Maastricht University

Academic Bachelor in Circular Engineering

Assessment NVAO condition

October 2022

Introduction

In October 2020, an NVAO panel assessed the new academic bachelor's programme in Circular Engineering of Maastricht University. The advice on the programme was conditionally positive. The panel was positive about the programme's intended learning outcomes and the system of student assessment, but had some reservations about the teaching-learning environment. In the second year, students select courses from a wide range of electives, guided by an academic advisor. The panel wished more assurances that all these courses contribute to the programme's learning objectives. The panel expected that, if the role of the electives in year 2 is clarified and guaranteed, the BSc Circular Engineering would be an innovative and attractive programme.

The NVAO followed the panel's advice and, in December 2020, granted Maastricht University conditional accreditation of its new academic bachelor in Circular Engineering. The condition to be met within a period of two years was the following:

> Ensure the relevance of students' study paths in year 2 by making an explicit link between each elective course, circular engineering and the programme's intended learning outcomes, evidenced in the course descriptions, their learning goals and assessment.

In September 2022, Maastricht University described in a document (Information file for the evaluation of year 2 of the BSc Circular Engineering) how it addressed the panel's condition. The university invited the 2020 NVAO panel to assess whether the programme now meets the criteria for an unconditional accreditation.

All panel members accepted the invitation:

- Em. Prof. dr. ir. J.C. (Han) Brezet (chair), professor of Sustainable Product Innovation, University of Aalborg, Denmark; emeritus professor Design for Sustainability, Delft University of Technology, the Netherlands;
- Prof. dr. J. (Jarka) Glassey, professor of Chemical Engineering Education, School of Engineering, Newcastle University, United Kingdom;
- Prof. Dr.-Ing. Th. (Theodor) Doll, professor of Biomaterial Engineering, Hannover Medical School, Germany;
- Ir. W.H.J. (Willem) Gommans (student-member), graduate Construction Management and Engineering, Eindhoven University of Technology, the Netherlands.

The panel was supported by Dr. Marianne van der Weiden, independent secretary.

On 27 September 2022, the panel had an online meeting to assess whether the programme now meets the condition.

Assessment

In the information file, the programme gives an update on the bachelor's programme Circular Engineering since the start in September 2021, its design and the considerations while developing the second-year curriculum.

The first year provides students with an engineering foundation with courses in mathematics, physics, chemical engineering and biotechnology, skills training and two engineering projects at the end of each semester. The second year consists almost entirely of electives, which enables the formation of a unique academic profile per student. They select two courses and one skills course per course period (two course periods per semester), aided by an academic advisor. Each semester ends with a design project. In the third year, students select a set of courses in one of three concentrations (Circular Chemical Engineering, Sustainable Biotechnology, Engineering Physics for Sustainable Manufacturing) as a specialisation and finish their bachelor with a thesis within the concentration of their choice.

In October 2020, it was not sufficiently clear to the panel how the programme could guarantee that, given the wide range of electives in year 2, each student's elective course portfolio would contribute sufficiently to the programme's intended learning outcomes. In the 2022 information file, the programme describes that students in their choice of electives are encouraged to play to their strengths, interests and future ambitions, and apply their unique set of knowledge and skills in the engineering project at the end of each semester. Students will gradually diverge slightly in skillset owing to their varied elective choices during this second year. This results in project teams where students can contribute individually to problem solving and design tasks in varied ways. This introduces a degree of interdisciplinarity within the programme and allows students to play individual roles within project teams and take ownership of skill specific tasks.

The panel appreciates the role of the academic advisor: students are guided in their choice of electives to ensure that their final portfolio of courses includes a balance of systems level courses linked to issues of circularity and sustainability in engineering and courses with specialist technical content. In this manner, students follow effective individualised pathways through the programme which meet the programme level intended learning outcomes.

The programme started in autumn 2021 with 22 first-year students, 17 of whom continued into the second year in September 2022. The information files describes that the programme team consulted the teaching teams and the student cohort to select the optimal elective syllabus for academic year 2022-23, given the number of registered students. This led to a set of courses and skills trainings which guarantees a sufficient level of student choice, a coherent programme architecture and alignment with programme objectives. The assessment programme, which aligns assessed course outcomes with programme outcomes, was used to guide the development of individual elective courses and the elective syllabus. The current course registration for the second year shows that this works out as planned: students are evenly spread, with enough students in each course to ensure a quality educational experience.

The panel received the course descriptions of the second year elective courses. The panel is positively impressed by the formal quality of the course descriptions. In each relevant course description, the course learning objectives and assessment are explicitly related to circular engineering and clearly linked to the programme learning objectives. In some more generic courses the link to the circular engineering is not explicitly mentioned, but the panel doesn't expect it to be. The information provided to students is detailed. The panel wonders if the content of some courses may not ask too much from students (e.g. Quantum Physics or Signal Processing and Control Skills) or

are too scientific, without sufficient engineering (Plant Biology Skills). On the other hand, stretching students to do more than they would expect to be capable of, can be a powerful teaching intervention. Whether the panel's questions are justified can only be determined by monitoring and evaluating the courses on the basis of student experience.

The panel appreciates the careful way in which the elective courses syllabus has been designed. Both the set of elective courses and the individual course descriptions, supplemented by the system of academic advising, ensures the relevance of students' study paths in year 2. The programme has made this clear by providing an explicit link between each elective course, circular engineering and the programme's intended learning outcomes, evidenced in the course descriptions, their learning goals and assessment.

Conclusion

The panel concludes that the organisation of students' study paths in year 2 **meets the condition** set by NVAO.

The panel concludes that the condition is met and advises NVAO to take a positive accreditation decision for the academic bachelor in Circular Engineering of Maastricht University.

On behalf of the entire assessment panel, Utrecht, 4 October 2022

Em. Prof. dr. ir. J.C. (Han) Brezet, chair Dr. M.J.H. (Marianne) van der Weiden, secretary