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Summary

Standard 1. Intended learning outcomes

The profile and aims of the MSc Information Sciences are fitting for an academic master's programme in this field. The panel appreciates the stated focus on decision-making. As this concept will be emphasized even more strongly in the future, the panel suggests being more explicit about the perspectives that will be emphasized. The goals of the programme have been translated into a broad set of intended learning outcomes that are to be attained at an academic master's level. The panel supports the programme's plans to revise the ILOs in the near future and has given a few suggestions that could help with their refinement. On the one hand, these suggestions concern the explicit application of frameworks (regarding content and level) to ensure compliance with international standards for comparable programmes. On the other hand, the panel recommends that the programme formulates the ILOs in a more precise manner to make sure that they become less open to interpretation; for instance, regarding the extent to which the ILOs should be mastered, the management aspects that the programme wants students to learn, and the tracks (i.e. via dedicated ILOs). The panel is satisfied that the programme has various means to keep the ILOs well connected to the requirements of the professional field.

Standard 2. Teaching-learning environment

The curriculum of the MSc Information Sciences reflects the intended learning outcomes of the programme. Students are enthusiastic and content, especially about their options in making their own educational choices (re: electives, thesis topics etc.) and the small scale of the programme. The panel appreciates that the programme offers tracks to help students create a study path, but does find that these overlap considerably. Therefore, reconsidering the tracks is in order; *Aligning Business and IT* could benefit from increased clarity of its goals and strengthening of its content. In addition, the program should provide more insight into the coherence of the curriculum and the (technical) level and depth that is expected in the courses and tracks.

The teaching staff is well-qualified, both in terms of academic activities and teaching qualifications. Most lecturers have a computer sciences background or come from the School of Management. If there is any room to hire additional (teaching) staff, the panel suggests that efforts should be made to attract expertise from the information sciences field specifically. The panel recommends setting up a structure to accommodate regular staff meetings to support a more formal working method is in place rather than the informal structures that are now mainly relied upon (i.e. strengthen form coordination of the programme). The teaching staff will experience an increased workload when the programme executes its revision plans in the near future, and the programme management should therefore be proactive and take adequate measures to counteract any potential issues concerning work load.

The collaboration between the Faculty of Science and the Nijmegen School of Management could be strengthened to ensure that ownership of the programme is experienced in both faculties. Extra efforts by management could also lead to options to offer students more and a greater variety of (elective) management courses.

Standard 3. Student assessment

The programme has a reliable, valid and transparent system of assessment in place. There are adequate procedures for design and quality assurance of exams, assignments and the theses. The panel recommends that the programme develops a more formal and systematic approach to master's theses' grading practices. This approach should lead to better calibration and guarantee improved coherence between the assessment

form and the ultimate grade. Examiners should also aways substantiate their grade with a narrative, and as such justify the (final) grade to enforce the enrichment of the grades given. Finally, clear(er) criteria for grades should be set up and adhered to. The Examination Board fulfils its legal duties, but the panel does recommend that the EB takes on a more proactive approach, for instance concerning the emergence of AI, the collaboration with the EB of the Nijmegen School of Management, and the closing of feedback loops.

Standard 4. Achieved learning outcomes

The theses show that students realize the intended learning outcomes of their programme. Alumni are generally satisfied with their education, and indicate that the programme helped them further shape their career in business and IT.

Score table

The panel assesses the programme as follows:

M Information Sciences

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

Prof. Olga De Troyer   Drs. Linda te Marvelde
Chair   Secretary

Date: 8 March 2024

Introduction

Procedure

Assessment

On 21 and 22 November 2023, the master's programme Information Sciences of Radboud University was assessed by an independent peer review panel as part of the cluster assessment Information Science. The assessment cluster consisted of eight programmes, offered by the Open Universiteit, Radboud University, University of Twente, Utrecht University and Vrije Universiteit Amsterdam. The assessment followed the procedure and standards of the NVAO Assessment Framework for the Higher Education Accreditation System of the Netherlands (September 2018).

Quality assurance agency Academion coordinated the assessment upon request of the cluster Information Science. Peter Hildering acted as both coordinator and secretary, and Anne-Lise Kamphuis and Linda te Marvelde as secretaries in the cluster assessment. They have been certified and registered by the NVAO.

Preparation

Academion composed the peer review panel in cooperation with the institutions and taking into account the expertise and independence of the members, as well as consistency within the cluster. On 20 July 2023, the NVAO approved the composition of the panel. The coordinator instructed the panel chair on her role in the site visit according to the Panel chair profile (NVAO 2016).

The programme composed a site visit schedule in consultation with the coordinator (see Appendix 3). The programme selected representative partners for the various interviews. The online development dialogue took place sometime after the site visit. A separate development report was made based on this dialogue.

