

Assessment report
Limited Framework Programme Assessment

Master Industrial Ecology

Leiden University/Delft University of Technology

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1. Executive summary

In this executive summary, the panel presents the main considerations which led to the assessment of the quality of the joint degree Master Industrial Ecology programme of Leiden University and Delft University of Technology. The programme was assessed according to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, as published on 20 December 2016 (Staatscourant nr. 69458).

The panel considers the programme profile to be distinct and valuable, as the programme specifically addresses the industrial ecology domain. The panel recommends, however, to formulate the programme profile more explicitly and to detail this profile in terms of knowledge and skills. The programme is strongly interdisciplinary, as this includes natural sciences, engineering sciences and social sciences perspectives.

The programme objectives are within the boundaries of the domain-specific reference framework for academic programmes in Environment and Sustainability Sciences, this programme having a clear, very interdisciplinary profile within this framework. The panel is very positive about the effort by the joint academic programmes in Environment and Sustainability Sciences in the Netherlands to draft this framework and regards this to be a sound and up-to-date description of this domain.

The objectives of the programme have been translated into the intended learning outcomes. Being well articulated, these reflect knowledge and understanding of the industrial ecology domain, research skills and academic skills. The intended learning outcomes conform to the master level.

The panel appreciates the programme goals to educate students for appropriate positions not only in research, but also for positions in the professional field.

The panel considers the cooperation for this joint degree programme between the Faculties of the two Universities on the Faculty Board level, on the programme management level and on the level of the lecturers to be well organised and to be effective.

The curriculum corresponds to the intended learning outcomes of the programme. The panel regards the contents and the structure of the curriculum to be up to standard. The panel recommends, however, to address the academic and professional skills in the curriculum more clearly and to monitor the skills development of students more comprehensively. In addition, the panel advises to introduce business cases and cost-benefit analyses. The panel is positive about the Interdisciplinary Project Group and recommends to place this project (partly) in first year to introduce students to transdisciplinary and participatory aspects. The specialisation modules are welcomed by the panel, as they offer a degree of choice to students. The panel appreciates the Curriculum Renewal Committee adjusting the programme to new concepts and developments in the programme domain.

The panel regards the lecturers to be qualified, they being experienced researchers in this domain, having obtained PhDs and the majority of them being or becoming BKO-certified. The lecturers are easily approachable for the students. The panel advises programme management to discuss with Leiden University opportunities for lecturers to achieve SKO-certification. The panel suggests to limit the number of guest lecturers in some courses or introduce cases in these courses.

The panel considers the admission prerequisites and procedures to be up to standard, appreciating the online preparatory courses. The panel advises to better tailor the curriculum to the February-intake, as courses may not always be in logical order. The panel feels the programme attracts motivated and talented students.

The panel appreciates the educational infrastructure, but advises to state the educational concept for the programme more explicitly. The study methods are appropriate and the programme is experimenting with new study methods, such as MOOCs. The panel regards the student success rates to be rather unfavourable and proposes to take measures to improve these. The panel advises to intensify the study guidance for students to outline their preferred study paths. The bilocation of the programme is handled appropriately. The panel recommends to accommodate foreign students regarding their travel expenses.

The panel considers the examinations and assessments policies of the programme to be adequate. The role and the responsibilities of the Board of Examiners are up to standard as well.

The panel appreciates the variety of examination methods, matching the course contents. In addition, the panel is of the opinion programme management has taken appropriate measures to counter free-riding in group assignments.

The strict organisation and the reliable assessment of the Thesis Preparation Module and the Thesis Research Project are welcomed by the panel. In addition, the panel appreciates both examiners coming from different research groups and the Board of Examiners reviewing theses. The panel advises, however, to have examiners fill out the thesis scoring forms and add comments more comprehensively.

The panel appreciates two examiners preparing the examinations and answering models but proposes to make test matrices an obligatory part of course examinations. The panel advises to schedule calibrating sessions to synchronise assessments and grades among examiners.

The panel regards the course examinations, which were reviewed, to be up to standard.

The Thesis Research Projects the panel studied, were in general well-written and well-structured. The panel especially appreciates the theoretical and the methodological thoroughness of these projects. In some instances, the reports could have been less lengthy. The contents of the projects are appropriate, but they could be oriented more towards the breadth of the industrial ecology domain and include, among others, transdisciplinary dimensions. The panel agrees with the grades, given by the thesis projects examiners of the programme. The level of the theses convincingly shows the graduates having more than reached the intended learning outcomes.

