hbo-master Data Science for Life Sciences

Hanze University of Applied Sciences

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1 Executive summary

The Accreditation Organisation of the Netherlands and Flanders (NVAO) received a request for an initial accreditation procedure regarding a proposed hbo-master Data Science for Life Sciences at Hanze University of Applied Sciences. NVAO convened an expert panel, which studied the information available and discussed the proposed programme with representatives of the institution and the programme during a site visit.

The following considerations have played an important role in the panel's assessment.

The programme's main objective is to train students to acquire relevant skills for data handling and analyses, data stewardship and effective communication in a multidisciplinary, professional and international setting. The programme intends to prepare professional data scientists to work in a self-directed and autonomous manner on complex problems, integrating data from different areas within the scope of the life sciences. The panel established that the intended learning outcomes comply with the Dublin descriptors for the master's level and have a clear professional orientation. The panel recognizes the high demand for professional data scientists in the life sciences and highly appreciates the initiative for fulfilling this demand by establishing this programme.

The intended learning outcomes were developed in close co-operation with the regional professional field to ensure that the learning outcomes and content are up-to-date and aligned with professional needs and demands. A particularly strong element of the programme is its embeddedness within the regional professional field, which provides students with the opportunities to work on real life research projects through which they can apply their knowledge and skills in a practical context. That being said, the panel does think that the programme could benefit from a more "external" – outside of the region of Groningen, or even international – view for its future development.

The programme expects graduates to find a job within an internationally oriented work environment, which is the reason for positioning the programme as an international master. Although the Hanze University of Applied Sciences has a strong overall internationalisation strategy and a relevant partner network, in the opinion of the panel, the programme itself should offer more than simply opening up the classroom for international students. The panel therefore recommends the programme management to further develop and clarify its vision on internationalization at a programme level.

Concerning the teaching-learning environment, the panel considers the curriculum to be well-designed. Strong elements are the real life research projects, the project modules in the first year which offer a flexible and hands-on introduction into relevant data-science for life sciences topics and state-of-the-art IT-facilities. The digital portfolio related to the *Professional and Research Skills* module is a key asset of the programme. The panel believes that the combination of the portfolio, mentoring and assessment system guarantees a balanced development of the broad competence profile that is laid out in the intended learning outcomes. However, as it became clear that various delegation with whom the panel spoke had a different understanding of the concept of entrepreneurship and its related competences, the panel recommends the programme management to closely monitor whether the translation of the intended learning outcome "Being entrepreneurial" in the curriculum is in line with the expectations of various stakeholders.

The panel is enthusiastic about the experienced lecturers who seem to be well equipped to implement the programme. All in all, the panel is convinced that the curriculum, the teaching-learning environment and the quality of the teaching staff will enable incoming students to achieve the intended learning outcomes.

With regard to the assessment, the panel established that the programme has a solid assessment plan in place and that it is characterised by a wide variety of assessments. The panel noticed that the representatives of the Examining Board, Assessment Committee and Program Committee are well aware of the potential vulnerabilities for the Data Science for Life Sciences programme. The panel was impressed by their attention to detail and encourages them to maintain their critical eye. The panel shares the concern of the Examining Board that the summative assessment of the portfolio at the end of the final semester could potentially lead to a higher study load for students. Subsequently, the panel recommends keeping an eye on the study load of the portfolio through the module evaluations and student mentoring.

The panel comes to the conclusion that the programme meets all assessments standards. Given these considerations, the panel advises NVAO to take a positive decision regarding the quality of the proposed programme hbo-master Data Science for Life Sciences at Hanze University of Applied Sciences.

The Hague, 8 October 2018

On behalf of the assessment panel convened for the initial limited accreditation assessment of the hbo-master Data Science for Life Sciences at Hanze University of Applied Sciences,

Dr. ir. K. Anton Feenstra   Aurelie van 't Slot MA
(chair)   (secretary)

2 Introduction

2.1 The procedure

NVAO received a request for an initial accreditation procedure including the information dossier regarding a proposed hbo-master Data Science for Life Sciences. The request was received on 3 April 2018 from Hanze University of Applied Sciences.

An initial accreditation procedure is required when a recognised institution wants to award a recognised bachelor's or master's degree after the successful completion of a study programme. The procedure for initial accreditation is slightly different as compared to the approach for programmes that have already been accredited. Initial accreditation is in fact an ex ante assessment of a programme. The programme becomes subject to the normal accreditation procedures once initial accreditation has been granted.

To assess the program, the NVAO convened an international panel of experts (see also Annex 1: Composition of the panel). The panel consisted of:
Chair:
− Dr. ir. K. Anton Feenstra, assistant professor Bioinformatics ,Vrije Universiteit van Amsterdam;

Panel members:
− Mieke Demeyere, lectorate in biotechnology, Howest University of Applied Sciences;
− Kim Bisschop MSc, Liaison Officer Universities of Applied Sciences at the Medical Delta and Manager Exernal Affairs and Internationalisation, Institute of Healthcare, Rotterdam University of Applied Sciences;

Student member:
− Lars Blom, student Software Engineering with a specialisation in cyber security, Fontys University of Applied Sciences.