The programme provided the coordinator with a list of graduates over the period 2020-2022. In consultation with the coordinator, the panel chair selected 15 theses, taking the diversity of final grades and examiners into account. Prior to the site visit, the programme provided the panel with the theses and the accompanying assessment forms. It also provided the panel with the self-evaluation report and additional materials (see Appendix 4).

The panel members studied the information and sent their findings to the secretary. The secretary collected the panel's questions and remarks in a document and shared this with the panel members. In a preliminary meeting, the panel discussed the initial findings on the self-evaluation report and the theses, as well as the division of tasks during the site visit. The panel was also informed on the assessment framework, the working method and the planning of the site visits and reports.

Site visit

During the site visit, the panel interviewed various programme representatives (see Appendix 3). The panel also offered students and staff members an opportunity for confidential discussion during a consultation hour. The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair presented the preliminary findings.

Report

The secretary wrote a draft report based on the panel's findings and submitted it to the coordinator for peer assessment. Subsequently, the secretary sent the report to the panel for feedback. After processing this feedback, the secretary sent the draft report to the programme in order to have it checked for factual irregularities. The secretary discussed the ensuing comments with the panel chair and changes were implemented accordingly. The panel then finalized the report, and the coordinator sent it to the Radboud University.

Panel

The following panel members were involved in the cluster assessment:

- Prof. Olga De Troyer, emeritus professor of Computer Science, Vrije Universiteit Brussel – chair;
- Prof. Geert Poels, professor of Management Information Systems, Ghent University;
- Prof. Alessandro Bozzon, professor of Human Centered AI, Delft University of Technology;
- Prof. Jos van Hillegersberg, scientific director Jheronimus Academy of Data Science Den Bosch (TU/e and TiU), professor Design and Implementation of Information Systems, University of Twente;
- Prof. Jürgen Ziegler, professor of Interactive Systems, University of Duisburg-Essen;
- Prof. Barbara Pernici, professor of Computer Science and Engineering, Politecnico di Milano;
- Prof. Remco Dijkman, professor of Information Systems, Eindhoven University of Technology;
- Prof. Marijn Janssen, professor of ICT and Governance, Delft University of Technology;
- Kelly Kurowksi BSc, master student Business Informatics, Utrecht University – student member;
- Amber Pater BSc, master student Information Sciences, Radboud University – student member.

The panel assessing the master's programme Information Sciences at Radboud University consisted of the following members:

- Prof. Olga De Troyer, emeritus professor of Computer Science, Vrije Universiteit Brussel – chair;
- Prof. Alessandro Bozzon, professor of Human Centered AI, Delft University of Technology;
- Prof. Jürgen Ziegler, professor of Interactive Systems, University of Duisburg-Essen;
- Kelly Kurowksi BSc, master student Business Informatics, Utrecht University – student member.

Drs. Linda te Marvelde acted as secretary for the site visit.

Information on the programme

Name of the institution: Radboud University
Status of the institution: Publicly funded institution
Result institutional quality assurance assessment: Positive

Programme name: M Information Sciences
CROHO number: 60255
Level: Master
Orientation: Academic
Number of credits: 60 EC
Location: Nijmegen

Mode(s) of study: Fulltime
Language of instruction: English
Submission date NVAO: 1 May 2024

Description of the assessment

Recommendations previous panel

During the site visit, the panel requested (and was provided with) an overview of how the programme followed up on the recommendations given by the previous panel (2018). The panel discussed the recommendations and their follow-up actions and concludes that they have been acted upon by the programme. The panel however noted that this was mostly done in an implicit rather than systematic way. The panel therefore encourages the programme in the future to ensure that the choices made regarding improvement measures taken are more extensively substantiated and traceable.

The follow-up of several recommendations is highlighted in this report under the applicable standards.

Organization

The master's programme Information Sciences of Radboud University is hosted by the Faculty of Science in cooperation with the Nijmegen School of Management. The Faculty of Science houses five 'educational institutes' that offer a range of degree programmes; the Institute for Computing and Information Sciences (I&I) is responsible for the bachelor's programme Computing Science, the master's programme Computing Science and the master's programme Information Sciences. Educational institute I&I has its own Examination Board and Programme Committee

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

Profile and aims
The one-year master's programme Information Sciences at Radboud University trains students to look beyond the technical perspective in the design, evaluation, and optimization of IT solutions of companies and businesses. The concept of decision-making is key to the programme as it serves as the linking pin between the actions of humans (in organizations) and data, information and knowledge (in information systems). The programme is taught in English and has an English name due to the international nature of both the academic discipline and professional field of information science. Therefore, according to the panel, the choice of English as the language of instruction is logical and sensible.

