

Assessment report
NVAO Limited Framework Programme Assessment

Bachelor Data Science (joint degree)

Eindhoven University of Technology/Tilburg University

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1. Executive summary

In this executive summary, the assessment panel presents the main considerations with respect to the assessment of the quality of the Bachelor Data Science programme (joint degree) of Eindhoven University of Technology and Tilburg University. The panel assessed the programme according to the limited framework for programme assessments of the NVAO Assessment framework for the higher education accreditation system of the Netherlands, taking into account the NVAO Protocol for Dutch Applications for Accreditation leading to a Joint Degree.

The programme organisation is solid. The panel praises the strong community feeling within the programme. The cooperation between the two universities is productive and is stated well in the Cooperation Agreement. The added value of the cooperation between the two universities is clear, Eindhoven University of Technology providing technical expertise and Tilburg University bringing in expertise from social sciences.

The objectives of the programme meet the internationally accepted requirements for programmes in the data science domain. The intended learning outcomes of the programme match the objectives, are articulated well, and correspond to the bachelor level.

The programme is aligned with trends in the academic world and in industry through, among others, consultation with the External Advisory Board. The panel suggests to continue along this route and to maintain the contacts with industry, as it is relevant to keep an eye on industry's needs.

The panel endorses the English name of the programme and English as the language of instruction, as programme management brought forward convincing arguments in favour of English.

Programme management appropriately followed up on the recommendations of the previous assessment panel.

The entry requirements and admission procedures of the programme are appropriate and assure admitting students, with the motivation and capacities to complete the programme. Previous administrative bottlenecks in the enrolment procedures are remedied.

The panel endorses the ambitions of programme management to raise the number of incoming students, while maintaining small-scale education. The proportion of students enrolling in Eindhoven is relatively high, which may point to the majority of incoming students having technical backgrounds and interests. The panel recommends to attract more students interested in the T-shaped contents of the programme and to lower overrepresentation of technically-oriented students.

The curriculum meets the intended learning outcomes of the programme. The course contents are adequate. The learning lines and the sequence of courses within the learning lines assure curriculum coherence and build-up in terms of level and complexity. The curriculum is clearly

organised along the T-shaped professional lines, addressing both technical and social knowledge and skills. The panel appreciates the Data Challenge courses, allowing students to integrate these two, though advises to address legal, behavioural and ethical aspects more clearly in these courses. Professional skills are covered appropriately. The panel approves of the Bachelor final project, but advises to further clarify the position of the project in terms of the build-up of students' competencies.

The panel appreciates the intentions of programme management to offer students the option to take the statutory teacher-training minor, as this allows students to qualify for *grade two* teacher positions in Dutch secondary education. If the assessment panel for university teaching-training programmes at both bachelor and master level advised NVAO to accredit this minor, the current panel is in agreement with this advice.

The panel praises the staff teaching in the programme. The lecturers are experts in their fields of study, qualified researchers in this domain and enthusiastic teachers. The panel sees the lecturing team with lecturers from both universities as a coherent group, that works together productively and effectively. Teachers and programme management may easily be contacted by students.

The educational principles of the programme are conducive to the learning processes of students. Although these principles are adequately implemented in the programme, the panel advises to further strengthen research-based training. The study methods are appropriate and reflect the educational principles. The study guidance in the programme is up to standard. The study success figures are adequate.

Programme management took appropriate measures to account for education and examinations during the Covid crisis, to assure the quality of these, and to monitor the well-being of students.

The rules and regulations for the programme examinations and assessments are adequate and are laid out appropriately. The differences between the Eindhoven-based rules and regulations for the programme and the Tilburg rules and regulations are minor and are handled adequately by the Examination Board.

The Examination Board effectively monitors the quality of examinations and assessments of the programme. The panel welcomes the close and productive relations which have been established between the Examination Board and programme management. The panel suggests, nevertheless, the Examination Board to keep sufficient distance from programme management to assure a position of independence.