On behalf of the NVAO, Gijs Kremers and Aurelie van 't Slot were responsible for the process-coordination and the drafting of the experts' report.

This composition reflects the expertise deemed necessary by NVAO. (Annex 1: Composition of the panel). All the panel members signed a statement of independence and confidentiality.

The panel has based its assessment on the standards and criteria described in the NVAO Assessment framework for the higher education accreditation system of the Netherlands (Stcrt. 2016, nr 69458).

The following procedure was undertaken. The panel members prepared the assessment by analysing the documents provided by the institution (Annex 3: Documents reviewed). The panel organised a preparatory meeting on 25 September 2018 - i.e. the day before the site visit. During this meeting, the panel members shared their first impressions and formulated questions for the site visit.

The site visit took place on 26 September 2018 at Hanze University of Applied Sciences. During this visit, the panel was able to discuss the formulated questions and to gather additional information during several sessions (Annex 2: Schedule of the site visit). Afterwards, the panel discussed the findings and considerations and pronounced its preliminary assessments per theme and standard. At the end of the site visit, the initial findings were presented to the institution.

Based on the findings, considerations and conclusions the secretary wrote a draft advisory report that was first presented to the panel members. After the panel members had commented on the draft report, the chair endorsed the report. On 11 October 2018 the advisory report was sent to the institution, which was given the opportunity to respond to any factual inaccuracies in the report. The institution replied on 18 October 2018. All suggested corrections were adopted. Subsequently the final report was endorsed by the panel chair.

2.2 Panel report

The first chapter of this report is the executive summary of the report, while the current chapter is the introduction.

The third chapter gives a description of the programme including its position within the institution, Hanze University of Applied Sciences and within the higher education system of the Netherlands.

The panel presents its assessments in the fourth chapter. The programme is assessed by assessing the themes and standards in the Initial Accreditation Framework. For each standard the panel presents an outline of its findings, considerations and a conclusion.

The outline of the findings are the objective facts as found by the panel in the information dossier, in the additional documents and during the site visit. The panel's considerations consist of the panel's judgments and subjective evaluations regarding these findings and their relative importance. The considerations presented by the panel are at the basis of a concluding overall assessment.

The panel concludes the report with a table containing an overview of its assessments per standard.

3 Description of the programme

3.1 General

Country	: The Netherlands
Institution	: Hanze University of Applied Sciences
Programme	: Data Science for Life Sciences
Level	: Master
Orientation	: HBO
Specialisation	: n/a
Degree	: Master of Science
Location	: Groningen
Study Load (EC)	: 90 EC
Field of Study	: Technology

3.2 Profile of the institution

Hanze University of Applied Sciences (hereafter: Hanze UAS) was founded in 1798 and offers 54 Bachelor degrees, 19 Master degrees and 8 Associates degrees, both full-time and part-time, in the social, economic and technical domain as well as in the domains of health care and the arts.

Hanze UAS aspires to be a learning community where teaching, research and professional practice are inseparably intertwined. This learning community consists of living labs where students, lecturers and practitioners from the professional field learn from each other and work together on solving current societal challenges. These aspirations are reflected in the mission of Hanze UAS:

Hanze University of Applied Sciences Groningen educates skilled and committed professionals and conducts applied research, making it a key partner locally, nationally and internationally in the development of entrepreneurship and innovative, applicable knowledge.

3.3 Profile of the programme

The master's programme *Data Science for Life Sciences* is a new programme in the Netherlands. The information dossier indicates that there are several related wo-master programmes, but no other programmes at hbo-master level. The master's programme is taught in English and intends to prepare master students for an internationally oriented career as professional data scientists for the life sciences sector.

Data Science for Life Sciences students will learn to take on an active role to get the best information out of the growing (medical) data banks. The applied curriculum and the strong connection with the life sciences industry and other partners like universities and hospitals will create an effective learning environment for graduates to gain relevant insights on new data processing technologies. They are skilled in methods for data handling and analysis whilst also receiving training in data stewardship and effective communication, especially in a multidisciplinary setting. Furthermore, the programme strives to deliver graduates with an entrepreneurial attitude by facilitating opportunities to work in close co-operation with

experts from the professional field on design and innovation processes, where aspects such as project-based work and working in (multi)disciplinary teams are addressed.

4 Assessment per standard

This chapter presents the evaluation of the standards by the assessment panel. The panel has reproduced the criteria for each standard. For each standard the panel presents (1) a brief outline of its findings based on the information dossier and on documents provided by the institution and the site visit, (2) the considerations the panel has taken into account and (3) the panel's conclusion. The panel presents a conclusion for each of the standards, as well as a final conclusion.

The assessment is based on the standards and criteria described in the NVAO Assessment framework for the higher education accreditation system of the Netherlands (Stcrt. 2016, nr 69458). Fundamental to the assessment is a discussion with peers regarding the content and quality of the new programme.