The programme aims to train information specialists who are experts in information architecture, systems theory and the quality and security of IT systems, and who have the ability to connect people and organizations involved in using, designing, and building such systems. Students, therefore, must learn to work with different stakeholders, such as technical programmers, demanding clients, and - in some cases - computer-illiterate users or unknowing managers. Students learn to represent these stakeholders' interests and find solutions that are satisfactory to all. This requires technical understanding as well as communicative and managerial skills.

Students are offered tracks in *Security and Privacy* and/or in *Aligning Business and IT* (see Standard 2). Those who choose *Security and Privacy* become experts on information security strategies and privacy policies of

(private and public) organizations. As organizations become increasingly data-driven and need to comply with new privacy regulations, expertise in law and privacy and, more generally, information security is highly sought after at all management levels. Students of the *Aligning Business and IT* track become experts in digital architecture and business and IT alignment. As such, they will be able to communicate with a wide range of stakeholders to represent and incorporate their needs into a holistic view of an organization's strategy, processes, information needs, and systems. Based on (the analysis of) the information obtained from these stakeholders and on the technical assessment and evaluation of priorities, students can design an architecture that involves business processes and IT implementation, provide competitive business solutions, and support the most efficient and secure IT environment to meet a company's business needs.

The panel has discussed the profile of the programme and finds that its objectives are clear; the combination of technical understanding, communicative and managerial skills highlighted in the general objectives is an important prerequisite for acting as a bridge between the different stakeholders in IT development and use. The two tracks are highly relevant for today's society and are helpful in shaping the profile of the programme and providing students with a potential professional perspective. The panel appreciates the stated focus on decision-making, and it learned that this concept will be emphasized even more strongly in the future. The panel suggests that it would be helpful to be more explicit about the perspectives that will be emphasized under this general concept, such as technical decision support, psychological factors, group decision making, or others. As per the recommendation of the previous panel, the programme has compared itself to various similar programmes in the Netherlands. The outcome of this benchmark shows that the programme in Nijmegen is unique in terms of its collaboration between the Faculty of Science and the Faculty of Management and its track in *Security and Privacy*. The panel concludes that these are appealing features that can serve to attract potential students.

Intended learning outcomes
The aims of the programme are translated into a series of intended learning outcomes (ILOs, see Appendix A). The panel deems the ILOs to align with the program's aims; they are stated to be attained at an academic master's level. The recent arrival of a new program coordinator is the reason for revising the intended learning outcomes (and curriculum) in the near future. When doing so, the panel suggests ensuring an explicit connection of the ILOs to a(n) (international) framework(s), such as the Information Systems model curriculum developed by the Association for Computing Machinery (ACM) and the Association for Information Systems (AIS) in 2020 (ACM/AIS framework, as this would confirm clear compliance with international standards for comparable programmes. Although the master's level and academic orientation are currently implicitly embedded in the ILOs, the programme could clarify how the intended learning outcomes cover the Dublin Descriptors for academic programmes (or similar frameworks). The panel acknowledges that using any of these frameworks is not mandatory, yet their use will be helpful when revising the ILOs. In addition, the panel noted that the current ILOs are formulated in quite general and broad terms, which makes them open to interpretation, for instance, regarding the extent to which the ILOs should be mastered. In addition, the panel found that the ILOs are not specific in referencing the management aspects that the programme wants students to learn, and the tracks (i.e. via dedicated ILOs). The panel, therefore, recommends that ILOs be formulated in a more specific manner.

Professional field
There are various ways in which the programme validates that the ILOs and the curriculum match the needs and expectations of the professional field. The programme reports that its staff plays an important role (e.g., research collaborations with external parties, professors by special appointment, staff with part-time appointments outside the university), as well as its external speakers/guest lecturers and GiPHouse clients (see Standard 2). The programme also maintains contacts with professional organizations, including the CIO

platform, Nederland ICT, PvIB (Dutch Platform for Information Security) and participates in DCYPHER, the national cybersecurity platform for higher education and research. The panel appreciates that the programme also benefits from a dedicated labour market committee, the 'Commissie Afnemend Veld'. However, the panel does find that its membership is skewed towards computer science rather than information science. When attracting future members, the programme would do well to take this finding into consideration and try to ensure that the field of information sciences is adequately represented as its own discipline. Overall, the panel finds that the programme is well positioned with respect to the demands of the labour market; as evidenced by the ample opportunities for alumni to fill (high-level) positions in industry (see Standard 4).

