial detail.

In the panel's view, the Advisory Board of the programme offers programme management a broad window on trends in the professional field.

Assessment of this standard

These considerations have led the assessment panel to assess standard 1, *Intended learning outcomes* to be good.

5.2 Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Findings

As has been mentioned, this is a programme of the Faculty of Geosciences. The Dean of the Faculty is ultimately responsible for the programme. The programme is part of the Graduate School of Geosciences, in which all master programmes of the faculty are brought together. On a day-to-day basis, the director of education of the Department of Innovation, Environmental and Energy Sciences has the responsibility for the programme. This department is one of the four departments of the faculty. The chair of this department has the authority to decide to what extent staff and resources are allocated to this programme. For the delivery of the programme, the departmental Master Management Team is responsible, consisting of the director of education of the department and the programme leaders for the specialisations of this master programme and the two specialisations of the other master programme in the department, being Master in Environmental Science. This management team is advised on the programme quality by the Master Education Committee, on which sit one student and one lecturer of each of the specialisations. The faculty-wide Board of Examiners oversees the examination and assessment processes and outcomes. The Board of Examiners of the Department of Innovation, Environmental and Energy Sciences is one of the three chambers of the faculty Board of Examiners and especially given the task to monitor the examinations and assessments for this and other programmes in the department. The faculty Board of Examiners is assisted by the faculty-wide Committee of Assessments, which inspects examinations and assessments to verify their quality.

The number of students enrolling in the *Innovation Sciences* specialisation diminished over the years to the influx of 25 students in 2015. The influx in the *Sustainable Business and Innovation* specialisation increased since 2013 to an influx of 33 students in 2015. The inflow in the *Energy Science* specialisation fluctuated somewhat and amounted to 26 students in 2015.

To be admitted to the programme, programme management requires applicants in a formal sense to have a higher education degree on bachelor level in the relevant domain. In addition, applicants are to report proficiency in English. Applicants are selected on the basis of motivation, level of knowledge in this domain, command of research methods and techniques and level of academic and professional skills. Students having the bachelor diploma of universities of applied sciences in the Netherlands (in Dutch: hbo) are required to take the pre-master programme to remedy their deficiencies, before being allowed to enter the programme. Foreign students have to meet the requirements and are not allowed to take the pre-master programme.

Programme management presented tables in which the relations between the intended learning outcomes and the curriculum components of each of the specialisations have been specified. From these tables, it may be deduced that for each of the specialisations all of the intended learning outcomes are addressed in one or more courses. The curriculum of the programme spans two years. The *Innovation Sciences* specialisation is directed towards the study of innovation systems. In the first year of the curriculum, three theoretical and three methodological courses are scheduled. These courses address the theoretical and methodological concepts to study innovation systems. The *Sustainable Business and Innovation* specialisation is directed towards change processes within organisations to arrive at more sustainable business models. The curriculum of this specialisation in the first year includes four courses on theory and two courses on methodology. The *Energy Science* specialisation focuses on the transition to sustainable energy systems. In the first year of the curriculum, two science and technology courses, two courses on energy systems, an interdisciplinary course on the context of sustainability and an elective course are offered. In all of the specialisations, students take a *Consultancy project* at the end of the first year. In small groups, students address real-life subjects or problems, do scientific research within an organisation and write an advice about solving the problem. These projects are inherently integrative, approaching the problem from different angles. Depending upon the specialisation chosen, students select elective courses with a different total of credits. At the end of the curricula of all of the specialisations, the students write their *Master thesis*. In the *Innovation Science* and *Sustainable Business and Innovation* specialisations, the thesis amounts to 45 EC, while in the *Energy Science* specialisation, it is 30 EC. In the *Sustainable Business and Innovation* specialisation, the internship is mandatory. In the *Innovation Science* specialisation, it is recommended. In the *Energy Science* specialisation, students may take an internship (*Systems Analysis* variant) or do the *Natural Science Research Project* (*Natural Science* variant) at one of the research groups in the Faculty of Geosciences or the Faculty of Science. Students are offered the opportunities to go abroad to write their *Master thesis* or to take internships. The students with whom the panel met, were content about the contents of the curriculum and described it as coherent.

The educational concept of the programme is directed towards activating students to learn, to foster the interaction between lecturers and students and to offer small-scale teaching and learning. Study methods are lectures, tutorials, discussion groups, assignments and group projects. in small classes. The programme is quite demanding. In the evaluations, students reported studying between 35 and 41 hours per week. In case of questions about or problems in their studies, students may turn to the study advisor.