Regarding each of the standards, the assessment panel gives a substantiated judgement on a three-point scale: meets, does not meet or partially meets the standard. The panel subsequently gives a substantiated final conclusion regarding the quality of the programme, also on a three-point scale: positive, conditionally positive or negative.

4.1 Standard 1: Intended learning outcomes

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

Outline of findings
The programme's main objective is to train students to acquire relevant skills for data handling and analyses, data stewardship and effective communication in a multidisciplinary, professional and international setting. The programme intends to prepare professional data scientists to work in a self-directed and autonomous manner on complex problems, integrating data from different areas within the scope of the life sciences. Next to internationalization, the master's programme is also focused on entrepreneurship, which is inextricably linked to practice-based approach of the programme.

The programme has formulated six intended learning outcomes: Conduct critical and creative research, Model meaningful information, Deliver organized solutions, Communicate effectively, Being responsible and Being entrepreneurial. These learning outcomes are constructed in a matrix and match individual courses and the programme as a whole. The learning outcomes reflect a professional character. In the information dossier it is substantiated that they comply with the Dublin descriptors.

According to the information dossier, the intended learning outcomes were developed in close co-operation with the professional field to ensure that the learning outcomes and content are up-to-date and aligned with (international) professional needs and demands. The representatives of the professional field interviewed by the panel expressed the need for graduates within the field of data science and were very enthusiastic about the proposed programme. Several representatives were consulted in the set-up of the programme and

indicated that they are eager to stay involved in its further development, for example through guest lectures or as a member of the Professional Board.

The programme expects graduates to find a job within an internationally oriented work environment, which is the reason for positioning the programme as an international master. As is described in the information dossier, the Hanze UAS is located in a region that contains many internationally oriented research institutes and companies active in or related to the life sciences. In addition, the programme notes that workspaces in the Netherlands tend to be internationally oriented because of international cooperation on joint databases. In the future, the programme also aims to attract students from abroad who can potentially contribute in fulfilling the growing demand for data scientists in life sciences. During the site visit, the panel learned that Hanze UAS works with several preferred international partners with whom agreements are made concerning the exchange of teachers and scholarships.

Next to internationalization, the master's programme is also focused on entrepreneurship. Representatives of the institutional management explained that entrepreneurship is embedded within all the programmes offered by Hanze UAS. The Data Science for Life Sciences programme aims to foster entrepreneurial behaviour by providing an environment in which students can work with experts from the professional field. An example mentioned in the information dossier is the innovation work place 'Digital Society Hub' supervised by Hanze UAS Centre of Entrepreneurship. This is a living lab where students, lecturers, researchers and entrepreneurs work together on the latest technological developments.

Considerations
The panel has taken note of the intended learning outcomes and considers these both relevant and ambitious. The panel established that the ILO's comply with the Dublin descriptors for the master's level and, therefore, meet the master's level requirements. The panel recognizes the high demand for professional data scientists in the life sciences and highly appreciates the initiative for fulfilling this demand by establishing this programme. Additionally, the panel was pleased to hear that the representatives of the professional field are really enthusiastic to stay involved in further development of the programme.

The panel considers the connection with the regional professional field a strong suit of the programme. However, in the current set-up of the programme and the composition of the Professional Board, the professional field outside the region of Groningen is not represented. The panel understands the reasoning behind the regional focus for the initial set-up of the programme, but thinks that the programme could benefit from a more "external" – outside of the region, or even international – view for its future development. Furthermore, the panel recommends the programme to ensure a sustainable relationship with all relevant external stakeholders which enables the programme to stay up to date in a fast changing work field.

Although the Institute for Life Science & Technology takes part in a national consultative body for research and education within the domain of the Life Sciences, the panel found that these national contacts have not been established at a programme level. It therefore advises the programme management to actively establish these contacts with similar master's programmes, which would help in further clarifying its own national profile. It is the opinion of the panel that clarifying the programme's profile will be beneficial in attracting and informing potential students.

The programme positions itself as an international master. During the site visit, the panel learned that the vision on internationalization is well developed at an institutional level. However, when speaking to representatives of the programme, the panel found that their vision on internationalization was limited to the international experience of staff members and the internationally oriented work environment within the professional field. According to the panel, a truly international master's programme should offer more than simply opening up the classroom for international students. Running an international master's programme demands a more explicit internationalisation strategy and policy, including a shared vision and strong commitment among all staff members. Both students and staff will need policy documents to explain the why and how about internationalisation. In addition, practical procedures should be described for recruiting, housing and administrative support for incoming students. During the site visit the panel learned that budget and knowhow for capacity building of teaching staff is already available within the institution. Furthermore the Hanze UAS has a strong overall internationalisation strategy and a relevant partner network that can also be used for the master DSLS.

Conclusion
The programme meets standard 1.

4.2 Standard 2: Teaching-learning environment

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

Outline of findings
The international master's programme Data Science for Life Sciences intends to train students to become thorough researchers and professionals specialized in data-driven methodologies that play an increasingly prominent role in Life Sciences. The programme's curriculum consists of a total study load of 90 European Credits (EC) and has a nominal length of 1,5 years. The master's programme is divided into three semesters, including a preparatory course of 5 EC and a graduation project of 30 EC.

