NVAO • THE NETHERLANDS

INITIAL ACCREDITATION

MASTER'S PROGRAMME
ARTIFICIAL INTELLIGENCE & ENGINEERING SYSTEMS
Eindhoven University of Technology

FULL REPORT
2 DECEMBER 2021

Content

1 Peer review

The Accreditation Organisation of the Netherlands and Flanders (NVAO) determines the quality of a new programme on the basis of a peer review. This initial accreditation procedure is required when an institution wishes to award a recognised degree after the successful completion of a study programme.

The procedure for new programmes differs slightly from the approach to existing programmes that have already been accredited. Initial accreditation is in fact an ex-ante assessment of a programme. Once accredited the new programme becomes subject to the regular review process.

The quality of a new programme is assessed by means of peer review. A panel of independent peers including a student reviews the plans during a site visit to the institution. A discussion amongst peer experts forms the basis for the panel's final judgement and the advisory report. The agenda for the panel visit and the documents reviewed are available from the NVAO office upon request.

The outcome of this peer review is based on the standards described and published in the limited NVAO Assessment framework for the higher education accreditation system of the Netherlands (Stcrt. 2019, nr. 3198). Each standard is judged on a three-point scale: meets, does not meet or partially meets the standard. The panel will reach a conclusion about the quality of the programme, also on a three-point scale: positive, conditionally positive or negative.

NVAO takes an accreditation decision on the basis of the full report. Following a positive NVAO decision with or without conditions the institution can proceed to offer the new programme.

This report contains the findings, analysis and judgements of the panel resulting from the peer review. It also details the commendations as well as recommendations for follow-up actions. A summary report with the main outcomes of the peer review is also available.

Both the full and summary reports of each peer review are published on NVAO's website www.nvao.net. There you can also find more information on NVAO and peer reviews of new programmes.

Because of COVID-19 temporary measures apply for this peer review.

2 New programme

2.1 General data

Institution	Eindhoven University of Technology (TU/e)
Programme	Artificial Intelligence & Engineering Systems (AI&ES)[1]
Variants	Fulltime
Degree	Master of Science
Tracks	1. High-tech systems and robotics 2. Mobility 3. Health applications 4. Smart cities 5. AI Foundations and science applications 6. Manufacturing systems
Locations	Eindhoven
Study load	120 EC[2]
Field of study	Technology

2.2 Profile

The programme Artificial Intelligence & Engineering Systems (AI&ES) will be a two-year, fulltime, English-taught and government-funded master's programme. It aims to educate engineers at the interface of Engineering Systems and Artificial Intelligence. The programme offers students a multidisciplinary curriculum containing core courses as well as a choice between 6 tracks focusing on specific application areas where Electrical Engineering; Mechanical Engineering; Applied Physics; Mathematics and Computer Science; Biomedical Engineering; Built Environment; and Industrial Engineering and Innovation Sciences meet AI. AI&ES will be offered in a joint co-operation of these 7 (out of a total of 9) departments of TU/e, with the Department of Electrical Engineering as the leading department.

2.3 Panel

Peer experts

- Prof. dr. ir. Inald Lagendijk (*chair*), Distinguished Professor of Computing-based Society, and captain of science of Dutch Digital Delta, the Dutch top sector for missions and innovation in ICT.
- Prof. dr. Maarten de Rijke, University Professor of Artificial Intelligence and Information Retrieval at the University of Amsterdam. He is also the scientific director of the national Innovation Center for Artificial Intelligence;
- Prof. dr. Bo Wahlberg, professor of Chair in Automatic Control at KTH Royal Institute of Technology; Sweden;
- Wietske Rem (BSc) (*student member*), master student Mechanical Engineering, Universiteit Twente.