About 30 lecturers are involved in the programme. They are employed by the Copernicus Institute of Sustainable Development, a research institute within the Faculty of Geosciences. As a consequence, the lecturers are researchers in their field of study. About 90 % of the lecturers holds a PhD. No less than over 87 % of them is in possession of the BKO-certificate, whereas the remaining 13 % of the lecturers is in the process of acquiring this certificate. Over 37 % of the lecturers holds the SKO-certificate (Senior University Teaching Qualification). These figures all testify to the lecturers' capabilities in education. The lecturers in the programme meet regularly to discuss educational topics and the contents and coherence of the curriculum. In the programme, guest lecturers present specific topics.

Considerations

The number of incoming students is regarded by the panel to be satisfactory for the *Sustainable Business and Innovation* and the *Energy Science* specialisations. The panel shares the concerns of programme management regarding the diminishing influx of students in the *Innovation Sciences* specialisation and recommends to raise the inflow of students in this specialisation.

In the panel's opinion, the admission requirements and the admission processes are well designed and strict. These are suited to allow only students in who have the capacities to complete the programme. The panel is positive about the pre-master programme for Dutch students with deficiencies.

The curriculum reflects all of the intended learning outcomes of the programme adequately and evenly. The panel considers the curriculum to be well designed, addressing the theories and the methodologies inherent to the specialisation chosen. The panel is positive about the *Consultancy projects*, as these allow students to link their knowledge and understanding to real-life problems and to address these problems in an integrative way. For the panel, the coherence of the curricula within each of the three specialisations is quite appropriate. The interaction between the specialisations is less intensive. The panel recommends to exchange best practices among the specialisations, so they may benefit from each other, and to consider increasing the overlap between the specialisations, investigating which courses of the other specialisation students take in their elective space as the first step. The panel considers the international dimension of the programme to be appropriate, students being able to spend part of their studies abroad in an internship and/or in the *Master thesis*.

The panel approves of the educational principles and the study methods of the programme, as these allow for intensive, small-scale teaching and learning. The study load is substantial, making the programme challenging. The study guidance is appropriate for a master programme.

The panel is very positive about the lecturers' research track records as well as about their educational track records. The Copernicus Institute of Sustainable Development, at which all of them are employed as researchers, has a very strong reputation as a research institute. The educational capabilities are equally impressive, to be deduced from the very high proportion of 87 % of lecturers having obtained the BKO-certificate and 37 % of them being in possession of the SKO-certificate. The lecturers discuss the curriculum on a regular basis.

Assessment of this standard

These considerations have led the assessment panel to assess standard 2, *Teaching-learning environment* to be good.

5.3 Standard 3: Assessment

The programme has an adequate assessment system in place.

Findings

The procedures regarding examinations and assessments of this programme meet the *Utrecht University Educational Model* requirements and the *Examination Policy* of the Faculty of Geosciences. Rules and regulations about examinations and assessments are laid down in the programme Teaching and Examination Regulations, the specialisations catalogues and the course outlines.

As has been explained while discussing standard 2, for all of the Faculty of Geosciences graduate and undergraduate programmes, the faculty-wide Board of Examiners monitors the examinations and assessments. For this programme, the Department of Innovation, Environmental and Energy Sciences Board of Examiners, one of the chambers of the faculty Board, takes up these responsibilities. To promote the examinations and assessments quality, in 2012 the *Memorandum for Assessments* was drafted. Subsequently, this Memorandum has been implemented and an assessment culture in this and other programmes of the Faculty of Geosciences has been established. The Board of Examiners is assisted by the Committee of Assessments. This committee regularly checks examinations to verify the quality and level thereof. The committee is in the process of improving the assessments of individual results in group assignments.

Examination methods are quite diverse and include written examinations, group and individual written assignments, research papers and oral presentations. In all of the courses, multiple examinations are to be taken by the students and the final grade of the courses is a composite grade, this being the weighed outcome of the grades of the course components.

To enhance the validity, examinations are prepared by one of the lecturers and is presented to another lecturer for review. In addition, lecturers submit an assessment matrix, relating the examinations to the course learning goals. Examinations with deviant outcomes are analysed by programme management to investigate the examination validity.

In close collaboration with the Board of Examiners, programme management has the intention to draft a comprehensive assessment matrix linking the course goals and contents to the intended learning outcomes of the programme. In addition, an examinations repository is planned to be implemented to document the goals, contents and examinations of each of the courses.