The focus of the master is on *health* and *agri-food* topics. Research activities of partners ranging from professorships and living labs to research departments of the UMCG are embedded in the core of the educational programme. These partners will provide *real life research projects* in which students will encounter challenging problems that require creativity, critical sense, teamwork and knowledge creation. By connecting students, lecturers, research and partners from the professional field, the programme aims to develop a *community of learners* in which education, research and professional practice connect and reinforce one another. Such a community then also aims to foster an entrepreneurial attitude and will aid in the development of competences related to entrepreneurship.

Curriculum
Semester one and semester two have a similar structure, divided into three components:
– Projects (20 EC)
– Courses (30 EC), including the preparatory course (5 EC)
– Research and Professional skills (10 EC)

The *Projects* component of the curriculum consists of two modules (one in each semester) and forms the core of the first year. Each module consists of comparatively large research projects that run throughout the semester. In the information dossier, they are referred to as projects on omics, which encompasses the collective set of fields relevant for data science in the life sciences (genomics, transcriptomics, proteomics, etc.). The content of these research projects are provided by the partners of the programme and require students to work together as a group, forming learning communities. It is envisioned that students will utilise the various knowledge and skills learned in the other modules to be integrated and applied in a practical context.

During the site visit the panel learned that the projects will focus on both health and agri-food topics. Both sectors are characterized by a strong life sciences component and share similar data-driven methodologies. Students are not required to become experts on both topics, but are expected to choose projects based on their interests.

The *Courses* component of the curriculum consists of six modules (three in each semester), including the preparatory course in semester one. The modules cover various theories, methods and tools on *data science* and *programming*.

The *Research and Professional Skills* component of the curriculum consists of one module that runs throughout the entire programme. During this module, students will develop more general skills like critical and creative thinking, experimental design, collaboration, effective communication, project management, being entrepreneurial and responsible. Students are required to develop a digital portfolio in relation to this module that contains evidence of their learning and professional development.

The panel initially questioned the choice of the programme to schedule the summative assessment of the portfolio at the end of the third semester. On paper, this means that in terms of EC, the study load for students is considerably higher in the final semester. The representatives of the programme explained that they specifically chose for the module to run throughout the entire programme, since the portfolio is aimed to give a complete overview of the student's competences and the development thereof. The assessed competences are closely related to the projects, meaning that students will be able to fill the portfolio during the first and second semester. The third semester can then be used to fill any remaining gaps or to further enrich the portfolio with examples from the graduation project. As such, the actual study load is mostly limited to the first and second semester.

The *Research and Professional Skills* module is also used to further develop the student's entrepreneurial attitude. During several workshops, students will learn more about project management and working in a professional environment. Representatives of the programme stressed that students are not expected to become entrepreneurs in the sense of being able to start their own business, but rather to develop skills that will enable them to translate research results into business cases.

The third and final semester of the curriculum is mostly dedicated to the *Graduation project and thesis* (30 EC). Students are expected to individually conduct an applied research project for a duration of six months at one of the related professorships, research centres or a client in the professional field. It is required that the topic of the research project enables the student to demonstrate mastery of all the intended learning outcomes at a final level.

Didactical approach

The didactical approach as described in the information dossier is derived from the 'seven design principles' of Filip Dochy and his theory of High Impact Learning that Lasts (HILL). The panel has established that the programme has adequately described how these seven design principles informed the development of the master's programme. The didactical approach fits the practice-based curriculum. It furthermore emphasizes a hybrid learning environment which includes a variety of teaching methods such as lectures, in practice, by discussion, presenting, etc.

Entry requirements

The programme is expected to be attractive for Dutch and international students who want to become experts in FAIR (Findable, Accessible, Interoperable and Re-usable) data science for life sciences data and research. In order to be admitted, candidates are expected to hold one of the following bachelor's degrees:
- Bachelor of Chemistry;
- Bachelor of Chemical Engineering;
- Bachelor of Biology & Medical Laboratory Research;
- Bachelor of Bioinformatics;
- Bachelor of Information and Communication Technology;
- Bachelor of Medical Imaging and Radiation Therapy;
- Bachelor of Engineering, Sensor Technology.

The panel learned that this list is non-exhaustive, but is currently limited to bachelor's programmes offered by Hanze UAS.

All candidates with a bachelor's degree within the fields described above must deliver documented proof of knowledge and skills in the disciplines of programming, data science and biology. Furthermore, candidates must show proficiency in English. The minimum level of English is similar to other international master's programmes offered by Hanze UAS. An Admissions Committee, consisting of three members, will assess the student's potential and prospects. Should there be any type of deficiency or doubt about the student's knowledge and skills, then the student is asked to take an entry test of which the precise content will be decided on by the Admissions Committee.