The assessment methods of the courses are described well in the course dossiers. The assessment methods are aligned with the course goals and the intended learning outcomes of the programme, and appropriately test knowledge, insights and skills in these courses. The panel recommends to clearly identify the assessment of the professional skills within the course examinations. The panel sees the peer review procedures in the assessment of the Data Challenge group assignments as effective means to arrive at grades for individual students.

The panel regards the Bachelor final project supervision and assessment processes as appropriate. The evaluation form for the project includes all relevant criteria, though business items or other domains are not explicitly mentioned. The evaluation forms are filled out elaborately by the examiners. The Bachelor final projects are individual projects. In case Bachelor final projects are written in article format, the panel suggests to have students provide sufficient documentation to allow these projects to be assessed on the basis of the evaluation forms.

The panel reviewed fifteen Bachelor final projects of programme graduates, with lower, average and higher marks. All final projects reviewed are considered by the panel to be at least satisfactory. The panel finds the Bachelor final projects to have good quality and to be of high level.

The graduates from the programme are admitted a range of master programmes in various fields, about 40 % of them entering master programmes in computer science. Graduates are also equipped to enter the labour market, although this is not the prior goal of this bachelor programme. The panel notes only 10 % of programme graduates proceeding to the joint degree Master Data Science and Entrepreneurship programme. The panel suggests to try and raise this number, benefitting from the more diverse inflow the panel recommended.

The assessment panel conducted the assessment of the Bachelor Data Science programme (joint degree) of Eindhoven University of Technology and Tilburg University. The panel assesses this programme to meet the standards of the limited framework for programme assessments of the NVAO Assessment framework for the higher education accreditation system of the Netherlands, having taken into account the NVAO Protocol for Dutch Applications for Accreditation leading to a Joint Degree. The panel judges the outcome of the assessment for the programme to be positive and, therefore, recommends NVAO to grant this programme the accreditation of an existing programme.

Rotterdam, 13 September 2021,

Prof. W.E.A. Van Petegem PhD
(panel chair)

W. Vercouteren MSc
(panel secretary)

2. Programme administrative information

Name programme in CROHO: B Data Science (joint degree)

Orientation, level programme: Academic Bachelor

Grade: Bachelor of Science

Number of credits: 180 EC

Specialisations: N.A.

Location: Eindhoven and Tilburg

Mode of study: Full-time

Language of instruction: English

Registration in CROHO: 21PG-55018/21PN-55018

Names of institutions: Eindhoven University of Technology and Tilburg University

Status of institutions: Government-funded (both institutions)

Institutions' quality assurance: Approved (both institutions)

3. Findings, considerations and assessments per standard

3.1 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 Bachelor Data Science programme is a joint-degree programme of Eindhoven University of Technology and Tilburg University. Both this programme and the joint-degree Master Data Science and Entrepreneurship programme are offered by the Jheronimus Academy of Data Science, which the universities have set up to give the programmes their organisational and educational foundation. The Academy and both programmes were initiated six years ago. The Province of North-Brabant and the City of 's-Hertogenbosch participate in the Academy. The two universities signed the Cooperation Agreement Joint Degrees to regulate the organisational and financial cooperation for both programmes. The Academy is managed by the Steering Committee, being composed of the Deans of the most closely involved Departments or Schools within the universities. The Department of Mathematics and Computer Science of Eindhoven University of Technology has the prime responsibility for the Bachelor programme. The programme is managed on a day-to-day basis by programme directors and support staff in both Eindhoven and Tilburg. Students in this programme take courses in both cities. The Programme Committee, being composed of students and staff members, advises programme management on the quality of the programme. The Examination Board has the authority to monitor the quality of examinations and assessments in this programme and the Master Data Science and Entrepreneurship programme.