At the end of the programme, students are required to complete the *Master thesis*. In the thesis, students work individually, are expected to demonstrate their academic knowledge and research skills and are required to meet all of the intended learning outcomes of the programme. The study load of the thesis differs across the specialisations, being 45 EC for the *Innovation Sciences* and *Sustainable Business and Innovation* specialisations and 30 EC for the *Energy Science* specialisation. Before embarking upon the thesis process, students present their research proposal. This proposal is to be approved by the supervisor and the second, independent assessor. Students are entitled to 48 hours of supervision by their supervisor in the 45 EC theses. At completion of the *Master thesis* process, students are required to present the written report and have to give an oral presentation of the thesis. The thesis is assessed by the supervisor and the second assessor. For their assessments, they use a rubrics scoring model with a number assessment criteria.

Considerations

The panel observed the examination and assessment rules and regulations of the programme to meet the university-wide policies. The panel considers the *Memorandum for Assessments* and the implementation thereof to be an important step to promote and ensure the quality of the examinations and assessments in the programme.

The panel is positive about the position and activities of the Board of Examiners to ensure the quality and level of the examinations and assessments. The Board of Examiners has the responsibilities and works along the lines, as intended by Dutch applicable law. The examination and assessment processes are adequately monitored. The examinations are regularly inspected by the Committee of Assessments.

The panel approves of the examination methods, programme management has selected. They are in line with the course contents to be assessed. Having the courses assessed by multiple examinations allows to assess students' performances on different dimensions, relevant for the courses.

In the panel's view, programme management has taken a number of measures to foster the validity of the examinations and reliability of the assessments. Supporting the plans of programme management, the panel recommends to draft a comprehensive assessment matrix to relate course goals and contents to the intended learning outcomes and to implement an examinations repository to document the goals, contents and examinations of each of the courses. In addition, the panel advises to continue the intentions of the Committee of Assessments to improve identifying individual results in group assignments.

The panel regards the processes of supervision and assessment for the *Master thesis* to be satisfactory. The assessment by two examiners, using assessment forms leads to reliable assessments. The panel is positive about the adoption of rubrics scoring models to assess the theses.

Assessment of this standard

The considerations have led the assessment panel to assess standard 3, *Assessment* to be satisfactory.

5.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

In the last few years, the average grade for the *Master Theses* of all of the three specialisations together as an estimation for the learning outcomes achieved by the graduates was about 7.3. The average grade for the theses in the *Innovation Sciences* specialisation was 7.4, whereas in the Sustainable Business and Innovation specialisation this grade was 6.9. In the Energy Science specialisation, the average grade for the theses was 7.5. In the years 2012 – 2015, the proportion of students graduating cum laude (average grade for all courses 8.0 or more) amounted to nearly 17 %.

As has been mentioned when discussing standard 1, the graduates of the programme are trained to enter the labour market. Graduates have good career perspectives and tend to find positions relatively shortly after their graduation. The outcomes of a survey among alumni conducted by programme management, showed 62 % of the graduates to have found a position within three months after graduation and nearly all of them to have been employed within one year after this date. The graduates are employed in a wide array of positions, including consultancy, research, education, health care, government and commercial non-consultancy. About 15 % of the graduates continue their careers in the academic world as PhD-students. The majority of these students took the *Innovation Sciences* specialisation.

Considerations

The examinations which the panel studied are in line with the contents and the learning goals of the courses.

The panel assesses the Master theses to be of good quality and the level achieved by the students in the theses to be generally high. The panel approves of the grades given by the programme examiners. In a few of the *Master theses*, the panel noted some parts of the theses to have been elaborated less well. The panel considers this could have been prevented by more intensive supervision. The panel recommends to intensify the supervision and the coaching in the thesis process especially for students who may need some correction on the way, as this may raise the already high and much appreciated level of the theses and may allow students to pass to even more sophisticated analysis.

The panel is very positive about the career chances of the graduates of the programme. The graduates tend to find suitable positions rather soon after their graduation. For the panel this demonstrates the graduates to be in relatively high demand in the labour market.

Assessment of this standard

The considerations have led the assessment panel to assess standard 4, *Achieved learning outcomes* to be good.

6. Recommendations

In this report, a number of recommendations have been listed. For the sake of clarity, these are brought together below. The recommendations are the following.