The programme also offers a preparatory course consisting of three modules: Programming knowledge and skills (2,5 EC), Data science knowledge and skills (2,5 EC) and Biology knowledge and skills (2,5 EC). The Admissions Committee will advise which modules of the preparatory course are necessary to reach a sufficient level of entry. Incoming students should receive an exemption for one of the modules in order to participate in the preparatory course. An exemption can be received either based on a portfolio or based on the result of an entry test. All students are required to participate in two preparatory modules. Attendance of the lectures is not compulsory, but the student should pass the final exam of the module.

Study guidance

Once students are admitted to the programme, they can receive support and study guidance from a mentor. During the site visit, the panel understood that one teacher will act as the mentor for all students. Mentoring during the first and second semester is an important element in coaching students' development. The mentor also fulfils a role in the criterion-based interviews that are used to assess the student's progress in achieving the intended learning outcomes (also see 4.3).

Prior to the site visit, the panel did not receive any information concerning support for students with disabilities. During the site visit, the representatives of the programme management explained that they have plenty of experience with students who have mental or physical disabilities, which is why they did not address specific facilities or guidance for disabled students in the application documentation. The Institute of Life Science & Technology furthermore has two supporting staff members who provide guidance for students with disabilities.

Staff
The panel has received the CV's of all staff members and had an interview with several lecturers on the day of the site visit. The teaching team consists of two professors and twelve lecturers and is led by a programme manager. The programme selected the teaching staff based on their profound level of English language proficiency, teaching experience and specialist knowledge. Lecturers that will act as final examiners are required to be doctorate holders or PhD candidates. As is explained in the information dossier, staff quality is maintained by active participation in existing networks, seminars or dedicated training. The focus of these activities can either be on a subject matter or on didactic skills.

Both the teachers and the representatives of the programme management explained that 10% of their appointment can be used for further professionalization. Hanze UAS also offers additional training in intercultural competences.

Facilities
During the site visit, the panel was shown several specific facilities, such as lab rooms with PCs and a designated room for the master students of the Data Science for Life Sciences programme. Students and staff of the master's programme have their own high-performance computer network that is under the management of the Institute for Life Science & Technology. For large-scale research, the network can be deployed as a Grid network, allowing large-scale data processing and analysis.

Considerations
The panel considers the curriculum to be well-designed. Strong elements are the real life research projects where students can apply their knowledge and skills in a practical context, the project modules in the first year which offer a flexible and hands-on introduction into relevant data-science for life sciences topics and state-of-the-art IT-facilities. The digital portfolio related to the *Professional and Research Skills* module is a key asset of the programme, making the individual student's development visible throughout the programme. The panel believes that the combination of the portfolio, mentoring and assessment system (see paragraph 4.3) guarantees a balanced development of the broad competence profile that is laid out in the intended learning outcomes. That being said, the panel did notice during the site visit that various delegations seemed to have a different understanding of the concept of entrepreneurship and its related competences. It advises the programme management to closely monitor whether the translation of the ILO "Being entrepreneurial" in the curriculum is in line with the expectations of various stakeholders, in particular those of the professional field.

The diversity of the incoming students – both in terms of learning styles and former education – will definitely be challenging, but the panel is convinced that the programme is well prepared to attend to the needs of such a diverse student body. In terms of study

guidance, the panel does question whether one mentor for the entire cohort of students will be sufficient. It recommends the programme management to make clear choices in terms of the guidance ratio and urges to do so before the programme starts.

During the site visit, the panel had some difficulties in understanding what the admission procedure and related admission requirements entailed. Based on the Admission Procedure manual that was provided on site and the various discussions with representatives of the programme, the panel gained better understanding of the admission procedure. It considers the admission requirements appropriate in light of the programme's level and discipline. However, the entire admission procedure remains rather complex and the panel therefore advises the programme management to closely monitor if this will work out as planned once the programme has started. In addition, the panel suggests to expand the list of admissible bachelor's degrees with other programmes in the Netherlands and abroad. An international benchmark will be needed to decide which students can be admitted from international bachelor programmes.

The panel was pleased to hear that bachelor students from Hanze UAS will be advised to follow specific minors in preparation of the master's programme. The panel considers the preparatory course to be a sufficient way for students to fill any specific lacunas with respect to the life sciences, data analysis and/or programming. Although it is stated that students are exempted from one of the modules in the preparatory course, this "exemption" actually functions as an admission requirement because incoming students should be "exempted" from one of the modules in order to participate in the preparatory course. The panel therefore suggests to refrain from using the word "exemption", and instead address this scheme as an admission requirement.

The panel considers the teaching staff to be well-equipped to implement the programme. The expertise of the teaching team is particularly strong and the panel was pleased to hear that the Institute for Life Science & Technology is currently recruiting a lector in Data Science for Life Sciences. The staff development plan offers teachers the opportunity to further develop their competences, for example by following a training in intercultural skills. The panel is convinced that the programme offers a strong teaching-learning environment.

Conclusion
The programme meets standard 2.