The objectives of the programme are to educate students in a multidisciplinary way in the domain of data science, which implies collecting, modelling, analysing, querying, transforming and visualising data sets to address problems of societal and business relevance in a professional and ethical manner. Students are educated to become T-shaped professionals, having in-depth technical expertise combined with broader expertise in the social sciences. The data science domain requires students to have knowledge of computer science, mathematics and statistics, cognitive science, business and law and ethics. The first discipline is offered by Eindhoven University of Technology, whereas the last three disciplines are mainly the expertise of Tilburg University. Jointly, the universities offer the disciplines required for educating students in the data science domain including mathematics and statistics.

Programme management drafted the Benchmark Statement, based upon international IEEE (Institute of Electrical and Electronics Engineers) and ACM (Association for Computing Machinery) frameworks. The Benchmark Statement was updated in 2021 to account for current trends in the field. The programme is quite similar to programmes in this domain of, among others, Maastricht University in the Netherlands, TU Dortmund in Germany and Northeastern University in the United States.

The intended learning outcomes of the programme include knowledge and understanding of theories, methods and techniques for data storage, handling and processing; knowledge and understanding of data analysis; knowing how to apply techniques for data analysis; awareness of legal, behavioural and ethical issues in this domain; knowing how to solve well-defined (business) problems; assessment of the quality, limitations and potential of data sets to solve these problems; interpretation and critical evaluation of results of data analyses; oral and written communication skills, teamwork skills, and learning skills to proceed to master programmes; and reflective and critical attitude. Programme management demonstrated the intended learning outcomes to meet the Dublin descriptors for the bachelor level.

Programme management obtains regular advice from the External Advisory Board of the Department of Mathematics and Computer Science of Eindhoven University of Technology, on which sit academic and non-academic experts and to which are added data science experts. Partnerships with industry have been established, contributing to research by lecturers and providing real-life-based assignments for students.

The programme's name is in English, and the programme is taught in English as well. The reasons for English are the following. Data science is an international domain of study. Students may be prepared directly or via subsequent master programmes for the international labour market. Much of the research done in this domain is only available internationally. Experts from abroad may be recruited as teachers. The programme staff includes many international teachers.

Programme management took up the recommendations of the previous assessment panel, leading to a number of improvements. Among other things, courses on statistics and programming were strengthened, innovative teaching methods, such as in the Data Challenge courses, were adopted and the student community, including the study association, was fostered.

Considerations

The panel regards the programme organisation to be solid. The panel in particular praises the strong community feeling within the programme. The programme rests upon a coherent team making serious efforts to achieve a well-designed and well-executed programme. The leadership of both universities strongly support the programme. The cooperation between the two universities is productive and articulated well in the Cooperation Agreement. The added value of the cooperation between the two universities is clear to the panel, Eindhoven University of Technology providing technical expertise and Tilburg University bringing in expertise from social sciences.

The panel considers the objectives of the programme to meet the requirements for programmes at bachelor level in the data science domain. The objectives correspond to the Benchmark Statement, which is regarded by the panel as an adequate, internationally validated description of this domain.

The programme is aligned with trends in the academic world and in industry through, among others, consultation with the External Advisory Board. The panel suggests to continue along this route and to maintain the contacts with industry, as it is relevant to keep an eye on industry's needs.

The programme's intended learning outcomes correspond to the objectives of the programme and articulate well the requirements students should meet at completion of the programme. As the panel established, the intended learning outcomes of the programme correspond with the bachelor level.

The panel endorses the English name of the programme and English as the language of instruction, as programme management brought forward convincing arguments in favour of English.

Programme management appropriately followed up on the recommendations of the previous assessment panel.

Assessment of this standard

These considerations have led the assessment panel to assess the programme to meet Standard 1, Intended learning outcomes.

3.2 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

The programme entry requirements are the Dutch pre-university diploma (VWO) with sufficient levels of English and Mathematics (Mathematics B), or equivalent qualifications. In line with the mandatory Study Choice Check, applicants fill out a questionnaire and have a virtual meeting with one of the staff members to see whether this programme would be suitable for them.

