

Assessment report
Limited Programme Assessment

Bachelor Innovation Sciences

Eindhoven University of Technology

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1. Executive summary

In this executive summary, the panel presents the main considerations which have led to the assessment of the quality of the programme Bachelor Innovation Sciences of Eindhoven University of Technology. The programme was assessed according to the NVAO Assessment Framework.

The panel observed programme management has taken up the recommendations made in the previous assessment in 2011. Programme management, among others, managed to increase the student influx and raised the number of lecturers having obtained the University Teaching Qualification.

The panel supports the objectives of the programme to study innovation processes and innovations from a number of different angles and to take technological, socio-economic and user dimensions into account. The objectives of the majors *Psychology & Technology* and *Sustainable Innovation* are tailored to the distinct characteristics of these majors. The panel recommends programme management to pay attention to the coherence between the majors. The panel supports the programme goal to primarily prepare students for master programmes. The panel very much appreciates 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 Advisory Board is instrumental in keeping the programme aligned with trends in the professional field.

The panel observed the programme intended learning outcomes to meet the programme objectives, exhibiting, among others, knowledge and understanding of relevant disciplines, research skills and academic skills. The learning outcomes of the majors in the programme share the same structure, address the same categories of competencies and have been formulated at the same level, but differ with regard to subjects and methodologies to be studied. The panel regards the intended learning outcomes to be highly structured, to be very well-elaborated and to be very ambitious, definitely meeting and in a number of cases surpassing the bachelor level. The panel ascertained the intended learning outcomes to correspond to the domain-specific framework of reference for innovation sciences.

The panel is positive about the number of students enrolling. The panel, however, shares programme management's concern about the relatively low number of students entering the *Sustainable Innovation* major and recommends to increase this number. The panel is content with the proportion of female students in the *Psychology & Technology* major and regards the proportion of female students in the *Sustainable Innovation* major to be in line with those of technical studies in the Netherlands.

In the panel's opinion, the admission requirements and processes for the programme are adequate.

The panel feels the curriculum to be well-structured, covering all of the intended learning outcomes and addressing for this programme relevant subjects. In the panel's opinion, the level of disciplinary and interdisciplinary knowledge and understanding in the curriculum is adequate. To further improve the curriculum, the panel recommends to strengthen the application of the research methods and techniques and to implement the professional skills training more clearly and more distinctly.

The teaching concept and study methods of the programme are appropriate and promote, among others, active learning and self-reliance in the learning processes by the students. The panel approves of design-based learning as an effective study method to teach students to work on design assignments in teams.

The panel advises to smoothen the transition from group assignments to the individual *Bachelor Final Project*. The study load of the programme is satisfactory, especially since programme management balances the study load in the *Sustainable Innovation* major. The number of contact hours and the student-to-staff ratio are appropriate. The panel advises, however, to maintain a favourable student-to-staff ratio in the *Psychology & Technology* major, especially when student numbers will continue to rise. The study guidance in the programme is adequate. The panel recommends to inform students of the *Sustainable Innovation* major more clearly about their career perspectives.

The panel is positive about the lecturers' research track records and about their educational track records. The panel applauds programme management intentions to pursue a 50 % proportion of female lecturers in the set of yearly appointments of new staff. The panel advises to monitor the work load of the lecturers.

The assessment policy of the School of Innovation Sciences which applies to this programme as well, is appropriate, specifying relevant rules and regulations as well as control mechanisms for the examinations and assessments in the programme. The measures taken by programme management to foster the validity of the examinations and reliability of the assessments are satisfactory. The examinations and assessments and the processes in this respect are adequately monitored by the Board of Examiners. The panel approves of the examination methods, programme management has selected. They are in line with the course contents to be assessed. The panel feels the proportion of multiple-choice examinations to be within reasonable bounds, but recommends to keep this at the current level.

For the panel, the supervision and assessment processes for the *Bachelor Final Projects* are satisfactory. The assessment by two examiners, using forms with relevant criteria leads to reliable assessments. The panel recommends to require all assessment criteria to be satisfactory and not to allow compensation. In addition, the panel advises to introduce rubrics forms for the *Psychology & Technology* major to calibrate grades, like already has been done for the *Sustainable Innovation* major.

The examinations of the courses studied by the panel are satisfactory in breadth and depth and reflect the learning goals of the courses. The panel assesses the *Bachelor Final Projects* to be at least satisfactory. Among the projects of the *Sustainable Innovation* major, one was below satisfactory. Having reviewed the other projects, the panel regards this project to be an outlier, not representative of the general quality and level of the projects. The grades for the projects of the *Psychology & Technology* major are adequate. The comments by the examiners on the criteria of the *Sustainable Innovation* major projects met the panel's valuations, but the grades not always matched the comments and were sometimes too high. The panel, therefore, advises to improve the alignment between the grades for assessment criteria and the comments. The panel recommends to strengthen the reflection on research methodology in the projects. Programme management is advised by the panel to require the students of the *Psychology & Technology* major to add a section on the technical work, students have done. The panel observed the graduates of the programme to proceed to relevant master programmes.

The panel assesses the programme Bachelor Innovation Sciences of Eindhoven University of Technology to be satisfactory and recommends NVAO to grant re-accreditation to this programme.

Rotterdam, 20 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 Bachelor Innovation Sciences. This request was submitted by Eindhoven University of Technology.

The panel composition was as follows (for more detailed information please refer to Annex 6: 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);
- Prof. dr. C.M. Jonker, Professor Interactive Intelligence, 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 total of seventeen theses or *Bachelor Final Projects* (please refer to Annex 4: Documents studied and Annex 5: Final products reviewed). Originally, fifteen theses were selected. In order to obtain a balanced view on the theses' quality, the panel selected and reviewed two extra theses with lower grades.