4.3   Standard 3: Assessment

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

Outline of findings
As is described in the information dossier, the Examining Board is responsible for assuring the quality of the programme by supervising the content, method and level of examinations. It consists of five members (one of each bachelor's programme) and one external member, who are appointed by the dean. The members of the Examining Board explained that its composition will not be altered when the proposed master's programme will start, since one of its members will be teaching in the master's programme and will also act as a final examiner. All members have obtained a Basic Qualification in Examination (Dutch

abbreviation: BKE). Examiners and final examiners are appointed by the Examining Board and need to meet certain requirements that are laid out in the assessment policy of the Institute for Life Science & Technology.

The Examining Board gives mandate to the Assessment Committee for the operational work on safeguarding assessment. All programmes within Institute for Life Science & Technology are represented in the Assessment Committee. It is advised by an educational expert and includes one member of the Examining Board. The Assessment Committee reports to the Examining Board on the quality of examinations and fulfils both a signalling and advisory role within the quality assurance system.

In order to guarantee that the assessment is relevant to professional practice, the degree programmes of the Institute for Life Science & Technology also consult members of the Professional Board in the assessment of the exit level (i.e. "Graduation Projects").

The assessment system is described in the established policy of the Institute for Life Sciences & Technology, which corresponds to the policy of the Hanze UAS as a whole. In line with the assessment policy of the Institute for Life Science & Technology, the Data Science for Life Sciences programme has an assessment plan prescribing the form of assessment per course. During the site visit, the panel was able to establish that rubrics have been constructed for each semester.

The regulations regarding the admission, curriculum and examination of the Data Science for Life Sciences master's programme are documented in the Teaching and Examination Regulations (TER).

The programme has laid out several principles in the information dossier that guide its assessment plan. For instance, to cover the range of competences of a data scientist in the life sciences, the programme has included a wide variety of assessment types in the curriculum. Furthermore, hands-on research projects are a crucial component of the programme. The assessment of these projects is aimed at professional knowledge and its application in complex real-life projects that need creative and critical approaches.

Students are also required to develop a digital portfolio in relation to the *Professional and Research Skills* module that contains evidence of their learning and professional development. The programme intends to use this portfolio as an instrument to monitor the student's development and provide constructive feedback in relation to competences and skills that need to be acquired to meet the intended learning outcomes. The student's mentor plays an active role in the criterion-based interviews that are used to assess the digital portfolio. The interviews held in semester one and two are formative and allow the student to set new learning goals for the next semester. The final interview, held at the end of the master thesis phase, is summative. Assessment criteria are based on the description of each intended learning outcome. The programme has developed a Proof of Competence Manual for the assessment of the portfolio, which was provided to the panel on site.

The panel raised its concerns in relation to the summative assessment of the portfolio, also with the representatives of the Examining Board, Assessment Committee and Program Committee. During the site visit, the representatives explained that they had already questioned the programme management about this issue. They received additional information which substantiated the choice to schedule the summative assessment at the

end of the third semester. This also serves as an example of how the various committees were consulted and involved in the preparation of this master's programme. The representatives told the panel that their feedback has been taken into account and that the programme management has definitely earned their trust.

Considerations
The panel established that the programme has a solid assessment plan in place and that it is characterised by a wide variety of assessments. The panel furthermore established that the Institute for Life Science & Technology has an experienced Examining Board which has reliable procedures and the necessary level of independence. The way the Examining Board fulfils its tasks is in line with the legal tasks described in the WHW. The assessment and examination regulations of the master's programme are clearly described in the Teaching and Examination Regulations.

During its preparation for the site visit, the panel noticed some inconsistencies in the application documents, notably with regard to the assessment guidelines and the study load of the preparatory course. The panel was pleased to see that several documents such as the graduation manual, the TER and the admission procedure had been updated since the application of the proposed programme. This increased their quality and notably enhanced their transparency. The panel noticed that the representatives of the Examining Board, Assessment Committee and Program Committee are well aware of the potential vulnerabilities for the Data Science for Life Sciences programme. The panel was impressed by their attention to detail and encourages them to maintain their critical eye. In relation to the summative assessment of the portfolio, the panel shares the concern of the Examining Board that this could potentially lead to a higher study load for students in the third semester. Subsequently, the panel recommends keeping an eye on the study load of the portfolio through the module evaluations and student mentoring.

Conclusion
The programme meets standard 3.

4.4 Qualification and field of study (CROHO)

The panel advises to award the degree 'Master of Science' to the hbo-master Data Science for Life Sciences. The panel supports the program's preference for the CROHO field of study 'Technology'.

4.5 Conclusion

The panel concludes that the programme meets all three standards. The application documentation, the extensive programme materials on site and the discussions with motivated delegations have provided the panel with a comprehensive view of the programme. The panel considers the new master's programme to be a well-developed, ambitious and highly relevant programme. 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. A particularly strong element of the programme is its embeddedness within the regional professional field, which provides students with the opportunities to work on real life research projects through which they can apply their knowledge and skills in a practical context. The curriculum, the teaching-learning environment and the quality of the teaching staff will enable incoming

students to achieve the intended learning outcomes. The programme has an adequate system of student assessment in place, in which the Examining Board and Assessment Committee play an important role in terms of assuring the quality of (final) examinations. All in all, the panel assesses the quality of the programme as positive.