Assisting staff

Fiona Schouten (Academion secretary)
Frank Wamelink (NVAO policy advisor and process coordinator)

Site visit (online)

22 October 2021

[1] The panel decided to add "&" in the name of the programme as applied for. In this report the name advised for by the panel is consistently used. See 6.4 for the arguments.
[2] European Credits

3 Outcome

The NVAO approved panel reaches a conditionally positive conclusion regarding the quality of Artificial Intelligence & Engineering Systems offered by TU/e. The programme complies with two standards of the limited NVAO framework and partially complies with one standard.

AI&ES will be a two-year, fulltime, English-taught and government-funded master's programme. It aims to educate engineers at the interface of Engineering Systems and Artificial Intelligence and offers students a multidisciplinary curriculum containing 6 tracks focusing on specific application areas. AI&ES will be offered in a co-operation of 7 departments of TU/e, with the Department of Electrical Engineering as the leading department. In summary, an AI&ES graduate is able to contribute to the multidisciplinary development of complex engineering systems, from a solid disciplinary basis and from a thorough grasp of AI-technology.

The panel is convinced that the master's programme Artificial Intelligence & Engineering Systems responds well to the professional field's need for T-shaped trained engineers capable of integrating Artificial Intelligence in various Engineering Systems or solutions. The panel finds that the 6 tracks have a clear profile due to their focus on application areas. In contrast, the panel considers the overall profile of the programme less clear. The panel therefore recommends starting from coherence and alignment within the various tracks, working on a common understanding of how to build a curriculum on the shared goals and developing multidisciplinarity further to strengthen the overall profile.

The panel concludes that the intended learning outcomes formulated for AI&ES tie in with the level expected for an academic master's programme. They are tuned to international requirements and in line with the academic and professional domains the programme intends to cover. The panel recommends sharpening the ILOs and profile by reflecting on their relation to the KION criteria for AI programmes, by aligning the ILOs of track 5 'AI foundations and science applications' with the other tracks, and by representing the status of 'Humans and Ethics' more realistically.

According to the panel, AI&ES has the teaching staff, facilities, management, research and education environment, and experience with interdepartmental master's programmes that are necessary for successfully offering this programme. However, the panel thinks the relation between the actual courses, the general setup of the AI&ES curriculum and the intended qualification profile of the graduate need strengthening. This is needed to give the curriculum focus and internal coherence, to strike a clear balance between AI and engineering systems, to promote multidisciplinarity in and between tracks, and to develop a system of continuous evaluation with which to promote and strengthen the added value of combining all disciplines and AI in a single M.Sc. program. The panel formulated a concrete condition to be met within two years. This is an important issue to act upon in the coming years. The panel is confident that AI&ES has what it takes to successfully implement this condition.

The panel is convinced that student assessment in AI&ES will be done according to the policies and regulations in place at TU/e and the Department of Electrical Engineering. The programme has an adequate assessment policy and assessment system. The implementation of the assessment policy and system for the AI&ES program as described in the documents provided to the panel is currently being developed. The Examination Committee is yet to be appointed. The panel finds that work is still to be done, but it is confident that quality of assessment in AI&ES will be guaranteed.

The condition to be met within a period of 2 years is the following:
The programme should strengthen alignment between courses and ILOs to ensure that the various components of the programme contribute to achieving its aims and build on the added value of bringing all disciplines within one master programme.

In order to implement this condition, the panel invites the programme to consider such concrete actions as (1) clarifying the position, overlap and complementarity of the individual tracks relative to each other and relative to the AI discipline at large, paying specific attention to the aims and focus of the AI Foundation and Science Track; (2) aligning the tracks accordingly so that the intended multidisciplinarity can be maximally achieved both in the

current Team project (creating mixed disciplinary teams) and elsewhere in the curriculum; (3) optimising the balance between coherence and flexibility in individual study paths (currently, the student's course selection can vary widely, making the programme very heterogeneous, while at the same time students select a track very early on in the programme, making it quite rigid); (4) creating a process for constructively including feedback and lessons learned into adaptations of the design of the programme in the coming years; (5) formally adopting the draft teaching and examination regulations and the composition of the examination board.