Before the date of the site visit, the panel chair and the panel secretary met to discuss the assessment procedures. On 14 February 2017, the panel had a meeting to discuss the preliminary findings concerning the quality of the programme.

During the meeting on 14 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 14 February and 15 February 2017, the panel conducted the site visit at the Eindhoven University of Technology campus. The site visit was conducted in accordance with the schedule drawn up beforehand (please refer to Annex 3: 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 in CROHO: Bachelor Innovation Sciences
 Orientation, level programme: Academic Bachelor
 Grade: BSc
 Number of credits: 180 EC (three-year programme)
 Specialisations/majors: Psychology & Technology, Sustainable Innovation
 Location: Eindhoven
 Mode of study: Full-time (language of instruction is English, Dutch being phased out)
 Registration in CROHO: 56265

Administrative information about the institution:

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

Quantitative data about the programme

Cumulative proportion of students who dropped out after one, two or three years (vwo matriculation)

Cohort	2010	2011	2012	2013	2014
Drop-out rate after one year	44 %	32 %	10 %	24 %	21 %
Drop-out rate after two years	50 %	37 %	16 %	24 %	
Drop-out rate after three years	50 %	37 %	19 %		

Cumulative proportion of students who continued their studies in the second year and who completed the programme after three, four, five and six or more years (vwo matriculation)

Cohort	2010	2011	2012	2013	2014
Success rate after three years	16 %	31 %	31 %		
Success rate after four years	47 %	73 %			
Success rate after five years	74 %				
Success rate after six or more years					

Cumulative proportion of students who continued their study in the second year and who completed the programme after three, four, five and six or more years (all students)

Cohort	2010	2011	2012	2013	2014
Success rate after three years	10 %	32 %	32 %		
Success rate after four years	31 %	68 %			
Success rate after five years	48 %				
Success rate after six or more years					

Lecturers' qualifications

Qualification	MSc	PhD	BKO*
Percentage of lecturers	100 %	100 %	62 %

*BKO means having obtained Dutch University Teaching Qualification. Additionally, about 18 % of staff is in the process of acquiring the BKO-certificate.

Student-to-staff ratio

	2013	2014	2015
Psychology & Technology major	22.4	28.8	30.7
Sustainable Innovation major	12.0	16.1	19.7

Number of contact hours per week for each of the years of the programme

Year of the programme	Year 1	Year 2	Year 3
Psychology & Technology major	16.2	16.8	13.5
Sustainable Innovation major	15.8	14.7	13.7

3.2 Main facts about the institution

The Bachelor programme Innovation Sciences is a programme of the School of Innovation Sciences of the Department of Industrial Engineering & Innovation Sciences of Eindhoven University of Technology.

According to their website, the mission statement of Eindhoven University of Technology is to be a leading, international, in engineering science and technology specialised research University. The University wants to offer excellent teaching and research and thereby contribute to the advancement of technical sciences and research in the Eindhoven region and in the world as a whole. The education, research and knowledge valorisation activities of the University are meant to contribute to the solution of major societal issues in the areas of energy, health and smart mobility, to foster the development of technological innovation in cooperation with industry and to strengthen the progress in engineering sciences through excellence in key research areas and through innovation in education.

More than 10,000 students study at Eindhoven University of Technology, nearly 6,000 of them being bachelor students and over 4,000 of them being master students. There are more than 1,000 PhD-students.

Eindhoven University of Technology comprises nine departments, being the Departments of Biomedical Engineering, Built Environment, Electrical Engineering, Industrial Design, Industrial Engineering & Innovation Sciences, Chemical Engineering & Chemistry, Applied Physics, Mechanical Engineering and Mathematics and Computer Science. These departments offer 11 bachelor programmes and 22 master programmes.

4. Overview of assessments

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

5. Findings, considerations and assessments programme

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 objectives of the programme are to educate students to understand the complex relations between technology and innovations and to be able to influence these relations. In the programme, students are taught to study and to analyse innovations and innovation processes from technological, socio-economic and user perspectives, to advise on the innovations and innovation processes by combining or integrating technological and social sciences analyses and to reflect on the proposed improvements. In addition, students are trained in research skills and academic skills.

As has been indicated, the programme is offered by the School of Innovation Sciences of the Department of Industrial Engineering & Innovation Sciences. Two rather distinct majors are offered within the programme, these being the major *Psychology & Technology* and the major *Sustainable Innovation*. The major *Psychology & Technology* is meant to study, understand and improve innovations and the related processes at the interface of humans and technology, which may be said to involve the product-level of innovations. The goal of the major *Sustainable Innovation* is to study, analyse, manage and improve innovations and innovation processes at the level of socio-technical systems, addressing innovations from technological, economic and transitional perspectives. In the programme, innovations and innovation processes at the firm-level are not explicitly part of the objectives. Firm-level innovations and innovation processes are covered in the Master Innovation Management of the School of Industrial Engineering within the Department.

As is customary in the Netherlands, students are primarily trained to continue their studies at master level and not so much to enter the labour market. Students may, however, proceed in the latter sense. Depending on the major and the electives they have chosen, graduates of this programme have, among others, access to the Masters Innovation Sciences or Human-Technology Interaction as well as to the Master Innovation Management of this Department. In addition, graduates may enrol in engineering master programmes of Eindhoven University of Technology or other universities.

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 Utrecht University. 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 the intended learning outcomes of the programme. These learning outcomes (please refer to Annex 1 for an overview) are very elaborate and address, among others, knowledge and understanding of the disciplines related to the field, scientific thinking, research skills, design skills, academic skills and societal awareness. The intended learning outcomes have been differentiated to some extent to account for each of the majors of the programme.