The intake of the programme increased from 55 incoming students in 2016 to 144 students in 2020. Programme management wants to raise the student intake to about 180 students in 2021. Currently, about 30 % of the students come from abroad. About 30 % of all students are female. On average, 2/3 of the incoming students enrol in Eindhoven, whereas 1/3 have Tilburg as their university of enrolment. The main enrolment automatically triggers enrolment in the other university as well.

The Bachelor Data Science programme carries in total 180 EC of study load and takes three years to complete. Programme management demonstrated the curriculum to meet the intended learning outcomes of the programme. The curriculum has been organised along learning lines being Computer Science, Data Analytics, Law & Ethics, Cognitive Science, Business and Data Challenges. Each of the mandatory courses in the curriculum belongs to one of these learning lines. Within the learning lines, courses build upon each other in terms of level and complexity. The courses in the learning lines Computer Science and Data Analytics bring students to required levels of depth in technical knowledge and skills. The learning line Law & Ethics teaches them the professional, legal and ethical aspects of data science. The Cognitive Science and Business learning lines offer students knowledge and skills about the societal context of this domain. The courses in the Data Challenges learning line bring the technical depth and the social breadth together, inviting students to address data science problems, derived from real-life cases provided by partners from industry. In the curriculum, students are offered nine elective courses (25 % of the curriculum) to tailor the programme to their individual preferences. Electives can be technical or social. They have to be approved in order to assure level, depth and coherence. Students are trained in professional skills, such as academic writing skills, presentation skills, teamwork, and project management skills. The training of professional skills is incorporated in the courses and as such listed in the course goals. The total study load for obtaining these skills amounts to 5 EC. At the end of the curriculum, students complete the Bachelor final project (10 EC), in which they are to demonstrate their ability to formulate a research question in data science and to analyse the subject chosen on the basis of data science methods.

Based upon input of students, external experts, the curriculum committee, and the programme committee, changes are being made to the curriculum. From the academic years 2020/2021 and 2021/2022 onwards, the subjects of data management, linear algebra and statistics are strengthened

and technical aspects in broader courses are reinforced, such as artificial intelligence in Cognitive Science courses and network analysis in Business courses.

Programme management has the intention to offer the statutory teacher-training minor, allowing students to obtain positions as *grade two* teachers in Dutch secondary education. The minor consists of two coherent packages of 15 EC each, enabling students to acquire both knowledge of and practical skills in teaching in secondary schools. The minor and the packages are provided by the Eindhoven School of Education. The Examination Committee of this School assures the quality of examinations and assessments of the minor.

Over 60 teachers are involved in the programme, coming from both universities. About half of all courses are jointly taught by teachers from both universities. About 84 % of the lecturers teaching in the programme have a PhD. About 71 % of them are University Teaching Qualification certified, testifying to their educational abilities. For the course coordinators and examiners these proportions are somewhat higher. Teachers appreciate teaching in this joint degree programme and enthusiastically attend the meetings which are scheduled to discuss the programme. Teachers within learning lines meet regularly to address the coherence of the courses within the learning lines. Students find both programme management and the teachers very approachable.