4.6 Recommendations

The panel has also made some recommendations, which are meant for further improvement of the quality of the programme.

- The panel thinks that the programme could benefit from a more "external" – outside of the region, or even international – view for its future development. Subsequently, it advises the programme to take this into account when it comes to the composition of the Professional Board.
- The panel advises the programme management to actively establish contacts with similar master's programmes in the Netherlands. Such contacts would help in further clarifying the programme's own national profile.
- The panel recommends the programme management to further develop and clarify its vision on internationalization at a programme level.
- The panel advises the programme management to closely monitor whether the translation of the ILO "Being entrepreneurial" in the curriculum is in line with the expectations of various stakeholders, in particular those of the professional field.
- The panel recommends the programme management to make clear choices in terms of the guidance ratio and urges to do so before the programme starts.
- The panel advises the programme management to closely monitor if the admission procedure will work out as planned once the programme has started.
- The panel suggests to expand the list of admissible bachelor's degrees with other programmes in the Netherlands and abroad.
- The panel suggests to refrain from using the word "exemption" in relation to the modules of the preparatory course, and instead address this scheme as an admission requirement.
- The panel recommends keeping an eye on the study load of the portfolio through the module evaluations and student mentoring.

5 Overview of the assessments

Standard	Assessment
Intended Learning outcomes *Standard 1 : 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*	Meets (weighted and substantiated)
Teaching-learning environment *Standard 2 : The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.*	Meets (weighted and substantiated)
Student assessment *Standard 3: The programme has an adequate system of student assessment in place.*	Meets (weighted and substantiated)
Conclusion	Positive (weighted and substantiated)

Annex 1: Composition of the panel

Dr. ir. K. Anton Feenstra, assistant professor Bioinformatics ,Vrije Universiteit van Amsterdam (chair)

Anton Feenstra received his engineering degree in Molecular Life Sciences from Wageningen University in 1996 and his PhD on protein dynamics at the University of Groningen, under guidance of profs. Herman Berendsen and Alan Mark, in 2002. He then worked on dynamics, binding and reactivity of biotransformation enzymes, and since 2005 is active in teaching and research in bioinformatics. His research focuses on protein interaction prediction and modelling signalling and regulatory networks. He created a project module 'Bioinformatics for Drugs Design' for the Hogeschool Leiden, transformed the master Bioinformatics into a joint programme Bioinformatics and Systems Biology, and set up the new entry course Fundamentals of Bioinformatics. Anton has taught many courses in chemistry and bioinformatics at the bachelor and master level, has been chair of the programme committee, master coordinator, member of an accreditation committee, and involved in two rounds of accreditation of the master Bioinformatics and Systems Biology.

Mieke Demeyere, lectorate in biotechnology, Howest University of Applied Sciences

Mieke Demeyere got her engineering degree in Biochemistry in 1997 before becoming a lecturer in biotechnology and molecular biology. After having an advanced training in Bioinformatics, she set up the minor Bioinformatics in 2007 at the Howest University of Applied Sciences. Since 2010 she is the programme coordinator of the bachelor programme Biomedical Laboratory Science. Mieke organised several additional trainings such as the seminar Bioinformatics for the medical molecular laboratory. In 2013 she submitted the application for an advanced bachelor of bioinformatics and after receiving the initial accreditation in 2014, Mieke also became the programme coordinator of this advanced bachelor. Since 2017 she is organising the postgraduate "Applied Bioinformatics for the medical molecular diagnostic". She is chair of the Program Committee and the Assessment Committee for both educational programmes.

Kim Bisschop MSc, Liaison Officer Universities of Applied Sciences at the Medical Delta and Manager External Affairs and Internationalisation, Institute of Healthcare, Rotterdam University of Applied Sciences

After her first career as an occupational therapist in a university hospital, Kim started teaching at the Faculty for Paramedical Education of Rotterdam University of Applied Sciences in 1998. Within this department she got involved in internationalisation, inter-professional education, honours programmes and innovation through co-creation with external stakeholders. In 2012 she changed jobs within the university and became a staff member of the Healthcare Institute as Manager External Affairs and Internationalisation. She is responsible for strategy and policy-making and is functional manager for some inter-professional teacher groups for healthcare education- and research-programmes. In 2015/2016 Kim followed the executive master Management in Education at TIAS Business School. This gave her a deeper insight in strategy, governance and policy-making for semi-public organisations like universities and healthcare institutions. She is specialized in governance of public private cooperation in quadruple helix innovation for the healthcare sector. Since 2017 she combines her job as a manager with part time work at The Technical University Delft as Liaison Officer in the Medical Delta network, which consists of five universities, four universities of applied sciences and the local government, focussing on innovation and valorisation in healthcare technology.