Considerations

The profile and aims of the MSc Information Sciences are fitting for an academic master's programme in this field. The panel appreciates the stated focus on decision-making. As this concept will be emphasized even more strongly in the future, the panel suggests being more explicit about the perspectives that will be emphasized. The goals of the programme have been translated into a broad set of intended learning outcomes that are to be attained at an academic master's level. The panel supports the programme's plans to revise the ILOs in the near future and has given a few suggestions that could help with their refinement. On the one hand, these suggestions concern the explicit application of frameworks (regarding content and level) to ensure compliance with international standards for comparable programmes. On the other hand, the panel recommends that the programme formulates the ILOs in a more precise manner to make sure that they become less open to interpretation; for instance, regarding the extent to which the ILOs should be mastered, the management aspects that the programme wants students to learn, and the tracks (i.e. via dedicated ILOs). The panel is satisfied that the programme has various means to keep the ILOs well connected to the requirements of the professional field.

Conclusion
The panel concludes that the programme meets standard 1.

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

Curriculum
The curriculum (60 EC) comprises mandatory courses (18 EC), track courses (18 EC), free elective(s) (6 EC) and a thesis (18 EC). The programme attracts around 30 students per year. An exception is the academic year 2020-2021, when 50 students enrolled in the programme. The programme management indicates they would like the programme to grow and increase the annual intake to 40-50 students per year, and to attract more female and international students.

The panel reviewed the curriculum and found that the programme is comprehensive and allows students a healthy degree of freedom to make their own choices based on their interests. In the mandatory courses students learn how to conduct scientific research (Research Methods) and how to reflect on the ethical aspects of their work (Philosophy and Ethics for Computing and Information Science). In Software Development Entrepreneurship or in System Development Management, also known as the GipHouse

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courses, students obtain hands-on experience related to issues in the field. GipHouse is a virtual software company run entirely by students where they can gain experience managing the design and implementation of new IT solutions in a practical setting with real (external) stakeholders. Finally, the courses System Approaches to Information and Organization and Judgment and Decision Making for Information Sciences provide the system and user approaches to information sciences and, as such, provide essential perspectives and the common starting point for both tracks.

Security and Privacy familiarizes students with privacy and information security guidelines. The two mandatory courses Security in Organizations and Law and Technology acquaint students with the changes that computational technologies bring and the challenges they face in the context of security and law. *Aligning Business and IT* focuses on communication between a wide range of stakeholders while making a plan that takes different perspectives as well as the organization's view into account. The mandatory course Information Retrieval (6 EC) provides students with the knowledge of classic retrieval models and their limitations that are used in organizations. As track elective(s), students choose one (*Security and Privacy*) or two (*Aligning Business and IT*) of the four courses (based on personal interests): Organization Design, Organizational Change, Intervention in Organizations or Business Model Innovation. In addition, a free elective can be chosen from the course catalogue of the entire Radboud University, as per university policy.

The panel finds that the description of the track *Security and Privacy* is focused and clear, but that it shares most of its elective courses with *Aligning Business and IT*. The title *Aligning Business and IT* is quite broad and vague, making it harder to intuit the concrete content of the track. Moreover, this track offers only one mandatory track-specific course, which - according to the panel - does not cover the label of the track. Effectively, the two tracks overlap considerably, which leads the panel to conclude that they currently are not quite recognizable in the curriculum or indeed distinctive enough to be deemed tracks. As some students also report a lack of a common thread and/or insight into how the courses fit together, the panel concludes that the programme's coherence should improve, by reconsidering the (content of the) tracks (*Aligning Business and IT* in particular) and better communicate the rationale of the curriculum to the students.

Students conclude the programme with a thesis in which they demonstrate their ability to analyse a problem in information sciences at master's level and to design solutions using scientific methods and techniques. The panel appreciates the option to combine the master's thesis with an internship at a company or organization, either within the Netherlands or abroad. Approximately half of the students choose to do an internship. Recently, an internship supervisor who has a coordinating role was appointed. Students receive ample guidance and support in choosing a topic for their thesis and/or internship placement.

The programme attracts both students with a technological background with management ambitions, and those with a management background and a strong affinity with technology (IT). Students are enthusiastic about the programme. They enjoy the relatively small scale of the programme which makes it easy to engage with each other. They also appreciate the freedom the programme offers to make choices, based on personal interests. Students feel seen and heard by the lecturers and report that measures are visibly taken in reaction to student feedback. Some students indicate that they find it difficult to anticipate which level of technical depth the two tracks require, making it a challenge to make informed choices. This concurs with the panel's finding that the programme is not particularly explicit about the (technical) level that has to be achieved by the students in courses and tracks, which only became clear to the panel from the high-level master's theses that it read (see Standard 4).

The programme management informed the panel that the recent arrival of a new programme coordinator is the reason for curriculum revision (see Standard 1). Considering the panel's findings on the curriculum, the

panel recommends that the programme ensures that the (revised) intended learning outcomes are more explicitly identifiable and recognizable in the curriculum than they currently are (constructive alignment).