Programme management demonstrated the correspondence between the intended learning outcomes of the programme and the Criteria for Academic Bachelor and Master Curricula (the so-called Meijers-criteria) of the Universities of Technology in the Netherlands. Therefore, it may be deduced that the intended learning outcomes match the Meijers-criteria for the bachelor level. In addition, programme management showed the learning outcomes to be within the boundaries set by the domain-specific framework of reference and, therefore, to be part of the innovation sciences domain.

The Advisory Board of the Department of Industrial Engineering & Innovation Sciences, the members of which are representatives of the professional field, gives advice to programme management on a regular basis on the intended learning outcomes and the curriculum of the programme. They do so from the perspective of the professional practice.

Considerations

The panel supports the objectives of the programme to study innovation processes and innovations from a number of different angles and to take technological, socio-economic and user dimensions of innovations and innovation processes into account. The panel observed the programme to be interdisciplinary in addressing various disciplines and in integrating these. The objectives of the majors *Psychology & Technology* and *Sustainable Innovation* are tailored to the distinct characteristics of these majors. The panel recommends programme management to pay attention to the coherence between the majors.

The panel observed the programme being primarily geared towards preparing students for master programmes. The panel is positive about the choice of master programmes which are available to the graduates, including engineering master programmes of, among others, Eindhoven University of Technology.

The panel very much appreciates 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 panel studied the intended learning outcomes of the programme and observed these to meet the programme objectives, exhibiting, among others, knowledge and understanding of relevant disciplines, research skills and academic skills. The learning outcomes of the majors in the programme share the same structure, address the same categories of competencies and have been formulated at the same level, but differ with regard to subjects and methodologies to be studied.

The panel ascertained the intended learning outcomes to meet the Meijers-criteria for the bachelor level and to correspond to the domain-specific framework of reference for innovation sciences. The panel regards the intended learning outcomes to be highly structured and to be very well-elaborated. In addition, they are very ambitious, definitely meeting and in a number of cases surpassing the bachelor level.

In the panel's view, the Advisory Board of the Department of Industrial Engineering & Innovation Sciences is instrumental in keeping the programme aligned with 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 School of Innovation Sciences of the Department of Industrial Engineering & Innovation Sciences. The Department Board is chaired by the dean and is responsible for the policy and quality of all research and educational activities in the Department. The director of education has the day-to-day responsibility for all of the educational programmes of the School of Innovation Sciences, these being the Bachelor Innovation Sciences, the Masters Innovation Sciences and Human-Technology Interaction and the PhD programme Innovation Sciences, and advises the Department Board on these programmes. The director of education, the vice director of education and the programme chairs of the Bachelor Innovation Sciences, major Psychology & Technology and the Master Human-Technology Interaction on the one hand and of the Bachelor Innovation Sciences, major Sustainable Innovation and the Master Innovation Sciences on the other hand, together form the Educational Board. The Educational Institute of the School comprises a number of supporting departments, such as Student Counselling, Quality Assurance and International Office. The Educational Board is advised on the quality of the programmes mentioned by one Programme Committee, being composed of both students and lecturers of the programmes. The Advisory Board advises the Department Board on the alignment of the Departmental activities with the professional field requirements, including the educational programmes. The Board of Examiners of the School has the responsibility to monitor the quality of the examinations and assessments of the programmes.

The number of students enrolling in the programme grew substantially over the past six years. The influx of students in the year 2010 was 57 students, while the influx was 128 students in 2015. The number of incoming students in the *Psychology & Technology* major rose from 25 students in 2012 to 92 students in 2015. The influx in the *Sustainable Innovation* major remained more or less stable at about 30 students. Programme management informed the panel the relatively low influx in the latter major is a concern to them. The vast majority of the students have as their previous education the Dutch *vwo-diploma*. A limited number of students have the polytechnic propaedeutic diploma (in Dutch: *hbo*) or come from abroad. The proportion of female students entering the programme was on average 22 % in the years from 2012 to 2014 for the *Sustainable Innovation* major. This proportion was on average 44 % in these years for the *Psychology & Technology* major.

The entry requirements for applicants are the Dutch *vwo-diploma*, with the required level of mathematics (in the Dutch system: *Mathematics B*). Programme management intends to attract students who have a fair chance of completing the programme. To that end, programme management publishes brochures and organises presentations, information days and walk-along-days for prospective students. On these walk-along days, applicants spend one day of classes at the side of first-year students.

Programme management presented tables in which the relations between the intended learning outcomes and the courses have been specified. From these tables, it may be deduced that all of the intended learning outcomes are addressed in one or more courses.

The curriculum spans three years and is organised in line with the Bachelor College structure of Eindhoven University of Technology. This curriculum, therefore, consists of the major courses (90 EC), the basis courses (30 EC), the User Society Enterprise (USE) courses package (15 EC) and elective courses (45 EC). Students of the *Psychology & Technology* major may specialise in their major courses in *Information and Communication Technology*, *Living* or *Robotics*. The major addresses the core subjects of this field, including the specialisations courses (20 EC). Students taking the *Sustainable Innovation* major, may specialise in *Sustainable Energy* or *Sustainability for the Built Environment*. The structure of the majors is similar, the subjects and methodologies taught being, of course, different. In both major curricula, research methods courses are scheduled. The basis courses and USE courses are the same for both majors. The basis courses offer fundamental knowledge and include, among others, *Calculus*, *Applied Physical Sciences*, *Engineering Design* and *Professional Skills*. The professional skills are taught as part of the courses. The USE courses introduce students to the business and social context of technology. A variety of USE packages is offered. Packages are identical in set-up, but address specific themes. Students are to select one of these packages. Students are allowed 45 EC elective space. At least three elective courses (15 EC) have to be engineering courses. Students complete the programme with their *Bachelor Final Project* (10 EC). In addition to the regular curricula, talented students may enrol in the university-wide Bachelor Honours Academy, which implies 30 EC extra courses on scientific and societal subjects. Given the schedule of this Bachelor College curriculum, there are only limited possibilities to spend part of the studies abroad.