The panel found the graduates of the programme to be welcomed on the labour market and to obtain suitable and interesting positions. The panel feels the students completing the programme have more than reached the intended learning outcomes and are very well equipped to investigate industrial ecology subjects and to address problems in that domain.

The panel that conducted the assessment of the joint degree Master Industrial Ecology programme of Leiden University and Delft University of Technology assesses this programme to meet the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, judging the programme to be satisfactory. Therefore, the panel recommends NVAO to accredit this programme.

Rotterdam, 2 July 2018

Prof. dr. W.A. Hafkamp
(panel chair)

drs. W. Vercouteren
(panel secretary)

2. Assessment process

The evaluation agency Certiked VBI received the request by Leiden University and Delft University of Technology to support the limited framework programme assessment process for the Master Industrial Ecology programme (joint degree) of these Universities. The objective of the programme assessment process was to assess whether the programme would conform to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, published on 20 December 2016 (Staatscourant nr. 69458).

Management of the programmes in the assessment cluster Environment and Sustainability Sciences convened to discuss the composition of the assessment panel and to draft the list of candidates.

Having conferred with management of the Master Industrial Ecology programme of Leiden University and Delft University of Technology, Certiked invited candidate panel members to sit on the assessment panel. The panel members agreed to do so. The panel composition was as follows:

- Prof. dr. W.A. Hafkamp, full professor of Environmental Sciences, Erasmus University Rotterdam (panel chair);
- Prof. dr. M.C.E. van Dam-Mieras, emeritus professor Sustainable Development and Educational Innovation, Leiden University (panel member);
- Prof. dr. L. Hordijk, emeritus professor Environmental Systems Analysis, Wageningen University (panel member);
- P. Aarts BSc, student Master Biological Sciences, University of Amsterdam (student member).

On behalf of Certiked, drs. W. Vercoouteren served as the process coordinator and secretary in the assessment process.

All panel members and the secretary confirmed in writing being impartial with regard to the programme to be assessed and observing the rules of confidentiality. Having obtained the authorisation by the Universities, Certiked requested the approval of NVAO of the proposed panel to conduct the assessment. NVAO have given their approval.

To prepare the assessment process, the process coordinator convened with management of the programme to discuss the outline of the self-assessment report, the subjects to be addressed in this report and the site visit schedule. In addition, the planning of the activities in preparation of the site visit were discussed. In the course of the process preparing for the site visit, programme management and the process coordinator regularly had contact to fine-tune the process. The activities prior to the site visit have been performed as planned. Programme management approved of the site visit schedule.

Well in advance of the site visit date, programme management sent the list of final projects of graduates of the programme of the most recent years. Acting on behalf of the assessment panel, the process coordinator selected 15 final projects. The grade distribution in the selection was ensured to conform to the grade distribution in the list, sent by programme management. No additional criteria applied.

The panel chair and the panel members were sent the self-assessment report of the programme, including appendices. In the self-assessment report, the student chapter was included. In addition, the expert panel members were forwarded a number of final projects of the programme graduates, these final projects being part of the selection made by the process coordinator.

A number of weeks before the site visit date, the assessment panel chair and the process coordinator met to discuss the self-assessment report provided by programme management, the procedures regarding the assessment process and the site visit schedule. In this meeting, the profile of panel chairs of NVAO was discussed as well. The panel chair was informed about the competencies, listed in the profile. Documents pertaining to a number of these competencies were presented to the panel chair. The meeting between the panel chair and the process coordinator served as the briefing for panel chairs, as meant in the NVAO profile of panel chairs.

Prior to the date of the site visit, all panel members sent in their preliminary findings, based on the self-assessment report and the final projects studied, and a number of questions to be put to the programme representatives on the day of the site visit. The panel secretary summarised this information, compiling a list of questions, which served as a starting point for the discussions with the programme representatives during the site visit.

Shortly before the site visit date, the complete panel met to go over the preliminary findings concerning the quality of the programme. During this preliminary meeting, the preliminary findings of the panel members, including those about the final projects were discussed. The procedures to be adopted during the site visit, including the questions to be put to the programme representatives on the basis of the list compiled, were discussed as well.

On 23 March 2018, the panel conducted the site visit on the Leiden University campus. The site visit schedule was in accordance with the schedule as planned. In a number of separate sessions, panel members were given the opportunity to meet with Faculty Boards representatives, programme management, Board of Examiners members, lecturers and final projects examiners, and students and alumni.