Standard	**Judgement**
1. Intended learning outcomes	meets the standard
2. Teaching-learning environment	partially meets the standard
3. Student assessment	meets the standard
Conclusion	*conditionally positive*

4 Commendations

The programme is commended for the following features of good practice.

1. Intended learning outcomes -- The objectives of the programme answer to demands of the professional field. There is a clear need for generalist AI engineers who can work in multidisciplinary environments.

2. Intended learning outcomes -- The programme ties in with TU/e's focus area Artificial Intelligence and the recently founded EAISI Institute (Eindhoven Artificial Intelligence Systems Institute).

3. Teaching-learning environment – The complex organisation of the programme, with seven departments involved, is in the hands of experienced and capable university staff members who have ample experience with interdepartmental programmes and who are embedded in a solid quality culture.

4. Teaching-learning environment –The academic and didactic quality of the teaching staff is good.

5. Teaching-learning environment –The facilities that the programme offers access to are good.

5 Recommendations

Next to the condition formulated by the panel it suggests a number of follow-up actions for improvement.

1. Intended learning outcomes – develop a clearer common understanding of what AI & Engineering Systems entails and relate to KION criteria.

2. Teaching Staff – foster a higher level of obtainment of the University Teaching Qualification (UTQ) among teaching staff.

3. Teaching-learning environment – promote the wider introduction of challenge-based-learning and innovative teaching methods into the programme.

4. Curriculum – specify the proper balance between the domain-specific areas of the ILOS in the curriculum: Systems Engineering; Data and Algorithms and Humans and Ethics.

6 Assessment

6.1 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.

Judgement
Meets the standard.

Findings, analysis and considerations
The master's programme Artificial Intelligence & Engineering Systems (AI&ES) is initiated by Eindhoven University of Technology (TU/e) in response to the industrial, societal, and academic need to integrate Artificial Intelligence and Engineering Systems in a synergetic way. The panel considers the initiative for this programme timely and is convinced it meets a need of the working field. The programme ties in with TU/e's focus area Artificial Intelligence and the recently founded EAISI Institute (Eindhoven Artificial Intelligence Systems Institute) which stimulates, coordinates and strengthens research initiatives in the field of AI.

AI&ES will be organised by seven departments of TU/e, with the Department of Electrical Engineering as the leading department. The other six participating departments are Mechanical Engineering, Applied Physics, Mathematics and Computer Science, Biomedical Engineering, Built Environment, Industrial Engineering, and Innovation Sciences. AI&ES will incorporate 4 existing master TU/e tracks: the two almost identical tracks Artificial Intelligence Engineering Systems of the master's programmes Electrical Engineering and Mechanical Engineering, which both started in September 2020; and the two tracks Manufacturing Systems Engineering of the master's programmes Mechanical Engineering and Operational Management and Logistics. The AI&ES programme will be embedded in the TU/e Graduate School, which unifies all graduate programs (MSc, PDEng and PhD).

AI&ES aims to educate engineers at the interface of Engineering and Artificial Intelligence. It strikes a balance between these two domains in a multidisciplinary curriculum. Students enter the programme in one of six tracks addressing specific application areas: (1) High-tech systems and robotics; (2) Mobility; (3) Health applications; (4) Smart cities; (5) AI foundations and science applications; (6) Manufacturing systems.

The panel finds that five of six tracks have a clear profile due to their focus on application areas. These areas define the engineering, AI and multidisciplinary elements in the track curriculum. Track 5 on foundations and science applications is an exception since it chooses a different approach (see below). The panel was less convinced of the clear overall profile of the programme. This general profile suggests dealing with AI and engineering in a broad sense, in contrast with the specific domains of application in the tracks (see also 6.4: Programme Name). The bridging rationale and the connection between tracks was less clear to the panel. There is a lot of yet unused potential of bringing together all disciplines in one master-programme. (see also Standard 2).