The teaching concept of the programme is directed towards enabling students to acquire knowledge, understanding and skills at the bachelor academic level, towards promoting an attitude of active learning and towards fostering students' self-reliance in the learning processes. Study methods adopted in the curriculum are lectures, tutorials, feedback meetings, assignments, projects, design-based learning and self-study. To promote students' active attitudes, interim examinations and quizzes are scheduled in the courses. Design-based learning is a study method adopted in a number of courses in the curriculum. The method implies students working in teams on design assignments or cases. In this bachelor programme, this takes the form of drafting the requirements of products or systems.

The number of contact hours in the programme is about 16 hours per week in the first two years and about 13.5 hours per week in the third year. The student-to-staff ratio figures are 20 to 1 for the *Sustainable Innovation* major and 30 to 1 for the *Psychology & Technology* major. The binding study advice requires students to report at least 45 EC in the first year. Students are to draft their study plan for the second and third year, which is to be approved by the Board of Examiners. The Board also checks the coherence of the study plans.

Results from the latest survey showed students spending on average about 30 to 35 hours on their studies. Programme management considers to raise the study load in the *Sustainable Innovation* major.

As to the study guidance, study advisors assist students in case of study problems or study delay. They also monitor the study progress and issue the pre-binding study advice after the first semester. Students are guided in the first year by their student mentor, being a senior student. Mentor groups are comprised of five to ten students. The mentors especially advise students on the study plan for the second and third year. In addition, students are assigned their study coach, being a staff member. Study coaches meet with students every year, in the first year several times and mostly in small groups. Students of the *Sustainable Innovation* major with whom the panel met, expressed lacking a clear view on their career perspectives.

About 20 % of the students drop out in the first year and few students leave the programme in the years thereafter. The proportion of drop-outs has improved significantly in the last few years. The students success rates for the most recent cohorts are on average 25 % after three years and on average 50 % after four years. The student success rates are improving over the years.

About 48 lecturers are involved in the programme. These lecturers are all active researchers in their fields of expertise, being employed by the School of Innovation Sciences and being a member of either the research group *Human-Technology Interaction*, the research group *Philosophy & Ethics* or the research group *Technology, Innovation & Society* within the School. All lecturers in the programme hold a PhD. About 62 % of them is in possession of the BKO-certificate, whereas another 18 % of the lecturers is in the process of acquiring this certificate. These figures all testify to the lecturers' capabilities in education. From the figures for the years 2014 and 2015 it may be derived, that about 29 % of the lecturing staff are female lecturers. This figure is exemplary compared to the average percentages of female staff at universities of technology in the Netherlands, being more in line with the average proportion of general universities. Programme management informed the panel to pursue a 50 % proportion of female lecturers in the set of yearly appointments of new staff. The lecturers with whom the panel met, especially those participating in the *Psychology & Technology* major, expressed experiencing challenging work loads.

Considerations

The panel is positive about the number of students enrolling in the programme. The panel, however, shares programme management's concern about the relatively low number of students entering the *Sustainable Innovation* major and recommends to increase this number. The panel is content with the proportion of female students in the *Psychology & Technology* major and regards the proportion of female students in the *Sustainable Innovation* major to be in line with those of technical studies in the Netherlands.

In the panel's view, the admission requirements and the admission processes are appropriate. The panel approves of the presentations, information days and walk-along-days, as these enable to attract the most talented students for this programme.

The panel feels the curriculum to be well-structured, covering all of the intended learning outcomes and addressing for this programme relevant subjects. In the panel's opinion, the level of disciplinary and interdisciplinary knowledge and understanding in the curriculum is adequate. Programme management informed the panel having sufficient latitude within the Bachelor College structure to tailor the curriculum to the programme requirements. Although research methods and techniques are taught satisfactorily, the panel advises to strengthen the application of these research methodology. The panel also recommends to implement the professional skills training more clearly and more distinctly in the curriculum.

The teaching concept and the study methods of the programme are appropriate. In the panels' view, these promote, among others, active learning and self-reliance in the learning processes on the part of the students. The panel is positive about the study method of design-based learning to teach students to work on design assignments, working in teams. The panel recommends, however, to smoothen the transition from these group assignments to the individual *Bachelor Final Project*.

The panel regards the study load of the programme to be satisfactory, having observed programme management is working on balancing the study load in the *Sustainable Innovation* major. The number of contact hours and the student-to-staff ratio are appropriate, but not very favourable for the *Psychology & Technology* major. The panel recommends to maintain a favourable student-to-staff ratio in this major, especially when student numbers will continue to rise.

The study guidance in the programme is adequate. The panel advises programme management, however, to inform students of the *Sustainable Innovation* major more clearly about their career perspectives.

The panel is positive about the lecturers' research track records and about their educational track records. All of the lecturers have a PhD and are active researchers in their field. The proportion of 62 % of the lecturers having obtained their University Teaching Qualification and another 18 % of the lecturers being in the process of acquiring this certificate is quite satisfactory. The panel applauds the programme management intentions to pursue a 50 % proportion of female lecturers in the set of yearly appointments of new staff. The panel advises to monitor the work load of the lecturers.

Assessment of this standard

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

5.3 Standard 3: Assessment

The programme has an adequate assessment system in place.

Findings

The examination policy of the School of Innovation Sciences applies to all of the programmes of the School. The examination policy has been laid out in the *Examination Policy School of Innovation Sciences* document, in which the strategy on examinations and assessments has been described and the rules, regulations and control mechanisms have been stipulated. The examination policy of the School is consistent with the *Examination Framework* of Eindhoven University of Technology.