The programme has been founded upon educational principles of self-directed learning, challenge-based learning and research-based learning. Self-directed learning implies students being trained to take control of their learning processes and being stimulated to actively engage and participate in courses. Challenge-based learning means students being trained to face challenges, derived from real-life cases, in the data science field. Challenge-based learning is in particular practised in the *Data Challenge* courses. Research-based learning, which is offered in some courses and particularly in the Bachelor final project, involves students learning about recent research outcomes and to conduct research themselves in the data science field. Teaching methods in the programme include lectures and tutorials and, in some courses, group work. Education in the programme is small-scale, the students-to-staff ratio being about 7 : 1. With the rising numbers of students, programme management intends to maintain the small scale character of the programme and to maintain the community of students and staff. Students attend courses in both Eindhoven and Tilburg, and travel between the two cities. The two academic advisors of the programme inform students at the start of each quarter, monitor study progress of all students, advise students in case of questions or problems, and refer students to other university services. First-year students are guided by student mentors in small groups, addressing study skills and the selection of elective courses. The proportion of students achieving the positive study advice at the end of the first year is on average 72 % which is in line with other programmes of both universities. The study success rates of the programme are about 35 % of the students completing the programme in three years and over 70 % of them finishing in four years. As the programme is relatively new, figures currently available are limited.

Programme management has taken proper measures to organise education in the Covid crisis and to monitor the quality of the education. On campus education often proved not to be feasible, due to government regulations. Therefore, teachers were forced to change learning activities to online

lectures and tutorials or other alternatives. They adequately did so, being assisted by programme management and online education teams. Programme directors and academic advisors in collaboration with the programme study association contacted students and assisted them in overcoming obstacles in their studies. This way, students' well-being was actively being monitored and taken care of.

Considerations

The panel approves of the entry requirements and admission procedures of the programme. These assure admitting students, with the motivation and the capacities to complete the programme. The panel notes previous administrative bottlenecks in the enrolment procedures to be remedied.

The panel endorses the ambitions of programme management to raise the number of incoming students, while at the same time maintaining small-scale education. The proportion of students enrolling in Eindhoven is relatively high, which may point to the majority of incoming students having technical backgrounds and interests. The panel recommends to attract more students interested in the T-shaped contents of the programme and to lower overrepresentation of technically-oriented students within the total inflow.

The curriculum meets, so the panel established, the intended learning outcomes of the programme. The contents of this curriculum are appropriate and the courses offered are solid. The learning lines and the sequence of courses within the learning lines assure curriculum coherence and build-up in terms of level and complexity. The curriculum is clearly organised along the T-shaped professional lines, addressing both technical and social knowledge and skills. The panel appreciates the Data Challenge courses, allowing students to integrate these two professional lines. The panel advises to address legal, behavioural and ethical aspects more clearly in these courses. Professional skills are covered appropriately in the different courses all over the curriculum. The panel approves of the Bachelor final project, but recommends to further clarify the position of this project within the curriculum in terms of the build-up of students' competencies and in relation to the Data Challenge courses.

The panel appreciates the intentions of programme management to offer students the option to take the statutory teacher-training minor, as this allows students to qualify for *grade two* teacher positions in Dutch secondary education. If the assessment panel for university teaching-training programmes at both bachelor and master level advised NVAO to accredit this minor, the current panel is in agreement with this advice.

The panel praises the staff teaching in the programme. The lecturers are experts in their fields of study. They are qualified researchers in this domain and enthusiastic teachers. The panel sees the lecturing team with lecturers from both universities as a coherent group, who are in agreement and who work together productively and effectively. Teachers and programme management may easily be contacted by students.

The educational principles adopted in the programme are seen by the panel as conducive to the learning processes of students. Although these principles are adequately covered in the programme,

the panel advises to further strengthen research-based training. The study methods are appropriate for this programme and reflect the educational principles. The study guidance in the programme is up to standard. The study success figures for the programme are adequate.

In the panel's view, programme management took measures to provide adequate education during the Covid crisis, to assure the quality of this education, and to monitor the well-being of students.

Assessment of this standard

These considerations have led the assessment panel to assess the programme to meet Standard 2, Teaching-learning environment.

3.3 Standard 3: Student assessment

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

The rules and regulations with respect to examinations and assessments of the programme are laid down in the Programme and Examination Regulations for the programme, the Regulations of the Examination Board and the Bachelor Data Science Assessment Policy. For this programme, the Eindhoven University of Technology examinations and assessments rules and regulations are leading.