The profile has been translated into a set of general intended learning outcomes (ILOs) as well as subsets of ILOs for the various tracks. The ILOs reflect the Dublin Descriptors for masters' programmes as well as the Meijers criteria specific & Engineering developed by the Dutch technology universities. They are tuned to national and international requirements and are clearly of an academic level. The panel also finds that they are in line with the demands of the professional field. The panel advises looking for structural ways to organise and receive input on the ILOs from the working field, so that they remain topical and are continually adapted to the changing needs of this field.

The panel considers the ILOs to be well-chosen, but recommends developing a clearer common understanding of what AI & Engineering Systems entails. This should guide the design and development of the programme and the individual study careers of students. The panel noticed that the ILOs refer to a specific subset of AI: Data and Algorithms. According to the information dossier, the programme comprises both AI and Engineering Systems. The AI approach is reflected in the use of the KION framework. Not all KION aspects are considered equally relevant for this programme. The panel recommends reflecting more explicitly on the KION criteria and clarifying to what extent they are met by the programme. The result should be clearly reflected in the profile and ILOs. Which of the AI qualifications defined by the KION framework are reached by the graduate of this programme?

The panel also points out that the profile and specific ILOs of track 5, 'AI foundations and science applications', suggest that this track takes a more foundational approach. Different from the other four tracks, the specific ILOs of track 5 refer to generic application domains and discovery processes rather than synergy with system engineering in a specific domain. In this way it overlaps with the computer science perspective on AI foundations. The panel discussed the track with its teaching staff and learnt that it is actually strongly focused on the application domain of science. It recommends aligning the profile and ILOs of this track with those of the other tracks, making clear that it follows the same multidisciplinary and application-oriented setup of the other tracks, with the application area in this case being engineering for the purpose of scientific research in several domains. An appropriate name of the track would then be 'AI for science applications'.

Finally, the general ILOs suggest that 'Humans and Ethics' has the same status in the programme as Engineering Systems and Data and Algorithms, presenting it as a third pillar in the curriculum. While this societal and ethical approach is certainly present in the curriculum, it is less prominent than the other two pillars mentioned there. The panel recommends refining the ILOs in such a way that they reflect the balance of all aspects in the curriculum more realistically.

Conclusion
The panel is convinced that the master's programme Artificial Intelligence & Engineering Systems will answer the professional field's need for T-shaped trained engineers capable of integrating AI in various engineering systems. The panel finds that the tracks have a clear profile due to their focus on application areas, assuming the issues with track 5 are addressed. In contrast, the panel considers the general profile of the programme less clear, leaving the panel with the impression that track ownership trumps ownership of the overall program. The panel therefore recommends starting from coherence and alignment within the various tracks and work on the overarching rationale. The panel concludes that the intended learning outcomes formulated for AI&ES tie in with the level expected for an academic master's programme. They are tuned to international requirements and in line with the academic and professional domains the programme intends to cover. The panel recommends sharpening the ILOs and profile by reflecting on their relation to the KION criteria for AI programmes, by aligning the ILOs of track 5 'AI foundations and science applications' with the other tracks, and by representing the status of 'Humans and Ethics' more realistically.

6.2 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.

Judgement
Partially meets the standard.

Findings, analysis and considerations
Curriculum

The curriculum consists of core courses (30 EC), track-related courses (20 EC), free electives (15 EC), an interdisciplinary teamwork project (10 EC) and a graduation project (45 EC). The core courses are (re)designed specifically for AI&ES students and are all scheduled in the first year of the programme, providing a disciplinary foundation. The six core courses are Mathematics, Learning in AI, Data Science, Engineering Systems, Human Interaction and Ethics, and Programming. For some topics, an alternative of two core courses is offered. The tracks all contain four specialization courses (20 EC): students select courses from a limited set specific for their track's application domain. The choice of courses is classified under four labels: 1) Domain-specific Knowledge; 2) AI in Engineered Systems; 3) Learning and Intelligence; and 4) Data Cultivation. Students make a coherent selection of one course in each of these categories. In addition, they have an elective space (15 EC) and participate in an interdisciplinary Team Project (10 EC). Finally, they do a Graduation Project (45 EC) that focuses on experimental work, application-oriented work or fundamental research questions, and in most cases combinations of these. The project can be carried out on campus, in collaboration with companies or research institutions outside TU/e, or abroad. The project results in a final thesis.