The examination methods selected are in line with the course learning goals types. Knowledge acquisition is examined by means of written examinations. Knowledge application, for instance in the form of exercises, is examined through assignments. Professional or academic skills acquisition are examined in the form of assignments or portfolios. In all courses interim examinations are scheduled, these being part of the grading of the courses. Also in all 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 promote the examinations' validity, these are prepared by one of the lecturers and presented to another lecturer for review. In addition, lecturers submit test matrices, relating the examination items to the course learning goals. To foster the reliability of the assessments, answer models are used for the assessments of examinations.

At the end of the programme, students are to complete the *Bachelor Final Project*. For this 10 EC project, a manual has been drafted. Students are to do their project strictly individual, although some interaction with fellow students in a group is allowed. In this group, students may discuss specific aspects of their projects. Students are entitled to guidance on an individual basis by their supervisor. Students are to write an interim report, stating, among others, their research question and their research design. At the end of the process, students have to submit their final report. A presentation is part of the project. The projects are graded, taking the interim report (20 % of the grade) and the final report (80 %) into account. The project is assessed by the supervisor and the second, independent assessor. If a third party has been involved in the thesis process, the examiners may be advised by an external supervisor. This is not frequently the case. For their assessments, they use a scoring model with a set of assessment criteria, derived from the Meijers-criteria.

As has been explained in the discussion of standard 2, the School-wide Board of Examiners monitors the examinations and assessments of this and other School of Innovation programmes. The responsibilities of the Board include appointing examiners and monitoring their performance, inspecting the course examinations quality, when courses are in the initial phase, analysing grade distribution outcomes of examinations, when they deviate significantly from the normal distribution and checking the quality in samples of *Bachelor Final Projects*. The Board is very strict on cases of fraud.

Considerations

The assessment policy of the School of Innovation Sciences which applies to this programme as well, is appropriate. The panel is of the opinion this policy specifies relevant rules and regulations as well as control mechanisms for the examinations and assessments in the programme.

The panel approves of the examination methods, programme management has selected. They are in line with the course contents to be assessed. The panel feels the proportion of multiple-choice examinations to be within reasonable bounds, but recommends not to raise this proportion above the current level. Having the courses assessed by multiple methods of examination allows to assess students' performances on different dimensions, relevant for the courses.

Programme management has taken a number of measures to foster the validity of the examinations and reliability of the assessments. The panel regards these measures to be satisfactory.

The panel regards the processes of supervision and assessment for the *Bachelor Final Projects* to be satisfactory. The assessment by two examiners, using forms with relevant assessment criteria leads to reliable assessments. The panel recommends to require all of the assessment criteria to be satisfactory and not to allow compensation. In addition, the panel advises to introduce rubrics forms to calibrate grades in the *Psychology & Technology* major, like already has been done for the *Sustainable Innovation* major.

The panel approves of the position and activities of the Board of Examiners to ensure the quality and level of the examinations and assessments. The Board has the responsibilities and works according to the rules, as intended by Dutch applicable law. The examinations and assessments and the processes in this respect are adequately monitored.

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

The panel studied the examinations of a number of courses in the programme.

In the *Bachelor Final Projects* with a 10 EC study load, all of the intended learning outcomes of the programme are addressed and the students are to demonstrate in these projects to master these learning outcomes. The panel studied a total of seventeen *Bachelor Final Projects*.

As has been indicated, the primary objective of the programme is to prepare students to proceed with their studies at master level, and not so much for them to enter the labour market. Students continue their studies in innovation sciences or industrial engineering master programmes, but also in engineering master programmes at Eindhoven University of Technology or other universities in the Netherlands.

Considerations

Having studied the examinations of a number of courses, which programme management presented, the panel concludes these examinations to be satisfactory in breadth and depth and to reflect the learning goals of the courses.

The panel assesses the *Bachelor Final Projects* the panel reviewed to be at least satisfactory. Among the projects of the *Sustainable Innovation* major, one project was in the panel's view below satisfactory. Having reviewed the other projects, the panel regards this project to be an outlier, not representative of the general quality and level of the projects. For the projects of the *Sustainable Innovation* major, the panel considers the grades given in a number of cases to be somewhat too high. The grades given for the projects of the *Psychology & Technology* major are appropriate. The comments by the examiners on the criteria of the *Sustainable Innovation* major projects met the panel's valuations, but the grades not always matched the comments and were in some cases too high. The panel, therefore, advises to improve the alignment between the grades for assessment criteria and the comments. In addition, the panel recommends to strengthen the reflection on research methodology in the projects. Programme management is advised by the panel to require the students of the *Psychology & Technology* major to add a section on the technical work, students have done.

The majority of the students continue their studies at master level, as is common in the Netherlands. The panel observed the graduates of the programme to proceed to relevant master programmes.

Assessment of this standard

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

6. Recommendations

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

- To pay attention to the coherence between the majors.
- To take measures to try and increase the influx of students in the *Sustainable Innovation* major, as this number is remaining relatively low.
- To implement the professional skills training more clearly and more distinctly in the curriculum.
- To strengthen the application of research methods and techniques in the curriculum.
- To smoothen the transition from group projects in the courses to the individual work in the *Bachelor Final Project*.
- To maintain a favourable student-to-staff ratio, especially in the *Psychology & Technology* major when student numbers will continue to rise.
- To inform students of the *Sustainable Innovation* major more clearly about their career perspectives.
- To monitor the lecturers' work load, especially in the *Psychology & Technology* major when student numbers will continue to rise.
- Not to raise the proportion of multiple-choice examinations above the current level.
- To require all of the assessment criteria in the *Bachelor Final Project* to be satisfactory and not to allow compensation.
- To introduce rubrics forms for the assessment of the *Bachelor Final Project* in the *Psychology & Technology* major to calibrate grades, like already has been done for the *Sustainable Innovation* major.
- To improve the alignment between the grades given for assessment criteria of the *Bachelor Final Projects* and the written comments regarding the criteria.
- To strengthen the reflection on research methodology by students in the *Bachelor Final Projects*.
- To require students in the *Psychology & Technology* major to include in their *Bachelor Final Projects* a section on the technical work, which they have done.