The constructivist approach to teaching and learning, with special attention to making professional products, including software, case studies, demos, and reports, prepares students adequately for their future professional careers. Teaching formats range from regular lectures, guest lectures, tutorials, practical assignments/projects, and internships. The professional orientation of the programme is clear and reasonable. The students that the panel spoke with mentioned their entrepreneurial spirit and desire to start their own companies or their ambitions to join the workforce as information scientists. Regarding academic orientation, students are treated as independent junior researchers as much as possible or receive feedback intended to help them reach the level of independent junior researchers. Students get to read scientific literature rather than just textbooks, and they must show independence in the planning and organization of projects.

Students find that the programme is feasible, but suggest that improvements could be made in the distribution of the study load. For students registered longer than two years, a detailed analysis of the cause(s) of delay was made by the programme, showing that in addition to personal circumstances or students already maintaining a job, completing the master's thesis turns out to be a potential source of delay. The panel appreciates that countermeasures have been implemented, including close(r) guidance and monitoring by the master's thesis coordinator and the student advisor.

Teaching staff
The programme is taught by lecturers connected to the research institute iCIS and the Nijmegen School of Management (mostly the Department of Organizational Design and Development). They have the obtained basic qualification to teach at a Dutch university (in Dutch: Basiskwalificatie Onderwijs) or an advanced qualification (in Dutch: Seniorkwalificatie Onderwijs), except newly appointed lecturers who are still in the process of obtaining their qualification and a few exceptional cases of professors with part-time positions. The panel is satisfied with the English proficiency of the teaching staff. An adequate language policy is in place to ensure that all lecturers who teach in English have sufficient command of the language. The teaching staff consists of 11 full professors, 9 associate professors, 19 assistant professors and 8 other teaching staff members.

Lecturers do not work exclusively for the programme Information Sciences, but are involved with multiple programmes, research groups and faculties. The programme, therefore, organizes annual team meetings to connect with and inform staff members specifically on any issues related to the information sciences programme. Despite the programme's efforts to inform its teaching staff adequately, the panel finds that the lecturers mostly rely on informal contacts between each other in organizing and executing their courses. There is room for more active knowledge among teaching staff concerning the alignment and coherence of the information sciences curriculum. For instance, the panel learned that some lecturers are unaware of how their course relates to other courses in the programme. It also made the observation that the majority of courses in the information sciences curriculum are shared with other programs. As a result, classrooms are filled with students with different (educational) backgrounds and aims. The panel, therefore, recommends that the programme (management) commit to investing more time and energy in the formal coordination of the programme to ensure that lecturers are made aware of their courses' place and role in the information sciences curriculum specifically.

Another point of attention is that most lecturers are not from the field of information sciences, but rather have a computer sciences background, or come from the School of Management. The panel, therefore,

suggests that - if there is room to hire additional (teaching) staff - efforts should be made to attract expertise from the information sciences field. The panel suggests that such expertise would help with further crafting a shared vision of the programme; this would be useful in making the programme more robust to organizational change, as well as safeguarding the coherence of the programme. Formalizing the current rather informal working culture is an important aspect of that.

Lastly, lecturers report a significant workload, which potentially negatively influences their research time and the ability to dedicate time to professionalization activities. For instance, there are no quotas for thesis supervision resulting in high supervision loads for some. The panel would therefore welcome a more balanced load with regards to thesis supervision. A high workload is a well-known problem in academia; this is not unique to the Information Sciences programme. However, as the programme will revise its ILOs and develop the curriculum accordingly, this will increase the team's workload even further. Adequate measures should be taken to ensure that the teaching staff can deal with the added task of developing the programme without negatively impacting them.

Collaboration with Nijmegen School of Management
The panel sees the obvious benefits of the collaboration with the Nijmegen School of Management (NSM), but does find that it could be strengthened. Ownership of the programme needs to be present in both faculties, and the panel finds that the NSM is not fully involved at the moment. For example, NSM lecturers are often unavailable for thesis supervision and/or unaware that they could play a role. Also, the programme currently offers a somewhat limited course selection for students that are interested in management and business, mostly focused on courses that are on offer by the department of organization design. The panel recommends that the programme explores whether it would be possible to offer students a broader range of electives in management.

Considerations
The curriculum of the MSc Information Sciences reflects the intended learning outcomes of the programme. Students are enthusiastic and content, especially about their options in making their own educational choices (re: electives, thesis topics etc.) and the small scale of the programme. The panel appreciates that the programme offers tracks to help students create a study path, but does find that these overlap considerably. Therefore, reconsidering the tracks is in order; *Aligning Business and IT* could benefit from increased clarity of its goals and strengthening of its content. In addition, the program should provide more insight into the coherence of the curriculum and the (technical) level and depth that is expected in the courses and tracks.