The Examination Board is the authority to monitor the quality of examinations and assessments and to ensure students reaching the intended learning outcomes. Representatives from both universities sit on the Board. The Board appoints the course examiners. The examiners have to assure the contents and level of the examinations and assessments and the assessment methods being in line with the course contents and the course goals, and adequately contributing to the intended learning outcomes of the programme. The Examination Board reviewed the ways of assessment in the courses of the first year and will, in the near future, review the courses of the other years as well. The Board also reviewed a number of Bachelor final projects. The Examination Board did not find serious defects and established the examinations and assessments to be aligned with the course contents and goals, and the programme intended learning outcomes.

The assessment methods for courses are primarily individual written examinations and individual or group assignments. Testing of professional skills is incorporated in the course examinations. In most courses, interim tests are scheduled, representing at least 30 % of the courses' final grades. In the Data Challenge courses, students work on assignments in groups. Group work in these courses is accompanied by peer review procedures, in which students assess each other's performances. The results of this peer review are taken into account to arrive at the individual grades and may lead to deviations of the group grade of up to 2.0 points. Students are informed about the rules for fraud and plagiarism. Written assignments are automatically checked for plagiarism.

For their Bachelor final project, students select topics from larger themes presented to them. The themes are derived from research activities by programme staff or activities of companies. Students work individually on their final project and draft their own, individual report. In drafting and completing the final projects, students are guided by their supervisor. Students come together in thesis circles for peer feedback and review. The final projects are assessed by the supervisor and the second assessor, both of them using the standardised evaluation form for these projects.

Programme management has taken measures to organise examinations and assessments in the Covid crisis and to monitor their quality. In the Covid crisis, all examinations were transferred to online examinations. Requests for alternative, online assessment methods were submitted to the Examination Board for approval. The Examination Board ruled on these assessment methods,

verifying whether these met the course goals and consequently the programme intended learning outcomes. Fraud prevention procedures were part of the assessment methods, which were adopted.

Considerations

The panel considers the rules and regulations for the programme examinations and assessments to be adequate and to be laid out appropriately. The differences between the Eindhoven-based rules and regulations for the programme and the Tilburg rules and regulations are minor and are handled adequately by the Examination Board.

The Examination Board effectively monitors the quality of examinations and assessments of the programme. The panel welcomes the close and productive relations which have been established between the Examination Board and programme management. The panel suggests, nevertheless, the Examination Board to keep sufficient distance from programme management to assure the position of independence.

The assessment methods of the courses are described well in the course dossiers. The assessment methods are aligned with the course goals and the intended learning outcomes of the programme, and appropriately test knowledge, insights and skills in these courses. The panel recommends to clearly identify the assessment of the professional skills within the course examinations. The panel sees the peer review procedures in the assessment of the Data Challenge group assignments as effective means to arrive at grades for individual students.

The panel regards the Bachelor final project supervision and assessment processes as appropriate. The evaluation form for the project includes all relevant criteria, though business aspects or other domains are not explicitly mentioned. The evaluation forms are filled out elaborately by the examiners, offering clear arguments for the final project grades. In case Bachelor final projects are written in article format, the panel suggests to have students provide sufficient documentation to allow these projects to be assessed on the basis of the evaluation forms.

The panel considers the measures programme management has taken to organise examinations and assessments in the Covid-crisis and to monitor the quality of these examinations and assessments to be appropriate.

Assessment of this standard

These considerations have led the assessment panel to assess the programme to meet Standard 3, Student assessment.

3.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.
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Findings

The courses in the programme all together meet all the intended learning outcomes of the programme. Students having completed these courses, have achieved these intended learning outcomes. Students reach the final level of the programme in particular in the third and last Data Challenge course in the third year of the programme and in the Bachelor final project. The average grade for these final projects in the last three years was 7.9.