Lars Blom, student Software Engineering with a specialisation in cyber security, Fontys University of Applied Sciences (student member)
Lars Blom is currently graduating in Cyber security focussing on a forensic expertise. He has been a member of the Degree program committee for 4 years and was chairman of the degree program committee for the last three and a half years. He is co-founder and board member of hacker community Hatstack where he was in charge of treasury.

On behalf of the NVAO, Gijs Kremers and Aurelie van 't Slot were responsible for the process-coordination and the drafting of the experts' report.

Annex 2: Schedule of the site visit

The panel visited Hanze University of Applied Sciences on 26 September 2018 as part of the external assessment procedure regarding the hbo-master Data Science for Life Sciences.

08:30 – 09:00   **Preparatory panel meeting** *(confidential)*

09:00 – 09:15   **Reception and welcome**
- Dr. Victorine de Graaf, Dean ILST
- Drs. Ida van der Veen, team leader MA DSLS
- Fenna Feenstra MSc, project leader MA DSLS

09:15 – 09:45   **Representatives of the Executive Board and Institute for Life Science & Technology**
- Drs. Henk Pijlman, chair Executive Board Hanze UAS
- Dr. Victorine de Graaf, Dean ILST

10:00 – 10:45   **Representatives of the Programme Management**
- Dr. Victorine de Graaf, Dean ILST
- Drs. Ida van der Veen, team leader MA DSLS
- Dr. Hugo Velthuijsen, Lector New Business and ICT

11:00 – 11:45   **Representatives of the Professional Field**
- Prof. dr. Lude Franke, head section research and education, associate professor UMCG
- Dr. Johan Blok, researcher/teacher New Business & ICT, Hanze UAS
- Dr. Ronald Apeldoorn, Market Intelligence and Patents Manager, Avebe Groningen
- Lennart Johansson, PhD Candidate UMCG
- Prof. dr. Peter Horvatovich, associate professor UMCG
- Dr. Celia van Gelder, programme manager learning, Dutch Techcentre for Life Sciences

12:00 – 12:45   **Representatives of Examining Board and Program Committee**
- Drs. Suzanne Roelfsema, chair Examining Board
- Dr. Paschal Oude Weernink, secretary Examining Board
- Dr. Jessica Zweers, chair Program Committee
- Dr. Tsjerk Wassenaar, member Program Committee
- Ir. Remco Knigge, chair Assessment Committee
- Dr. Marjon Kuiper, member Assessment Committee
- Marion Dam MSc, member Admission Committee

12:45 – 13:30   **Panel meeting - Lunch** *(confidential)*

13:30 – 14:15   **Tour of the facilities and meeting prospective students**
- Marcel Kempenaar BSc
- Matthijs Knigge BSc, alumnus BA Bioinformatics
- Robert Sietsma BSc, alumnus BA Biomedical research

14:30 – 15:30   Teaching staff
- Fenna Feenstra MSc, teacher MA DSLS
- Dr. Tsjerk Wassenaar, teacher MA DSLS
- Dr. Dave Langers, teacher MA DSLS
- Drs. Martijn Herber, teacher MA DSLS
- Dr. Jurre Hagemen, teacher MA DSLS
- Drs. Mirjam Lurvink, teacher MA DSLS
- Dr. Hilbrand Oldenhuis, lector Hanze UAS

15:30 – 16:45   Panel meeting *(confidential)*

16:45 – 17:00   Presentation of initial findings

Annex 3: Documents reviewed

Programme documents presented by the institution
- Information dossier
- Appendices to the information dossier:
  - Decision macro-efficiency hbo-master Data Science for Life Sciences
  - Professional and Educational Profile (PEP)
  - Student Manual
  - Graduation Manual
  - Overview of staff
  - Assessment policy Institute for Life Science & Technology
  - Teaching and Examination Regulations, concept (TER)
- Documents made available during the site visit
  - Minutes of meetings with the Professional Board
  - Graduation Manual (updated)
  - Assessment Rubrics semester 1
  - Assessment Rubrics semester 2
  - Assessment Rubrics semester 3
  - Teaching and Examination Regulations (updated)
  - Admission Procedure
  - Assessment matrix preparatory courses
  - Student Manual (updated)
  - Proof of Competence manual
  - Organogram organization
  - Overview areas of expertise teaching staff
  - Various posters on e.g. entrepreneurship, community of learners, assessment plan, etc.

Annex 4: List of abbreviations

ba	bachelor
BKE	Basiskwalificatie examinering
EC	European Credit
hbo	hoger beroepsonderwijs
HILL	High Impact Learning that Lasts
ILST	Institute for Life Sciences & Technology
ma	master
NVAO	Nederlands-Vlaamse Accreditatieorganisatie
PEP	Professional and Educational Profile
TER	Teaching and Examination Regulations
UMCG	Universitair Medisch Centrum Groningen
WHW	Wet op hoger onderwijs en wetenschappelijk onderzoek
wo	wetenschappelijk onderwijs

The panel report was ordered by NVAO for the initial accreditation of the programme hbo-master Data Science for Life Sciences of Hanze University of Applied Sciences.