In a closed session at the end of the site visit, the panel considered every one of the findings, weighed the considerations and arrived at conclusions with regard to the quality of the programme. At the end of the site visit, the panel chair presented a broad outline of the considerations and conclusions to programme representatives.

Clearly separated from the process of the programme assessment, the assessment panel members and programme representatives met to conduct the development dialogue, with the objective to discuss future developments of the programme.

The assessment draft report was finalised by the secretary, having taken into account the findings and considerations of the panel. The draft report was sent to the panel members, who studied it and made a number of changes. Thereupon, the secretary edited the final report. This report was presented to programme management to be corrected for factual inaccuracies. Programme management were given two weeks to respond. Having been corrected for these factual inaccuracies, the Certiked bureau sent the report to the University Boards to accompany their request for re-accreditation of this programme.

3. Programme administrative information

Name programme in CROHO: M Industrial Ecology (joint degree)
Orientation, level programme: Academic Master
Grade: MSc
Number of credits: 120 EC
Specialisations: None
Location: Leiden and Delft
Mode of study: Full-time (language of instruction: English)
Registration in CROHO: 21PB-65003/21PF-65003

Name of institution: Leiden University/Delft University of Technology
Status of institution: Government-funded Universities
Institutions' quality assurance: Approved

4. Findings, considerations and assessments per standard

4.1 Standard 1: Intended learning outcomes

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

Findings

The Master Industrial Ecology programme is a two-year, research-oriented, interdisciplinary master programme.

The main objectives of this programme are to educate students in industrial ecology, which means the study of the material and energy basis of society from a socio-technical perspective in order to identify, design, implement and evaluate solutions for sustainability problems. These include problems, such as resource depletion and environmental pollution. The programme is interdisciplinary, addressing these problems from technical, environmental and social perspectives and drawing on knowledge and understanding of natural sciences, engineering sciences and social sciences. The objectives of the programme are for students to become researchers or practitioners in this field, being equipped to integrate the knowledge and understanding from these domains in order to design and implement research-based solutions for sustainability problems.

The objectives of the programme conform to the domain-specific reference framework for academic programmes in Environment and Sustainability Sciences, which has been drafted by the joint programmes in the Netherlands. In this domain-specific reference framework, reference has been made to international frameworks and benchmark statements. This programme may be regarded to be positioned at the intersection of the three *Natural Systems Emphasis*, *Sustainability Solutions Emphasis* and *Social Systems Emphasis* parts of the Environment and Sustainability Sciences domain, making this one of the most interdisciplinary programmes within the Environment and Sustainability Sciences domain in the Netherlands.

The programme objectives have been translated into intended learning outcomes. The intended learning outcomes specify students having thorough knowledge of the domain of industrial ecology, being able to conduct scientific research in this domain, being able to apply methods and techniques in this domain, being able to analyse sustainability problems and design solutions for these, and being able to contribute to the societal sustainability debate.

Programme management presented a table from which the correspondence of the intended learning outcomes to the Dublin descriptors for master programmes may be inferred.

The programme objectives specify educating students both for academic careers and careers in society as a whole.

Considerations

The panel considers the programme profile to be distinct and valuable, as the programme specifically addresses the industrial ecology domain. The panel recommends, however, to formulate the programme profile more explicitly and to detail this profile in terms of knowledge and skills. The programme is strongly interdisciplinary, including natural sciences, engineering sciences and social sciences perspectives.

The programme objectives are within the boundaries of the domain-specific reference framework for academic programmes in Environment and Sustainability Sciences, this programme having a clear, very interdisciplinary profile within this framework. The panel is very positive about the effort by the joint academic programmes in Environment and Sustainability Sciences in the Netherlands to draft this framework and regards this to be a sound and up-to-date description of this domain.

The objectives of the programme have been translated into the intended learning outcomes. Being well articulated, these reflect knowledge and understanding of the industrial ecology domain, research skills and academic skills, such as analytical and problem-solving skills.

The intended learning outcomes conform to the master level. This is exemplified by the Dublin descriptors criteria for master level programmes matching the intended learning outcomes.

The panel appreciates the programme goals to educate students for appropriate positions not only in research, but also for positions in the professional field.