The committee looked at the general setup of the curriculum as well as the planned content of the core courses, specialization courses, electives, and Team Project. It noticed that the curriculum clearly reflects the interdepartmental nature of the programme, where seven departments collaborate.
The departments all contribute to the body of courses and are involved in the organisation of one or more tracks. This leads to a wide range of courses that are frequently shared with faculties participating in the AIES program. The core courses are partly (re-) developed for the program while the Team Projects are exclusively developed for the AIES program, but many of the other courses are either re-used from other programmes or adapted.

The panel studied the examples of study paths in the application dossier and discussed the combination of courses with the management of the programme, lecturers and the Examination Committee. From this the panel drew the conclusion that the potential of bringing all tracks together in one programme in terms of broader exposure and multidisciplinary perspective materializes marginally. This is due to the fact that (a) individual learning paths can differ greatly, since even in the core courses they already diverge; (b) the AI&ES program envisions that multiple applications and challenges are provided in the Team Project and that challenges are relevant for multiple tracks, yet the cross-track nature of the Team Project is not yet structurally embedded; and (c) there are few newly designed courses that focus on the commonality / multidisciplinarity of the program. The panel formulated a condition to strengthen the relation between the actual courses and the overall aims of the programme.

An indication that there is still work to be done is the finding of the panel that in the examples of possible study paths some specialization courses did not fit the four categories of domain-specific knowledge, AI in engineered systems, learning and intelligence, and data cultivation. It also found that many of the shared courses still have a mainly disciplinary focus, and thus do not contribute to the multidisciplinary nature of the programme. The panel found that the core courses deal with important and urgent topics, but that the reason behind the choice for these topics as central to the programme is not made explicit or linked to the programme ILOs. Similarly, alignment to the outside world could be sought through making the relation of programme elements to the KION criteria explicit.

The panel advises the programme to focus and adapt the curriculum and align it better with the goals and general structure of the programme. In this way, the curriculum can achieve the desired balance between AI, engineering elements and human and ethical aspects, and all tracks can provide students with logical and coherent study paths with clear and motivated elective options that profit from broader exposure and multidisciplinarity. The various existing courses incorporated in the programme can be evaluated in the context of AI&ES's aims and renewed or changed to provide a good fit within the programme.

As a part of this exercise, the programme could look into ways to promote multidisciplinarity both at programme and at track level. In the current design, multi- and interdisciplinarity are chiefly addressed in the team project (10 EC), where students from one track cooperate in a challenge-based learning project. The panel considers this a promising set-up and advises mixing tracks in creating the team project to ensure the multidisciplinary nature is experienced sufficiently by all students. It recommends actively thematising and promoting multidisciplinary work throughout the curriculum, for instance by teaching courses in teams of staff members with various disciplinary backgrounds. The panel learnt during the site visit that many tracks actually have such courses scheduled, but this varies greatly per track and is not yet structurally planned at a programme level. The panel also suggests looking for ways to create multidisciplinary connections between tracks.

Guidance
The diversity in courses and options makes the programme challenging to navigate for (prospective) students. They choose a track before starting the programme and elect core courses, specialisation courses, electives, and a research group for their graduation project. The choices often have to be made very early on: the research group where students intend to do their final project can determine the choice in core courses at the start of the programme. This early choice might lead to rigidity and also to students choosing conservatively (track that aligns with their BSc), effectively limiting multidisciplinary crossover. AI&ES aims to guide students through the programme through an extensive mentoring scheme where different study phases are distinguished, and students are offered various forms of support. Approval by the Examination Committee also ensures coherent and logical choices. The panel appreciates the mentoring system and the involvement of the Examination

Committee. Nevertheless, it finds that the many possibilities and limitations students have to take into account when designing their study paths should be written out in a flow chart to provide extra clarity. The panel also warns that intensive mentoring poses a scalability challenge for faculty members.