- To apply for a separate registration for the *Energy Science* specialisation, in support of the intentions of programme management.
- To raise the inflow of students in the *Innovation Sciences* specialisation.
- To exchange best practices among the specialisations of the programme and to consider increasing the overlap between the specialisations, investigating which courses of the other specialisation students take in their elective space as the first step.
- To draft a comprehensive assessment matrix to relate course goals and contents to the intended learning outcomes and to implement an examinations repository to document the goals, contents and examinations of each of the courses, supporting the plans of programme management.
- To better identify the individual results in group assignments, in line with the intentions of the Committee of Assessments.
- To intensify the supervision of the master theses, in order to further raise the already high and much appreciated level of the master theses.

Annex 1: Site visit schedule

The site visit was conducted in Utrecht on 3 February 2017.

08.30 h. – 09.30 h.	Arrival panel and documents study (closed session)
09.30 h. – 10.00 h.	Dean and programme management Prof. dr. P. Hoekstra (Dean Faculty of Geosciences), prof. dr. M. Hekkert (Head of Copernicus Institute of Sustainable Development), dr. J. Farla (Director of Education), dr. M. Bootsma (Director of Education until 1 October 2016)
10.00 h. – 11.20 h.	Programme management and programme leaders Dr. J. Farla (Director of Education), dr. W. Boon (programme leader Bachelor), dr. F. van Rijnsoever (programme leader Master specialisation Innovation Sciences), dr. S. Negro (programme leader Master specialisation Sustainable Business & Innovation), dr. E. Nieuwlaar (programme leader Master specialisation Energy Science)
11.30 h. – 12.15 h.	Board of Examiners Prof. dr. E. Moors (Chair Board of Examiners of Department of Innovation, Environmental and Energy Sciences, member Board of Examiners of Faculty of Geosciences), prof. dr. O. Atzema (chair Board of Examiners of Faculty of Geosciences), dr. W. Wessels (chair Assessment Committee), drs. E. Dijkma (secretary Board of Examiners of Department of Innovation, Environmental and Energy Sciences)
12.15 h. – 13.30 h.	Lunch panel (closed session), consultation hour 12.15 h. – 12.45 h.
13.30 h. – 14.30 h.	Lecturers and theses examiners Prof. dr. ir. R. Raven (Bachelor, Master specialisation Innovation Sciences), dr. A. Herrmann (Bachelor, Master specialisation Innovation Sciences) prof. dr. M. Junginger (Master specialisations Sustainable Business & Innovation, Energy Science), dr. M. Chappin (Bachelor, Master specialisations Innovation Sciences, Sustainable Business & Innovation), dr. F. van der Hilst (Master specialisation Energy Science)
14.30 h. – 15.30 h.	Students and alumni, including Education Committee members M. Troost (Bachelor student), E. Schuurmans (Bachelor student), T. Arndt BSc (Master specialisation Sustainable Business & Innovation student), J. Leendertse BSc (Master specialisation Innovation Sciences student, Bachelor alumnus), A. Krishnan BSc (Master specialisation Energy Science student), N. Brinkel BSc (Master specialisation Energy Science student, Bachelor Honours programme alumnus), M. van Riemsdijk MSc (Master specialisation Sustainable Business & Innovation alumnus)
15.30 h. – 15.45 h.	Programme management (additional meeting) Dr. J. Farla (Director of Education)
15.45 h. – 17.15 h.	Deliberations panel (closed session)
17.15 h. – 17.45 h.	Main findings presented by panel chair to Dean, programme management and others.

Annex 2: Documents reviewed

The panel studied the following documents, presented by programme management prior to the site visit

- Self-Assessment Master's Degree Programme Science and Innovation 2012 – 2015
- Organisation of the Master's Degree Programme
- Domain-specific framework of reference Innovation Sciences
- Overview intended learning outcomes in relation to the Dublin descriptors and the Domain-specific framework of reference
- Members of the Advisory Board of the Copernicus Institute of Sustainable Development
- Specialisations course catalogues 2014 – 2015, 2015 – 2016, 2016 – 2017
- Teaching and Examination Regulations
- The canon of the Sustainable Business & Innovation and Innovation Sciences specialisations
- The relation between courses and the degree qualifications
- Course evaluation grades compulsory courses 2013 – 2015
- Science and Innovation Master's thesis-based publications, conference presentations, scientific reports and awards, 2011 – 2015
- Admission criteria Science and Innovation Master's degree programme
- Tables with quantitative data on the Science and Innovation Degree Programme
- Staff allocated to the Science and Innovation Master's degree programme (December 2015)
- Rubric assessment form Master's thesis
- IS, SBI and ES Master's theses 2013 – 2014 and 2014 – 2015
- Science and Innovation alumni survey report
- Institutional quality assurance assessment report and decision
- Self-assessment numbers NVAO Master by Croho (KUO-numbers)
- Proposal to revise Science & Innovation Management. Advice to the director of education of the Department of Innovation, Environmental and Energy Sciences
- Judgement and recommendations assessment panel Bachelor and Master programmes (2012) and follow-up actions by Department of Innovation, Environmental and Energy Sciences
- Course calendars 2015 – 2016
- Course manuals
- Minutes Master Education Committee
- Research assessment final report SENSE, 2014
- Quality assurance plan Geosciences
- Test and examination policy plan
- Academic learning and planning
- Academic skills