The teaching staff is well-qualified, both in terms of academic activities and teaching qualifications. Most lecturers have a computer sciences background or come from the School of Management. If there is any room to hire additional (teaching) staff, the panel suggests that efforts should be made to attract expertise from the information sciences field specifically. The panel recommends setting up a structure to accommodate regular staff meetings to support a more formal working method is in place rather than the informal structures that are now mainly relied upon (i.e. strengthen form coordination of the programme). The teaching staff will experience an increased workload when the programme executes its revision plans in the near future, and the programme management should therefore be proactive and take adequate measures to counteract any potential issues concerning work load.

The collaboration between the Faculty of Science and the Nijmegen School of Management could be strengthened to ensure that ownership of the programme is experienced in both faculties. Extra efforts by

management could also lead to options to offer students more and a greater variety of (elective) management courses.

Conclusion
The panel concludes that the programme meets standard 2.

Standard 3. Student assessment

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

Findings
The programme refers to the Rules and Guidelines of the Faculty of Science Examination Board 2023-2024 as the leading policy document that outlines assessment practices. In addition to this, the programme adheres to the institutional Manual Quality Assurance Radboud University 2021.

Course assessment
The panel finds that the programme has an adequate system of assessment. Lecturers hold primary responsibility for the quality and level of the assessments that they design. Course assessment methods include among others, written examinations, assignments, papers, projects, and presentations. Every assessment is subject to the 'four eyes' principle; the course coordinator consults with a colleague to check that the assessment tests what is required and whether the size, formulation, and level of the assessments are adequate. For oral exams, a second examiner must be present, or an audio recording must be made. Students informed the panel that they found the assessments transparent and fair.

The relation between the learning objectives of an individual course and its assessment is laid down in a test matrix, which is archived in the course files, which contain the course description, the learning objectives, and the examinations, together with a correction prescription and the test matrix. The course files also include the students' evaluation, the teacher's evaluation, and the findings of the Programme Committee.

Student evaluations are done by online surveys that cover the content and quality of the course, the lecturer, and the appropriateness of the examination. The results are automatically placed in the course files, after which the lecturer is informed and requested to complete their own (teacher's) evaluation. This must include a response to any issues raised in the student evaluations. At the end of each semester, the Programme Committee evaluates all student evaluations as well as the teacher evaluation and flags any problematic courses that require attention. The course files can be viewed by the programme coordinator, the education director, and the Examination Board.

Thesis assessment
Master's theses are always assessed by two members of staff. They each fill in an assessment form and decide on a grade independently. In a subsequent private meeting after the student's presentation the examiners have a discussion to agree on a final grade. In the case of an external project/internship at a company or other institute, the external supervisor(s) are asked for their informal evaluation and feedback; the decision on grades is always the responsibility of staff members to ensure quality and uniformity of the grading.

In preparing for the site visit, the panel reviewed 15 theses, including the accompanying assessment forms. The panel generally agreed with the grades given to the theses they reviewed. However, the panel found that the assessment forms could be improved regarding the transparency of the assessment, as it was sometimes

hard to follow how the individual scores on the subcriteria translated to the (final) grade. As the assessment form is split up into many detailed subcategories, as well as an 'Optional comments' section with an unclear link to the criteria, it has proven difficult for the panel to obtain a comprehensive picture of the performance and outcome of the theses. Furthermore, several examiners only put brief marks (very good/good/ satisfactory) in the fields without further explanation.

Discussions with lecturers and the Examination Board disclosed that grading is supported by an online tool; which means that examiners do not actually use the version of the forms that the panel was presented with. The panel was satisfied to be informed that examiners found the online tool workable. The panel was informed (in rebuttal of this report) that the online tool contains a four-scale rubric (unsatisfactory-satisfactory-good-excellent) to ensure consistent grading, but examiners informed the panel during the site visit that they rather use 'heuristics' to give grades. The panel appreciates the grading experience of examiners, but strongly recommends that the programme encourages a more formal and systematic approach when it comes to master's theses' grading practices. This approach should lead to better calibration and guarantee improved coherence between the assessment form (single items) and the ultimate grade. In addition, examiners should also always substantiate their grade with a narrative in free text form, and as such justify the (final) grade to enforce the enrichment of the grades given. Finally, clear(er) criteria for grades should be set up and adhered to, for instance in the form of a rubric.

Examination Board
The Examination Board (EB) fulfills its legal duties. The EB monitors the quality of examinations and assessments and theses of all programmes of the Educational Institute for Computing and Information Sciences. The EB periodically performs random checks of course files (at least 25% of the course files) with regards to completeness and content (including exams and test matrices) and of theses (at least 10% per programme) to check if these meet the requirements in terms of content, level and form, and to assess whether the final grade is in accordance with this, by consulting the evaluation forms of the assessor (supervisor) and the second reader. The EB sends its findings to the Education Board, which follows up when needed.