The graduates of the programme are admitted to an extensive range of master programmes in or related to the data science domain. Of the 48 students having graduated so far, 42 % proceeded to the Master Computer Science and Engineering programme of Eindhoven University of Technology and within this programme to the Data Science track. About 15 % of programme graduates entered the labour market. The rest of them were admitted to master programmes in, among other, business analytics, data science or cognitive science. About 10 % of the graduates enrolled in the joint degree Master Data Science and Entrepreneurship programme.

Considerations

The panel reviewed fifteen Bachelor final projects of programme graduates. The final projects were selected from all of the projects of graduates of the last two years. In the selection, projects with lower, average and higher marks were represented. All the final projects reviewed are considered by the panel to be at least satisfactory. The panel finds the Bachelor final projects to have good quality and to be of high level.

The panel regards the graduates from the programme to be well prepared to enrol in a range of master programmes in various fields, about 40 % of them entering master programmes in computer science. Graduates are also well prepared to enter the labour market, although this is not the prior goal of this bachelor programme. The panel notes only 10 % of programme graduates proceeding to the joint degree Master Data Science and Entrepreneurship programme. The panel suggests to try and raise this number, benefitting from the more diverse inflow the panel recommended.

Assessment of this standard

These considerations have led the assessment panel to assess the programme to meet Standard 4, Achieved learning outcomes.

4. Overview of assessments

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

5. 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:

- To attract more students interested in the T-shaped nature of the programme and to lower overrepresentation of technically-oriented students within the total inflow.
- To integrate legal, behavioural and ethical aspects more clearly in the Data Challenge courses.
- To further clarify the position of the Bachelor final project within the curriculum in terms of the build-up of students' competencies and in relation to the Data Challenge courses.
- To further strengthen research-based learning in the programme.
- For the Examination Board to keep sufficient distance from programme management to assure the position of independence.
- To clearly identify the assessment of the professional skills within the examinations of the courses.
- To have students provide sufficient documentation in case Bachelor final projects are written in article format to allow these final projects to be assessed on the basis of the standardised evaluation forms.
- To try and raise the number of students proceeding to the Master Data Science and Entrepreneurship programme, benefitting from the more diverse inflow the panel recommended.

Appendix: Assessment process

Certiked VBI evaluation agency was requested by Eindhoven University of Technology and Tilburg University to support the limited framework programme assessment process for the Bachelor Data Science (joint-degree) of these two universities. The objective of the programme assessment of this programme was to establish 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, September, 2018 (officially published in Stcrt. 2019 no. 3198, 29 January 2019), having taken into account the NVAO Protocol for Dutch Applications for Accreditation leading to a Joint Degree, 7 June, 2010.

Management of the Bachelor Data Science programme drafted the list of panel candidates. Having conferred with programme management, 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. W.E.A. Van Petegem PhD, Associate Professor, Faculty of Engineering Technology, KU Leuven, Belgium (panel chair);
- Prof. M.R. van Steen PhD, Full Professor in Computer Science, University of Twente, the Netherlands (panel member);
- Prof. J. van Hillegersberg PhD, Full Professor of Business Information Systems, University of Twente, the Netherlands (panel member);
- Prof. I. Velegrakis PhD, Full Professor in Computer Science, Utrecht University, the Netherlands (panel member);
- Prof. P. Andries PhD, Associate Professor of Entrepreneurship and Strategy, Ghent University, Belgium (panel member);
- L. Weedage MSc, PhD Candidate in Mathematics, University of Twente, the Netherlands (student member).

On behalf of Certiked, W. Vercouteren MSc 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 as well as observing the rules of confidentiality. Having obtained the authorisation by the University, Certiked requested the approval of NVAO of the proposed panel to conduct the assessment. NVAO has given its approval.