On the day of the site visit, programme management presented the following documents

- Course material of a number of selected courses of the programme, among which Consultancy projects
- Examinations of a number of selected courses of the programme
- Specialisations course catalogues, 2016 – 2017
- Report on group work in examinations
- Annual reports Board of Examiners, 2013 – 2016
- Minutes Master Education Committee
- Learning-teaching tracks

In addition, the panel was given access to the electronic learning system of the programme.

Annex 3: Theses reviewed

The theses of the following fifteen students have been selected for review by the panel.

- 3230678
- 3477118
- 3241114
- 3287831
- 3221180
- 3922332
- 3373630
- 3379566
- 3962261
- 4054210
- 3221105
- 4186087
- 3504972
- 3275256
- 3510271

Annex 4: Assessment panel composition

The assessment panel had the following composition:

- Prof. dr. ir. P.C. de Weerd-Nederhof, Professor Organizational Studies and Innovation and chair of NIKOS, University of Twente (panel chair);
- Prof. dr. A.M. Bergek, Professor Innovation Systems and Technology Policy, Chalmers University of Technology (panel member);
- Prof. dr. M.S. van Geenhuizen, Professor of Innovation and Innovation Policy in the Urban Economy, Delft University of Technology (panel member);
- E.E.M. Leo BSc, student Master Educational Sciences, University of Amsterdam (student member).

Prof. dr. ir. P.C. de Weerd-Nederhof (panel chair)

Mrs. De Weerd is Full Professor Organizational Studies and Innovation and chair of NIKOS, the department of Entrepreneurship, Strategy, Innovation and Marketing of the Faculty Behavioural, Management and Social Sciences of University of Twente. She, also, is the programme director of the Bachelor and Master International Business Management programmes of this University. From 2009 to 2015, she was responsible for setting up the Twente Graduate School. Mrs. De Weerd is, among others, a member of the Board of the International Product Development Management Conference and was until recently a member of the board of KIVI, the Dutch association for engineers.

Prof. dr. A.M. Bergek (panel member)

Mrs. Bergek is Full Professor Innovation Systems and Technology Policy at the Department of Energy and Environment of Chalmers University of Technology in Göteborg, Sweden. Prior to this appointment, she was an assistant and associate professor at the Department of Management and Engineering of Linköping University in Sweden. She published many articles and (parts of) books in her field of expertise, and conducted numerous research projects in this area. Mrs. Bergek holds a number of advisory positions at the Swedish Energy Agency.

Prof. dr. M.S. van Geenhuizen (panel member)

Mrs. Van Geenhuizen is Full Professor of Innovation and Innovation Policy in the Urban Economy at the Faculty of Technology, Policy and Management of Delft University of Technology. She took her doctorate from Erasmus University Rotterdam. Prior to her current appointment, she was, among others, a senior researcher at the Bartlett School of Planning at University College London. Mrs. Van Geenhuizen conducted a substantial number of activities in the Netherlands and abroad with regard to innovation and entrepreneurship. Her current research is mainly on commercialisation and entrepreneurship in sustainable energy and medical/healthcare systems. She has been a lead editor of eight edited volumes on subjects, including innovation, sustainability and knowledge economy, and she has published over 90 articles in peer-reviewed journals.

E.E.M. Leo BSc (student member)

Ms. Leo is a student in the Master programme Educational Sciences of University of Amsterdam. Previously, she completed the Bachelor programme in Educational Sciences at this University. She was, among others, a member of the Educational Committee of her programme and vice-chair of the Student Council of the Faculty of Social and Behavioural Sciences of University of Amsterdam. Ms. Leo participates as a student member on a regular basis in NVAO-accreditation panels.