An example of an issue raised by the EB has been incomplete course files. Making sure that lecturers complete course files, including the resit exams and test matrices of assessment forms other than written exams, requires ongoing attention. In response to the EB's finding, the Education Centre has set up improved automatic monitoring of the course files. In addition, the topic of course files and more specifically test matrices has been discussed at one of the annual iCIS meeting of teaching staff. The panel appreciates that the EB flags important issues, but also notes that the EB's feedback loop is not systematically fully closed. For example, as the EB does not proactively monitor the level of compliance concerning the quality/completeness of the course files, the achievement of the goal after sending the findings to the Education Board is unclear. The panel suggests that active knowledge of the level of compliance is helpful to the EB in executing its tasks and achieving its goals, and it encourages the EB to engage in a more proactive rather than reactive approach.

The programme offers courses that are organized by the Nijmegen School of Management. The quality of these courses is subject to monitoring by NSM's EB; the results of which are shared with the EB of I&I. The panel learned that beyond this division of tasks, there is no formal contact between the EB's of both faculties. The panel finds that this is an undesirable situation. When strengthening the collaboration between the two faculties, the manner in which the EB's work together and inform each other should be considered (see Standard 2).

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Monitoring of the master's theses by the EB has not signalled any problems concerning the level of the theses or the grades assigned to them, but the EB found some assessment forms lacking in detail, which was also concluded by the panel (see above). In response to this, the assessment forms were revised to draw more attention to the requirement to give an explicit motivation for any grade below 7 or above 8. The panel appreciates the EB's intervention but recommends taking this requirement further so that explicit motivation is always given, no matter the grade (see above).

During the site visit, the panel spoke with examiners about current policies for the use of AI tools such as ChatGPT. It learned that the lecturers have taken on a wait-and-see attitude as the university-wide policy emerges. The panel encourages the EB to proactively create a useful policy on the possibilities and limitations of using AI assistance tools in assessment now, as AI is a reality that is here to stay.

Considerations
The programme has a reliable, valid and transparent system of assessment in place. There are adequate procedures for design and quality assurance of exams, assignments and the theses. The panel recommends that the programme develops a more formal and systematic approach to master's theses' grading practices. This approach should lead to better calibration and guarantee improved coherence between the assessment form and the ultimate grade. Examiners should also aways substantiate their grade with a narrative, and as such justify the (final) grade to enforce the enrichment of the grades given. Finally, clear(er) criteria for grades should be set up and adhered to. The Examination Board fulfils its legal duties, but the panel does recommend that the EB takes on a more proactive approach, for instance concerning the emergence of AI, the collaboration with the EB of the Nijmegen School of Management, and the closing of feedback loops.

Conclusion
The panel concludes that the programme meets standard 3.

Standard 4. Achieved learning outcomes

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

Findings

Thesis quality
Prior to the site visit, the panel studied a representative selection of 15 theses distributed over the two tracks. The panel deemed that all theses were of good or very good quality and would achieve similar grades in other universities as well. There were a number of theses that contained good technical analyses, which the panel found to be positive as this gave a good impression about the level and depth of technical skills that will or should be acquired, which was initially unclear to the panel based on the programme description (see Standard 2). The theses were well elaborated: always discussing background/theory; related work, research questions, method of research/approach, a discussion, and limitations of the work. In most cases, some software was developed and an experiment was performed. A suitable amount of work was put in and a good approach was chosen.

Alumni
Graduates move on to a wide range of positions at a diverse range of organizations (regularly before they graduate): industrial or scientific research, consulting companies, more development-oriented jobs in industry, start-ups active in IT, or just about any public or private organization that relies heavily on IT or information. During the site visit, the panel spoke with alumni who either started their own business or

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moved onto a PhD programme. They all indicated to be satisfied with their education. This was confirmed by the results of the latest alumni survey (2021), where alumni indicated their overall satisfaction with the programme.

Considerations
The theses show that students realize the intended learning outcomes of their programme. Alumni are generally satisfied with their education, and indicate that the programme helped them further shape their career in business and IT.

Conclusion
The panel concludes that the programme meets standard 4.

General conclusion
The panel's assessment of the MSc Information Sciences is positive.

Development points

1. When revising the ILOs, the panel recommends that the programme explicitly takes into consideration:
   a. several internationally recognized frameworks (regarding content and level) to substantiate its choices, and
   b. that the panel's findings regarding the current ILOs are addressed to ensure that the ILOs are not open to interpretation (content and level), take tracks into account, and adequately reference the desired management aspects.

2. Elaborate the concept of decision-making as the future common focus of the programme.

3. Strengthen the collaboration between the Faculty of Science and the Nijmegen School of Business:
   a. at management level, and
   b. between the Examination Boards.