To prepare for the assessment process, the process coordinator met with programme management to discuss the planning of the preparatory activities, the documents to be presented to the assessment panel, and the site visit schedule. In the course of this process, programme management and the process coordinator regularly had contact to monitor the process. The activities prior to the site visit were 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 Bachelor final projects of programme graduates of the two most recent years. Acting on behalf of the assessment panel, the process coordinator/secretary selected fifteen projects from this list. In the selection, projects with lower, average and higher grades were evenly represented.

The panel members were forwarded in time the documents, prepared by programme management. These documents consisted of the self-evaluation report, the appendices to the self-evaluation report and additional documentation. Information on Covid-19 measures was provided in the self-evaluation report. The student chapter was also part of the self-evaluation report. The appendices to the self-evaluation report included, among other, the Cooperation Agreement Joint Degrees of Eindhoven University of Technology and Tilburg University, intended learning outcomes and Dublin descriptors, Benchmark Statement, well-being survey results, teaching staff overview, assessment policy, assessment plan, Programme and Examination Regulations, regulations of Examination Board, list of committees, and statutory teacher-training minor specialisation. The additional documentation consisted of course information, Bachelor Final Project information, minutes Programme Committee and the overview of quality assurance and evaluation reports.

To assist panel members in assessing the programme, they were presented the Trained Eye Limited Framework Joint Degrees document of Certiked evaluation agency, this document being the elaboration of the NVAO Assessment framework and the NVAO Protocol for Dutch Applications for Accreditation leading to a Joint Degree.

Prior to the site visit date, the assessment panel chair and the process coordinator/secretary met to discuss the assessment process procedures. In this meeting, the panel chair was informed about the profile of panel chairs as drafted by NVAO. The panel chair agreed to work in line with the profile of panel chairs.

Due to the continuing spread of Covid-infections in the Netherlands and the measures taken by Dutch government to counter the spread of infections, programme management proposed the site visit to be organised online. All panel members agreed to the online visit.

Prior to the date of the online visit, panel members sent in their preliminary findings, based upon their studying of the programme documents, and sent in questions to be put to the programme representatives on the day of the visit. The panel secretary summarised this information, and compiled a list of questions to serve as the starting point for the discussions with the programme representatives during the visit.

Shortly before the visit date, panel members met to prepare for the site visit. Panel members discussed the procedures to be adopted during the visit, the preliminary findings about the programme, the panel reviews of the Bachelor final projects studied, and the questions to be put to the programme representatives.

On 3 June, 2021, the panel conducted the online visit. The visit schedule was in accordance with the schedule as planned. The visit schedule included the following meetings:

- 09.00 – 09.45 Deans, Academy Board representatives, and programme directors
- 10.00 – 11.00 Programme management, core lecturers, and study advisor
- 11.15 – 12.00 Examination Board
- 12.00 – 13.00 Panel lunch (closed session), with 12.00 – 12.30 Open office hours
- 13.00 – 14.00 Lecturers and final project examiners
- 14.15 – 15.00 Students (with Programme Committee student member) and programme alumni
- 15.00 – 16.30 Deliberations panel (closed session)
- 16.30 – 16.45 Main findings presentation by panel chair to programme representatives
- 16.45 – 17.15 Development dialogue

In all of the meetings with management and staff, representatives of both universities were present. Open office hours were communicated timely by programme management to staff and students. No persons presented themselves during these open office hours.

In a closed session at the end of the visit, the assessment panel considered the findings, weighted the considerations and arrived at conclusions with regard to the quality of the programme. After these internal deliberations, the panel chair presented in broad outline the findings, considerations, conclusions and recommendations to programme representatives.

At the end of the site visit, panel members and programme management met to discuss further improvements of the programme in the development dialogue.

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 this draft and made a number of changes. The secretary included these changes and edited the report. This report was presented to programme management to be corrected for factual inaccuracies. Programme management were given time to respond. Having been corrected for the factual inaccuracies, the Certiked bureau sent the final report to the University Boards of Eindhoven University of Technology and Tilburg University to accompany their request to grant this programme the accreditation of an existing programme.