Annex 1: Intended learning outcomes

Intended learning outcomes Bachelor Innovation Sciences, major Psychology & Technology.

Competent in scientific disciplines

- Knowledge of and insight into specific technological systems and their components in one of the following technology domains: Information and Communication Technologies, Robotics, and Built Environment.
- Knowledge of and insight into the core concepts, theoretical frameworks, and methodologies of psychology and insights into their application to understand the relationships between technology and users.
- Knowledge of and basic skill in the relevant techniques of observation, data collection and analysis techniques, and an awareness of the scope and limitations of these methods.
- Knowledge of and skills in the basics of the engineering profession such as mathematics, statistics, and programming.

Competent in doing research

- Ability to (re) formulate a research problem in terms of the core concepts and theories of psychology; in particular those pertaining to human-technology interactions.
- Ability to develop and execute a research plan (with supervision).
- Ability (with supervision) to contribute to the development of scientific knowledge in the area of the psychology of human-technology interactions.
- Ability (with supervision) to identify and analyse problems typical for human-technology interaction from a technological and psychological perspective.
- Ability to appraise (under supervision) relevant scientific evidence on its usefulness in addressing a given research problem.
- Understanding of the ethics of psychological/user research, and has both the ability and attitude to adhere to these rules.

Competent in designing

- Ability to reformulate an ill-structured design problem in terms of the core concepts and theories of psychology; in particular those pertaining to human-technology interactions.
- Ability to develop and execute (under supervision) a sound plan for formulating design requirements.
- Ability to integrate existing knowledge on technological requirements for human-technology interactions in the (re-)design of (requirements for) products or systems.
- Ability (with supervision) to merge knowledge, method, and concepts of the technological and psychological domains.
- Ability to make decisions with respect to design requirements where they pertain to the interaction between the user and the system or product, and to provide justifications for these decisions.

A scientific approach

- Ability to document the result of psychological or user requirement research for future use within the organization.
- Ability to use a systematic approach characterized by the consistent application of existing theories, concepts, and models of psychology and technology.
- Ability to look beyond the borders of a specific discipline, to be sensitive to the relative contributions of various disciplines.
- Basic understanding of the practices and principles of science.

Basic intellectual skills.

- A reflective attitude, with an ability to critically reflect (with supervision) on own thinking, decision making, and professional behaviour.
- A critical mindset and the ability to ask constructive questions regarding the basic problems in the field.
- Ability to read and write scientific texts and evaluate argumentations.
- Ability to think in abstract terms, including the ability to use and modify formal models of basic phenomena and processes in the domain.

Competent in co-operating and communicating

- Capability of reporting and communicating the results of one's learning and decision making – including one's research outcomes – both verbally and in writing, with academic peers, engineers in one's domain, and users.
- Awareness of differences in work practices between scientific disciplines.
- Ability to work in (multidisciplinary) teams of engineers and academic peers.
- Ability to listen, read, talk, and write in English.

Takes account of the temporal, technological and social context

- Ability to reflect on the relation between the use of scientific knowledge and technology, the implicated social, normative, and ethical issues, and the way in which knowledge and technology development is influenced by its social and historical context.
- Understanding of the different roles of engineers and related professionals in society.

Intended learning outcomes Bachelor Innovation Sciences, major Sustainable Innovation

Competent in scientific disciplines

- Knowledge of and insight into specific technological systems and their components in one of the following technology domains: Sustainable Energy and Sustainability for the built environment.
- Knowledge of and insight into the core concepts, theoretical frameworks, and methodologies of innovation science for sustainability, thereby building upon disciplines such as economics and sociology.
- Multidisciplinary knowledge integrating innovation sciences knowledge with technological knowledge to address sustainability challenges.
- Knowledge of and basic skills in the relevant techniques of observation, data collection and analysis for sustainable innovation, and an awareness of the scope and limitations of these methods.
- Knowledge of and skills in the basics of the engineering profession such as mathematics, statistics, and programming.

Competent in doing research

- Ability to (re)formulate a sustainability research problem in terms of the core concepts and theories of innovation sciences.
- Ability to develop and execute a research plan (with supervision)
- Ability (with supervision) to contribute to the development of scientific knowledge in one of the areas of the innovation science for sustainability.
- Ability (with supervision) to identify and analyse problems typical for the innovation sciences, by integrating technological and social sciences perspectives.
- Ability to appraise (under supervision) relevant scientific evidence on its usefulness in addressing a given research problem.

Competent in designing

- Ability to translate the outcomes of sustainable innovation research into design, policy, or strategy recommendations for innovation in existing and new socio-technical systems (under supervision).
- Ability to identify both the social and the technical implications of innovation sciences in the design recommendations for sustainability problems.

A scientific approach

- Ability to use a systematic approach characterized by the consistent application of existing theories, concepts, and models in innovation sciences.
- Ability to look beyond the borders of a specific discipline, to be sensitive to the relative contributions of various disciplines.
- Basic understanding of the practices and principles of science.