Teaching methods
The panel recommends taking the opportunity of developing this new curriculum to opt for innovative teaching methods. Currently, many courses are still quite traditional in their design, especially those that already exist as parts of other programmes. The panel learnt from the documentation that the programme intends to expand challenge-based learning throughout other courses, in line with the university-wide vision on education. The pandemic has also inspired more variety in digital methods. The panel encourages the programme to enhance teaching methods from the very start, especially for the courses that are going to be newly designed or completely overhauled.

Teaching staff
The panel spoke to lecturers, programme management and track coordinators about the development of AI&ES and became convinced that the staff and organisation are fully qualified to implement the new programme. Staff members demonstrate the scientific and didactic quality necessary for this programme and have ample experience with interdepartmental master's programmes. Due to the large number of departments involved and the recent addition of the AI research institute, the quantity of staff is clearly sufficient.

Quality assurance
The panel points out that the complexity of organising a programme like AI&ES, with multiple tracks and a diverse course offering, requires clear references and procedures. The impression that the panel got from the information file and from its interviews during the site visit is that much has already been extensively discussed, and in general there is a shared understanding of what the programme entails. Still, further clarification of this common understanding is needed. In the further development of the programme there is need for further formalisation of plans. At this moment each of the tracks provide a coherent curriculum but the rationale of the overarching programme did not materialize fully, according to the panel. Finding common ground and developing innovative interdisciplinarity at this level should become a strength of the programme. Therefore, feedback and evaluation cycles need to be implemented to ensure that the programme is continuously improved once it has started. While the programme and university can bring their experience in other interdisciplinary master programmes to AI&ES, they need to clearly and transparently state how alignment and quality assurance will be implemented and maintained in this particularly complex programme, including the way in which continuous feedback from students, staff and the working field is gained, dealt with, and addressed (at programme as well as track level).

Facilities
The panel was provided with video material and evaluations on the facilities. This, combined with the impressions the panel members had from earlier visits, convinced the panel that TU/e will offer AI&ES students the space and equipment necessary for completing their studies. The programme will have access to the Innovation Space, the centre of expertise for Challenge Based Learning and entrepreneurship, the EAISI Institute's Digital Twin lab and among others three ICAI labs. All labs promote the cooperation between research and industry. EAISI also facilitates several multidisciplinary student teams, such as Blue Jay (drones), HART (augmented reality), and Tech United (autonomous soccer robots).

Conclusion
According to the panel, AI&ES has the teaching staff, facilities, management, research and education environment, and experience with interdepartmental master's programmes that are necessary for successfully offering this programme. However, further alignment of actual study paths with the ILOs of the programme is needed. The panel defined a concrete condition on this to be met by the programme. Additional procedural formalisation of the evaluation of the curriculum might help to give the curriculum the focus and internal coherence it needs, to strike a clear balance between AI, engineering systems and human an ethical aspects, to implement multidisciplinarity in and between tracks, and to ensure the programme is continuously evaluated and improved after its start. The panel is confident that AI&ES has what it takes to successfully implement this and formulated concrete steps to meet these conditions (see 3. Outcome).

6.3 Standard 3: Student assessment

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

Judgement

Meets the standard.

Findings, analysis and considerations

Student assessment in AI&ES will be done according to the policies, rules and regulations in place at TU/e as well as the assessment policy of the Department of Electrical Engineering. This means that assessments are valid, reliable and transparent, and that they support the learning process as well as measuring students' levels (formative and summative assessment). The four-eye principle is adhered to in the construction of tests as well as in the graduation project. Assessment forms match the learning goals of the courses.