Assessment of this standard

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

4.2 Standard 2: Teaching-learning environment

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

Findings

As this programme is a joint degree programme, Faculties of the collaborating Universities are involved, being the Faculty of Science of Leiden University and the Faculty of Technology, Policy and Management of Delft University of Technology. The Faculty Boards jointly take decisions on the design and delivery of the programme. The Faculty of Science of Leiden University is responsible for the coordination of the programme. The programme director in collaboration with the programme coordinator take care of the day-to-day management of the programme. The Faculty Boards jointly appoint the Board of Examiners for the programme as well as the Board of Admissions. The Board of Examiners has the authority to ensure the programme examinations and assessments quality. The Board of Admissions is responsible for students' admissions. The Education Committee for the programme, consisting of four staff members (two from Leiden and two from Delft) and four students, advises programme management on quality issues and has the right of consent on parts of the Course and Examination Regulations. In the opinion of programme management and others involved, the Universities and Faculties work together productively in managing this programme.

The influx of students remained rather stable over the last years. The student intake was about 64 students in the years 2013 to 2016. The strong interdisciplinary character of the programme is demonstrated by the diversity in student intake, about 20 % of the incoming students having natural sciences backgrounds, about 40 % of them having social sciences backgrounds and about 40 % of them having backgrounds in engineering sciences. About 40 % of the students come from abroad. Students may start in September (about 80 %) or in February (about 20 %).

Programme management presented a table to demonstrate the correspondence of the curriculum to the intended learning outcomes. The curriculum takes two years. The courses in the curriculum have been specifically designed for this programme. In the first year, ten courses of 6 EC each are offered, nine of these being compulsory core courses and one being a specialisation module of 6 EC. The first core course offers an introduction to and overview of the industrial ecology domain. The other core courses cover the analysis of sustainability problems (three courses, 18 EC), design of sustainable solutions (three courses, 18 EC) and implementation of sustainable solutions (two courses, 12 EC). Having been taught the building blocks in the first year, students are offered the integration and application of the gained knowledge and insights in the second year. The second year is composed of specialisation modules (12 EC), Interdisciplinary Project Group (12 EC), Thesis Preparation Module (6 EC) and Thesis Research Project (30 EC). The Interdisciplinary Project Group is a real-life group project (4 to 6 students), requiring students to come up with a solution for an industrial ecology problem. From February 2018 onwards, all projects should be commissioned by organisations outside of University. In this Project, students are acquainted with transdisciplinary and participatory dimensions. The Thesis Preparation Module prepares students for the Thesis Research Project. Students propose their individual study programme, which should satisfy the intended learning outcomes of the programme and is subject to approval by the Board of Examiners. Specialisation modules are used by students to deepen or to broaden their knowledge. Some overlap between core courses is criticized by students. Programme management installed the Curriculum Renewal Committee to redesign the curriculum in line with current trends in the industrial ecology domain. The new curriculum will commence in 2019.

The number of staff members lecturing in the programme are 20 lecturers. All lecturers are researchers, either at the Leiden Institute of Environmental Sciences or at the Delft Faculty of Technology, Policy and Management or, to a lesser extent, at one of the other Delft Faculties. The lecturers are equipped to address the natural sciences, engineering sciences and social sciences perspectives in the programme. About 90 % of the lecturers have PhDs and about 65 % are BKO-certified, testifying to their educational capabilities. Another 30 % of the lecturers are in the process of obtaining their BKO-certificate. No lecturers are currently in the process of obtaining the SKO-certificate. Staff members meet in annual meetings, as members of the Education Committee and the Board of Examiners, and as first and second examiners of Thesis Research Projects. In some of the courses, a number of external guest speakers from industry give lectures.

The admission prerequisites for the programme are bachelor degrees in either natural sciences, social sciences or engineering sciences of Dutch Universities or equivalent prior education. Applicants having a bachelor degree of Polytechnic Universities are only admitted, if they report a grade point average of at least 7.5. All prospective students are to submit their diplomas, motivation for the programme and proof of proficiency in English. Admission is at the discretion of the Board of Admissions. Students who are admitted but have some deficiencies in mathematics, physics or chemistry are strongly advised to take preparatory online courses in these disciplines, as offered by programme management. A MOOC is being developed to further prepare students who have deficiencies.

In the teaching and learning processes, close interaction between research and teaching, interdisciplinary collaboration among students and activating learning are promoted. Lecturers introduce their research in class. Students learn from their peers, coming from different natural sciences, engineering sciences or social sciences backgrounds. This leads to a strong community feeling among students, which is appreciated by them. Programme management fosters activating learning, as students have to adapt to courses in other than their own backgrounds and may choose specialisation modules and their thesis topic. The study methods adopted in the programme include lectures, working groups, tutorials, group and individual assignments, and self-study activities. For guidance, students may turn to the programme coordinator/study advisor. Students indicate not being adequately informed about the programme objectives and structure. Programme management is in the process of improving the information provision. Programme management has taken measures to improve the student success rates, the most important one being the introduction of the Thesis Preparation Module. The study advisor meets with students and makes plans to reduce the study delay.