Basic intellectual skills

- A reflective attitude, with an ability to critically reflect (with supervision) on own thinking, decision making, and professional behaviour.
- A critical mindset and the ability to ask constructive questions regarding the basic problems in the field.
- Ability to read and write scientific texts and evaluate argumentations.
- Ability to think in abstract terms, including the ability to use and modify (formal) models of basic phenomena and processes in the domain.

Competent in co-operating and communicating

- Capability of reporting and communicating the results of one's learning and decision making – including one's research outcomes – both verbally and in writing, with academic peers and engineers in one's domain.
- Ability to work in (multidisciplinary) teams of engineers and academic peers.
- Ability to listen, read, talk, and write in English.

Takes account of the temporal, technological and social context.

- Ability to reflect on the relation between the use of scientific knowledge and technology, the implicated social, normative, and ethical issues, and the way in which knowledge and technology development is influenced by its social and historical context.
- Understanding of the different roles of engineers and related professionals in society, in particular in relation to sustainability challenges.

Annex 2: Curriculum

In the table, the curriculum for the Bachelor Innovation Sciences, major *Psychology & Technology* is presented.

Courses	Credits
Calculus	5 EC
Introduction Psychology & Technology	5 EC
Programming for Psychology and Technology	5 EC
Physics for Technology	5 EC
Social Psychology & Consumer Behaviour	5 EC
Introduction to Modelling	5 EC
Hypermedia <i>or</i> Designing based on Building Physics and Materials <i>or</i> Signals and Mathematics*	5 EC
Research Methods I	5 EC
Humanities & Social Sciences (USE)	5 EC
Brain, Body, Behaviour	5 EC
Electives (two courses of 5 EC)	10 EC
First year	60 EC
Engineering Design	5 EC
Programming <i>or</i> Building Physics and Building Services Engineering <i>or</i> Computation*	5 EC
Research Methods II	5 EC
Logic and Set Theory <i>or</i> Integration of Human, Building and Environment <i>or</i> Fundamentals of Electronics*	5 EC
Perception & Motor Control	5 EC
Qualitative Research (Design Based Learning)	5 EC
Thinking and Deciding	5 EC
Computer Networks and Security <i>or</i> Built Environment Project for PT and SI <i>or</i> Sensing, Computing and Actuation*	5 EC
Electives <i>or</i> User Society Enterprise courses (four courses of 5 EC)	20 EC
Second year	60 EC
HTI in Social Context	5 EC
Advanced Research Methods & Research Ethics	5 EC
Human Factors	5 EC
Quantitative Research (Design Based Learning)	5 EC
Electives <i>or</i> User Society Enterprise courses (two courses of 5 EC)	10 EC
Final Project	10 EC
Electives (four courses of 5 EC)	20 EC
Third year	60 EC
Total credits of programme	180 EC

*One of these courses has to be selected by students. Their choice is determined by the specialisation they have chosen. Specialisations are ICT, Living or Robotics.

In the table, the curriculum for the Bachelor Innovation Sciences, major *Sustainable Innovation* is presented.

Courses	Credits
Calculus	5 EC
Sustainable Development in Global Context	5 EC
Economics of Innovation: Introduction	5 EC
Physics for Technology	5 EC
Sustainable Technology in Society: Introduction	5 EC
Introduction to Modelling	5 EC
Propeller (Design Based Learning) <i>or</i> Designing based on Building Physics and Materials*	5 EC
Research Methods I	5 EC
Humanities & Social Sciences (USE)	5 EC
Industrial Ecology	5 EC
Electives (two courses of 5 EC)	10 EC
First year	60 EC
Engineering Design	5 EC
Thermodynamics <i>or</i> Building Physics and Building Services Engineering*	5 EC
Research Methods II	5 EC
Managing Sustainable Technology	5 EC
Verbandingsmotor (Design Based Learning) <i>or</i> Construction Analysis*	5 EC
Managing Sustainable Technology (Design Based Learning)	5 EC
Warmte en Strooming <i>or</i> Built Environment Project for PT and SI*	5 EC
Economic Policy	5 EC
Electives <i>or</i> User Society Enterprise courses (four courses of 5 EC)	20 EC
Second year	60 EC
Evaluating Economic Policy: Social Cost Benefit Analysis	5 EC
Sustainable Technology in Society: Advanced	5 EC
Innovation Sciences Integration Project	5 EC
Economics of Innovation: Advanced	5 EC
Electives <i>or</i> User Society Enterprise courses (two courses of 5 EC)	10 EC
Final Project	10 EC
Electives (four courses of 5 EC)	20 EC
Third year	60 EC
Total credits of programme	180 EC

*One of these courses has to be selected by students. Their choice is determined by the specialisation they have chosen. Specialisations are Sustainable Energy or Sustainability for the Built Environment.

Annex 3: Site visit schedule

The site visit was conducted on the Eindhoven University of Technology campus on 14 and 15 February 2017.

Site visit schedule on 14 February 2017.

- 15.00 h. – 17.30 h. Arrival panel and documents study (closed session)
- 17.30 h. – 18.15 h. Dean and programme management
Dr. G.J.T. Bombaerts (coordinator User, Society and Enterprise courses), dr. ir. E. van der Geer (director of education), prof. dr. I.E.J. Heynderickx (dean), dr. M.H. Jansen-Vullers (vice director of education), prof. dr. A.M.C. Lemmens (dean Bachelor College), prof. dr. A.W.M. Meijers (vice dean School Innovation Sciences)
- 18.15 h. – 19.15 h. Board of Examiners
Dr. A. Chockalingam (external member Board of Examiners), dr. ir. A. Haans (vice chair Board of Examiners), dr. J.I. Höffken (member Board of Examiners), prof. dr. ir. Y.A.W. de Kort (chair Board of Examiners), ir. W.L.M. Kuijpers (study advisor)

Site visit schedule on 15 February 2017.