The panel looked at a sample of tests and rubrics designed for AI&ES, as well as final theses written in the MSc tracks that will be combined in AI&ES. The panel also received a draft version of the Teaching and Examination Regulations (OER) of the programme. It gained a positive impression of student assessment in the programme, although this is still under development. The panel points out that the programme will need to pay attention to multidisciplinarity in student assessment. Naturally, the provided sample theses are currently produced in the tracks are often monodisciplinary, and this will likely change in the new programme. The panel is convinced that the conditions it formulated (see 3. Outcome) will lead to this feature gaining prominence in assessment practices.

AI&ES does not have an Examination Committee (EC) yet, but it will be in place when the programme starts. TU/e appoints a separate EC for every interdepartmental programme, which the panel considers a wise choice considering the complex organisation of such programmes. The panel learnt during the site visit that the programme management and teaching staff have a clear view of the tasks and methods of the EC, and sufficient knowledge of the EC's responsibilities. The EC will be embedded in the TU/e's regular quality assurance environment. The panel is confident that the EC will guarantee quality of assessment adequately and proactively upon its appointment.

Conclusion

The panel is convinced that student assessment in AI&ES will be done according to the policies and regulations in place at TU/e and the Department of Electrical Engineering. The programme has an adequate assessment policy and assessment system. The implementation of the assessment policy and system as described in the documents provided to the panel is currently being developed. The Examination Committee is yet to be appointed. The panel finds that work is still to be done, but it is confident that quality of assessment in AI&ES will be guaranteed.

6.4 Programme name

The panel agrees with the choice of a separate, new name due to the limited overlap with other programmes in the field. However, it suggests Artificial Intelligence **&** Engineering Systems to indicate more clearly that (a) this programme does not address all KION criteria for AI programmes and (b) it focuses on specific application areas where engineering meets AI.

6.5 Degree and field of study

The panel advises awarding the following degree to the new programme: Master of Science.

6.6 Language

The panel agrees with the choice of English as language of instruction and an English-language programme title. English is the dominant language both in the academic and in the professional fields linked to AI&ES, and will be crucial in the multidisciplinary teams that graduates will end up working in.

6.7 Classification of Domain or Sector

The panel supports the programme's preference for the following field of study: Technology.

6.8 Two years' programme

TU/e proposes that the master programme in AI&ES has a duration of two years (120 EC). The faculty management's arguments concern the international requirements of the programme and the breadth and complexity of the programme, reflecting the requirements of the professional field and the multidisciplinary domain. The panel assessed the arguments, using the criteria put forwards in the Protocol for programme extension of NVAO, published on 8 October 2003.

Findings, analysis and considerations

The panel is convinced that for students to match the expectations of the working as well as the research field, they must master in-depth knowledge in engineering systems as well as in AI, be aware of human and ethical aspects of technology and gain multidisciplinary, team-working and research skills. AI&ES graduates are to be generalists with knowledge of engineering and AI in specific application domains. In order to achieve these ambitious aims within one master's programme, the panel considers the extended duration of two years (120 EC) justified for AI&ES. The panel takes into consideration that master's programmes in engineering in the Netherlands also take two years. The AI&ES documentation shows that similar programmes abroad also have this length (e.g., the MSc Robotics, Cognition, Intelligence, at the Technical University of Munich, Germany; or the MSc Artificial Intelligent Systems at the University of Trento, Italy).

Conclusion

Given these strong arguments in favour of two-year curriculum, the panel advises to grant Eindhoven Technical University (TU/e) the right to offer a two-year master programme (120 EC).

Abbreviations

AI	Artificial Intelligence
AI&ES	Artificial Intelligence & Engineering Systems
EAISI	Eindhoven Artificial Intelligence Systems Institute
EC	European Credits / Examination Committee
ILO	Intended Learning Outcome
KION	Kunstmatige Intelligentie-Opleidingen in Nederland
MSc	Master of Science
NVAO	Nederlands-Vlaamse Accreditatie Organisatie
TU/e	Eindhoven University of Technology

The full report was written at the request of NVAO and is the outcome of the peer review of the new programme Artificial Intelligence & Engineering Systems of Eindhoven University of Technology

Application no: AV-1061

NVAO

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