Students take courses in one of the two cities on the same day and not in both cities on the same day. So students meet in either Delft or in Leiden. The bilocation does not hamper student community building. Travelling is, however, expensive for non-Dutch students.

Considerations

The panel considers the cooperation for this joint degree programme between the Faculties of the two Universities on the Faculty Board level, on the programme management level and on the level of the lecturers to be well organised and to be effective, the programme coordinator linking bodies within the programme.

The curriculum corresponds to the intended learning outcomes of the programme. The panel regards the contents and the structure of the curriculum to be up to standard, addressing both natural sciences, social sciences and engineering sciences. In addition, sustainability problems and solutions analysis, design and implementation are covered. The panel feels any overlap of courses not to be counter-productive. The panel recommends to address the academic and professional skills in the curriculum more clearly and to monitor the skills development of students more comprehensively. As the circular economy concept is an important part of the field of study of the programme, the panel advises to introduce business cases and cost-benefit analyses in the curriculum. The panel is positive about the Interdisciplinary Project Group and recommends to place this project (partly) in first year to introduce students to transdisciplinary and participatory aspects of the domain of the programme. The specialisation modules are welcomed by the panel, as they offer a degree of choice to students. The panel appreciates the initiative of programme management to install the Curriculum Renewal Committee to adjust the programme to new (educational) concepts and developments in the programme and the programme domain.

The panel regards the lecturers in the programme to be qualified to lecture in the programme, they being experienced researchers in this domain, having obtained PhDs and the majority of them being or becoming BKO-certified. The lecturers are easily approachable for the students. The panel advises programme management to discuss with Leiden University opportunities for lecturers to achieve SKO-certification. The panel suggests to limit the number of guest lecturers in some of the courses or introduce cases in these courses.

The panel considers the admission prerequisites and procedures to be up to standard, appreciating the online preparatory courses. The panel advises to better tailor the curriculum to the February-intake, as courses may not always be in logical order. The panel feels the programme attracts motivated and talented students.

The panel appreciates the educational infrastructure, but advises to state the educational concept for the programme more explicitly. The study methods are appropriate and the programme is experimenting with new study methods, such as MOOCs. The panel regards the student success rates to be rather unfavourable and proposes to take measures to improve these. The panel advises to intensify the study guidance for students to outline their preferred study paths. The bilocation of the programme is handled appropriately. The panel recommends to accommodate foreign students regarding their travel expenses.

Assessment of this standard

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

4.3 Standard 3: Student assessment

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

Findings

The examination policy of the programme conforms to Course and Examination Regulations and the Implementation Regulations for the programme, approved by the two Faculties of the Universities involved. For the programme, the Board of Examiners has been installed to ensure the quality of examinations and assessment processes and products in the programme. The working of the Board of Examiners is governed by the Rules and Regulations of the Board.

The examination methods of the courses include written examination, in most courses combined with individual assignments, group assignments, oral presentations or written essays. The proportion of group assignments is relatively substantial. The group assignments in the courses are always in combination with individual examinations, to prevent, among others, the effects of free-riding. In the Interdisciplinary Project Group, the group assignment is the only examination method.

The new set-up of the Thesis Preparation Module started in September 2017. Previously, the preparation for the thesis was individual. Now, it is a group process and has been transformed into a course. The Module has been reorganised to include groups of 4 to 5 students with one supervisor, meeting regularly, writing the literature review and commenting on each other's assignments. The Module includes workshops on literature reviews, conducting interviews and other steps in the process. The final product of this Module is the literature review and the research proposal for the Thesis Research Project. Students are only allowed to start the Thesis Research Project, if they have completed the Module. The Thesis Research Project is individual and consists of milestones, being the kick-off meeting in which the research proposal is graded, the mid-term meeting, in which the outline of the thesis is evaluated, the greenlight meeting, in which the draft report is considered to be at least satisfactory and the defence, in which the project, including the oral defence is assessed. The two examiners are present at all these milestone meetings. The Thesis Research Project is graded by two examiners, coming from different research groups. They make use of the grading rubric.