- 08.30 h. – 09.00 h. Arrival panel and documents study (closed session)
- 09.00 h. – 10.00 h. Programme management and core lecturers Bachelor Innovation Sciences, major Psychology & Technology and Master Human-Technology Interaction
Dr. ir. E. van der Geer (director of education), dr. ir. A. Haans (coordinator Bachelor Innovations Sciences, major Psychology & Technology), dr. J.R.C. Ham (coordinator Master Human-Technology Interaction), dr. M.H. Jansen-Vullers (vice director of education), dr. ir. M.C. Willemsen (programme chair Bachelor Innovation Sciences, major Psychology & Technology and Master Human-Technology Interaction)
- 10.15 h. – 11.15 h. Lecturers and theses' examiners Bachelor Innovation Sciences, major Psychology & Technology and Master Human-Technology Interaction
Dr. ir. E.E.M. van Berkum (lecturer department Mathematics and Computer Science), dr. ir. R. H. Cuijpers (lecturer, thesis examiner), prof. dr. ir. W.A. IJsselstein (lecturer, thesis examiner), dr. G. Rooks (lecturer, thesis examiner), dr. ir. K.H.C.J. Smolders (lecturer, thesis examiner), dr. ir. M.C. Willemsen (lecturer, thesis examiner)
- 11.15 h. – 12.00 h. Students and alumni Bachelor Innovation Sciences, major Psychology & Technology and Master Human-Technology Interaction
P. Phillipens (second year student Bachelor, specialisation ICT), A. van Rietschoten (third year student Bachelor, specialisation Living), B. van der Stigchel (third year student Bachelor, specialisation Robotics), E. Corbet BSc (first year student Master), E. de Jong BSc (second year student Master), R. Conijn MSc (alumnus), M. Boerhof MSc (alumnus)
- 12.00 h. – 13.00 h. Lunch panel (closed session), consultation hour 12.00 h. – 12.30 h.

- 13.00 h. – 13.45 h. Tour around programme facilities
Ing. M.C. Boschman, prof. dr. C.C.P. Snijders, J. van Rijn (chair Intermate study association)
- 13.45 h. – 14.15 h. Programme management and core lecturers Bachelor Innovation Sciences, major Sustainable Innovation and Master Innovation Sciences
Prof. dr. F. Alkemade (programme chair Bachelor Innovation Sciences, major Sustainable Innovation and Master Innovation Sciences), dr. C. Castaldi (coordinator Bachelor Innovation Sciences, major Sustainable Innovation and Master Innovation Sciences)
- 14.15 h. – 15.00 h. Lecturers and theses' examiners Bachelor Innovation Sciences, major Sustainable Innovation and Master Innovation Sciences
Dr. C. Castaldi (lecturer, thesis examiner), dr. ir. A. Kirkels (lecturer, coordinator Bachelor thesis), dr. ir. H. Romijn (lecturer, thesis examiner), prof. dr. ir. G.P.J. Verbong (lecturer, thesis examiner), N. Verkade MSc (lecturer, thesis examiner), prof. dr. ir. E.B.A. van der Vleuten (lecturer, thesis examiner), dr. A.J. Wieczorek (lecturer, thesis examiner)
- 15.15 h. – 15.45 h. Students and alumni, including Programme Committee members, Bachelor Innovation Sciences, major Sustainable Innovation and Master Innovation Sciences
V. Mosmuller (first year student Bachelor, specialisation Energy), J. te Selle (second year student Bachelor), D. Prins (third year student Bachelor, specialisation Energy, member programme committee), P. Loonen (fourth year student Bachelor, specialisation Energy, board member Intermate study association), L. Hoefnagels BSc (first year student Master), Th. Ofman (second year student Master), L. van Son MSc (alumnus), T. Manders MSc (alumnus)
- 15.45 h. – 17.30 h. Deliberations panel (closed session)
- 17.30 h. – 17.45 h. Main findings presented by panel chair to dean, programme management and others

Annex 4: Documents studied

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

- Self-Assessment Bachelor's Programme Innovation Sciences, 2016
- Intended learning outcomes
- Domain-specific frame of reference Innovation Sciences
- Matrix intended learning outcomes versus Domain-specific frame of reference
- Curriculum overviews
- Intended learning outcomes versus courses
- List of teaching staff School Innovation Sciences

In addition, the panel was given access to extensive digital information about the programme.

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

- Recommendations assessment panel in 2011 and programme management actions taken
- Course material and literature of a number of selected courses of the programme
- Examinations of a number of selected courses of the programme
- Examination matrix (example)
- Programme Committee minutes, 2014, 2015, 2016
- Board of Examiners annual reports, 2014 – 2015, 2015 – 2016
- Bachelor theses intermediate reports

Annex 5: Final products reviewed

The theses of the following seventeen students have been selected and reviewed by the panel.

- 0663479
- 0744168
- 0810664
- 0715191
- 0767403
- 0817058
- 0791201
- 0846815
- 0842137
- 0854037
- 0806453
- 0805092
- 0815065
- 0832738
- 0819617
- 0791201
- 0771824

Annex 6: 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);
- Prof. dr. C.M. Jonker, Professor Interactive Intelligence, 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 her current appointment, she was an assistant professor and an 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.

Prof. dr. C.M. Jonker (panel member)

Mrs. Jonker is Full Professor Interactive Intelligence at the Faculty of Electrical Engineering, Mathematics and Computer Science of Delft University of Technology. She took her doctorate in Computer Science from Utrecht University. Prior to her current appointment, she was, among others, research assistant at Berne University and an assistant and associate professor at Vrije Universiteit Amsterdam and a full professor at Radboud University. Mrs. Jonker's primary research interests are the study and modelling of forms of natural intelligent reasoning and interaction.

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.