4. With regards to the curriculum:
   a. be explicit about the level and technical depth to be achieved in courses and tracks
   b. revise the tracks, in particular *Aligning Business and IT*
   c. explicate coherence of the curriculum and communicate this with the students.
   d. investigate whether a broader range of electives in management courses can be offered, that go beyond organization design.

5. With regards to the (teaching) staff:
   a. invest in formalizing the current informal work culture: strengthen formal coordination of the programme
   b. if given the opportunity, invest in attracting information sciences expertise

6. With regards to assessment:
   a. improve thesis assessment by formulating clear(er) criteria for thesis grades
   b. require examiners to always substantiate the thesis grade with a narrative.

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Appendix 1. Intended learning outcomes

The Information Sciences study programme aims to enable students to work and think at an academic level and to ensure that graduates of the programme are able to:

1. In relation to IT-related knowledge and skills:
    a. compile a balanced set of requirements;
    b. map out and analyse the mutual relationship of an information system with its environment and the relationship between the components of the system;
    c. create a design of an information system that meets the set of requirements;
    d. guide and monitor the actual construction of an information system;
    e. understand the social aspects of ICT.

2. In relation to fundamental knowledge and skills:
    a. guide the implementation of a project plan;
    b. communicate in an effective and suitable manner;
    c. conduct the necessary negotiations with the different stakeholders;
    d. work, think and reflect on their own contribution at an academic level;
    e. provide a mathematical foundation.

3. In relation to domain knowledge and skills:
    a. analyse, model, reason and validate a solution based on a given problem scenario in a domain relevant to information science.

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Appendix 2. Programme curriculum

		Courses in chronological order			Security & Privacy	Aligning Business and IT
		Course	**EC**	**Quarter**		
Compulsory courses		System Approaches to Information and Organisations	3	1		
		Research Methods	3	1		
		Judgment and Decision Making for Information Sciences	3	2		
		Philosophy and Ethics for Computing and Information Sciences	3	2		
Choose one out of		Software Development Entrepreneurship	6	1 2		
		System Development Management	6	3 4		
Elective program: Security & Privacy		Security in Organisations	6	1 2		
		Law and Technology	6	1 2		
Elective program: Aligning Business and IT		Information Retrieval	6	1 2		
Security & Privacy: choose one out of // Aligning Business and IT: choose two out of		Organisational Change	6	1		
		Organisation Design	6	2		
		Intervention in Organisations	6	2		
		Strategic Scenarios and Business Models	6	3		
Thesis & Research		Master's thesis	18	1 2 3 4		

Appendix 3. Programme of the site visit

Tuesday November 21st, 2023

12.30	14.15	Aankomst en vooroverleg (incl. lunch en open spreekuur)
14.15	15.00	**Gesprek opleidingsmanagement**
15.00	15.30	Pauze
15.30	16.15	**Gesprek studenten en recente alumni**
16.30	17.15	**Gesprek docenten**
17.15	17.30	Intern overleg
18.00		Paneldiner

Wednesday November 22nd, 2023

08.45	09.00	Aankomst en intern overleg
09.00	09.30	**Interview examencommissie**
09.30	10.00	Intern overleg
10.00	10.30	**Eindgesprek opleidingsmanagement**
10.30	12.30	Opstellen oordelen
12.30	13.15	**Mondelinge terugkoppeling**
13.15	13.30	Afronding

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Appendix 4. Materials

Prior to the site visit, the panel studied 15 theses. Information on the theses is available from Academion upon request. The panel also studied other materials, which included:

Self-evaluation report

Teaching and courses
- Document containing the main URL of the prospectus as well as URLs of course descriptions and description of course materials
- Brightspace materials: Auditor role for panel members has been added to Brightspace courses
- Course files (including student and lecturer evaluations) for 2021 and 2022.
- Thesis evaluation form

Management information and reports
- Annual reports from 2023 and 2021 (ac. year 2019-2020), including detailed management information and figures. (No reports were written in intermediate years due to COVID and pending format changes).
- Annual reports of the Examination Board. For 2020-2021 and 2021-2021, the annual reports were faculty wide; these reports have been edited in that content related to other programmes has been removed.
- (Draft) minutes of meetings of the Programme Committee 2021-2022-2023, as well as annual reports.

Assessment
- Examinatorenbeleid FNWI (FoS Examiner Policy)
- Handboek kwaliteitszorg RU (Manual Quality Assurance)
- Rules and Guidelines Examination Board FoS

Other
- EER Information Sciences
- Two reports of meetings with members of the Professional Field
- A document containing additional websites (e.g. about Elsevier or Keuzegids Rankings)
- NSE fact sheets of recent years
- Alumni surveys
- Follow-up recommendations previous panel