The Board of Examiners appoints examiners and drafts a list of them. Course examinations are prepared by two examiners, who include answering models. They do not yet always submit test matrices, showing the correspondence of the course learning goals and the examination contents. Model examinations are presented to students to inform them about the type of examination to expect. Every year, a number of the theses are selected and reviewed by the Board of Examiners. The Board of Examiners does not yet inspect examinations on a regular basis.

Plagiarism procedures are highly standardised, in the form of plagiarism checks of papers and theses and follow-up sanctions by the Board of Examiners.

Considerations

The panel considers the examinations and assessments policies of the programme to be adequate, being in line with rules and regulations approved by both Faculties. The role and the responsibilities of the Board of Examiners are up to standard.

The panel appreciates the variety of examination methods, matching the course contents. In addition, the panel is of the opinion programme management has taken appropriate measures to counter free-riding in group assignments.

The strict organisation and the reliable assessment of the Thesis Preparation Module and the Thesis Research Project are welcomed by the panel. In addition, the panel appreciates both examiners coming from different research groups and the Board of Examiners reviewing theses. The panel advises, however, to have examiners fill out the thesis scoring forms and add comments more comprehensively.

The panel appreciates two examiners preparing the examinations and answering models but proposes to make test matrices an obligatory part of course examinations. The panel advises to schedule calibrating sessions to synchronise assessments and grades among examiners.

Assessment of this standard

The considerations have led the assessment panel to assess standard 3, Student assessment, to be satisfactory

4.4 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 of the programme as well as a number of thesis research projects.

The average grade for the thesis research projects of the students, having graduated in the years 2015 to 2017, is about 7.7. The proportion of *cum laude* in this group of students is about 9 %.

Management of the joint academic programmes in Environment and Sustainability Sciences in the Netherlands very recently conducted a survey among alumni of these programmes. This survey shows graduates of academic programmes in this domain to have at present appropriate job opportunities and career prospects. The survey explains students will continue to have favourable positions on the labour market in the foreseeable future. The survey also shows academic programmes in this domain to adequately prepare students for the professional field in this domain.

The majority of the programme graduates find suitable positions rather easily. They obtain jobs with consultancy firms, in academia, in industrial organisations and in government agencies. The results of the survey conducted by programme among alumni, show about 12 % of the alumni having obtained PhD positions. Graduates of the programme tend to find employment in the areas of, among others, supply chain management, climate modelling, cleaner production, eco-design, environmental consulting and environmental and energy policy.

Considerations

The panel regards the course examinations, which were reviewed, to be up to standard.

The Thesis Research Projects the panel studied, were in general well-written and well-structured. The panel especially appreciates the theoretical and the methodological thoroughness of these projects. In some instances, the reports could have been less lengthy. The contents of the projects are appropriate, but they could be oriented more towards the breadth of the industrial ecology domain and include, among others, transdisciplinary dimensions. The panel agrees with the grades, given by the thesis projects examiners of the programme. These grades are relatively high, but are nevertheless assessed by the panel to be wholly justified. The level of the theses therefore convincingly shows the graduates having more than reached the intended learning outcomes.

The panel found the graduates of the programme to be welcomed on the labour market and to obtain suitable and interesting positions. The panel feels the students completing the programme have more than reached the intended learning outcomes and are very well equipped to investigate industrial ecology subjects and to address problems in that domain.

Assessment of this standard

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

5. Overview of assessments

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

6. Recommendations

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

- To formulate the programme profile more explicitly and to elaborate this profile in terms of knowledge and skills.
- To address the academic and professional skills in the curriculum more clearly and to monitor the skills development of students more comprehensively.
- To include knowledge about business cases and cost-benefit analyses in the curriculum, as the circular economy concept is an important part of the field of study of the programme.
- To place the Interdisciplinary Project Group (partly) in first year of the curriculum to introduce students to transdisciplinary and participatory aspects of the domain of the programme.
- To discuss with Leiden University opportunities for lecturers to achieve SKO-certification.
- To limit the number of guest lecturers in some of the courses and/or introduce cases in these courses.
- To better tailor the curriculum to the February-intake.
- To intensify the study guidance for students to outline their preferred study paths.
- To take measures to improve the student success rates.
- To accommodate foreign students regarding travel expenses for trips between Leiden and Delft.
- To make test matrices an obligatory part of course examinations.
- To schedule calibrating sessions to synchronise assessments and grades among examiners.
- To have examiners fill out the thesis scoring forms and add comments more comprehensively.
- To direct the contents of the thesis research projects more towards the breadth of the industrial ecology domain, including transdisciplinary aspects.