UAS PD T&D

Programme Proposal

Technology & Digitalisation Task Force

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Technology & Digitalisation Task Force

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Preface

In front of you is the Programme proposal for a Professional Doctorate (PD) in the domain Technology & Digitalisation. The programme aims to train PD candidates to become investigative professionals who know how to convert new knowledge of technology into applications for complex and social challenges. In all PD trajectories, the interaction between people and technology is central. PD candidates can both collect and use scientific knowledge to arrive at a validated prototype and focus on digitalization, the transition that people, organizations and society are going through in order to ultimately benefit optimally from the new application.

HAN University of Applied Sciences Arnhem/Nijmegen, Saxion University of Applied Sciences Twente, HU University of Applied Sciences Utrecht, University of Applied Sciences Amsterdam (HVA) en Hanze University of Applied Sciences Groningen have jointly designed this programme proposal. We also thank our ‘critical friends’ who shared their feedback on previous versions with us, in particular Platform PRIO, InHolland University of Applied Sciences, The Hague University of Applied Sciences, CBS ECHO and TValley. A special word of thanks goes out to Prof. Dr. Ir. Johan Versendaal (HU) and Dr. Ir. René Bakker (HAN), both my predecessors as the coordinator of our Taskforce, who were responsible for the realization of the Proposition PD pilot T&D (December 2021). This proposition forms the basis for this Programme proposal.

The development of the Programme proposal was in sync with the development of the Quality Assurance Framework that was recently adopted (December 2022). We realize that this profile therefore differs from the Quality Assurance Framework in a number of elements. However, we believe that the Programme proposal as it stands is a good basis for the start of the pilot, in which learning is central and the programme will undoubtedly develop even further.

Utrecht, December 2022,

Dr. Gerrita van der Veen

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1 Introduction

Taking the lead in the application of the state of the art in technology and digitalisation is of crucial importance for the Netherlands in terms of a sustainable industry and a prosperous society. This requires an agile labour market and a future-proof workforce, to be able to cope with various complex societal challenges such as climate change and an ageing population. In their roadmap, the Dutch Top Sectors emphasise the ambition and urgency of connecting and combining work, learning and innovation, so that innovations can pay off faster in practice and society can benefit optimally from their application. In the Professional Doctorate Technology & Digitalisation (PD T&D) pilot, Dutch universities of applied sciences (UASs) are taking up this challenge by having PD candidates conduct research, starting from a complex practical issue, into the available technological knowledge and develop it into high-quality interventions and applications in the professional field. This pilot is jointly developed and realised by the HU University of Applied Sciences Utrecht (HU), the University of Applied Sciences of Amsterdam (HvA), Saxion University of Applied Sciences (Saxion), HAN University of Applied Sciences (HAN) and Hanze University of Applied Sciences Groningen (Hanze).

Within the so-called third cycle of higher professional education (i.e., following a bachelor and master), the PD T&D trains candidates to become highly qualified research professionals who have learned to intervene in complex professional practices at level 8 of the European Qualifications Framework for Lifelong Learning (EQF), i.e., the same level as a PhD at a university. Since 2019, the PD programme has been developed by several universities of applied sciences and will also be offered as a joint programme by the participating universities of applied sciences in a so-called Graduate Network from 2023. In doing so, the first phase is considered a pilot. A review is scheduled in 2027. In the event of a positive evaluation, universities of applied sciences may be able to continue to offer PD programmes, so that PD programmes will be included in the permanent range of programmes offered by the universities of applied sciences, as a top-up to AD, Bachelor’s and Master's degree programmes (Andriessen et al., 2021).

The PD T&D programme integrates the training and development of PD candidates with research and innovation in practice contexts. As such, it is both a candidate development training programme and a research and innovation project with meaningful impact for organisations and society. For the candidates, the PD T&D programme is a high-quality professional training programme in which the development into and integration of the roles as (methodical) researcher, (design-oriented) professional, (co-creative) change agent and (technical and digital) innovator takes centre stage, with the aim of learning to intervene responsibly and effectively in complex professional practices. Through 'learning on the job' in the form of action research performed in a practical setting and under the supervision of UAS-professors and practice partners, PD candidates develop and implement professional products and work processes for practical issues.

The following chapters of this proposal describe how the training profile in this domain can be characterised (Chapter 2), how the training programme will be structured (Chapter 3), and how the development of PD candidates will be monitored and assessed during and at the end of this programme (Chapter 4).

2 Programme Profile

2.1 Summary

A PD programme at a university of applied sciences (UAS) trains candidates to become research-oriented professionals who, as innovative change agents, intervene in complex practices on the basis of a practical question from either society or the professional domain. A characteristic of such complex practices is that different issues, frames of reference, knowledge domains, professional practices, interests (stakeholders), solution options and contextual characteristics are intertwined. Complex issues are characterised by e.g., uncertainty, variability, ambiguity and interconnectedness. The practical questions that PD candidates work on are related to regional and national knowledge and innovation agendas. These are strategic questions, aimed at innovative and sustainable solutions. The professionals are learning to intervene in complex practices on the basis of developing and validating new professional products, professional processes and actionable knowledge, in which the learning and development processes of stakeholders can also play an important role. For PD candidates, agenda setting, articulation, research, design, testing, implementation and evaluation are central elements for working on complex issues in organisations and society.

Characteristic for PD programmes within the domain of Technology and Digitalisation is that candidates work iteratively, short-cyclically, multidisciplinary and co-creatively with the mission of contributing to societal impact and economic earning power. The programme is aimed at practitioners and practice-oriented researchers who want to work on innovation in complex technology and digitisation challenges at the highest level (level 8 of the EQF).

2.2 Added Value

The importance of technology and digitalisation for organisations and society was highlighted above in the introduction. More often than not, technological expertise is not developed to the point where it is directly applicable in the new complex and situational context of the requesting organisations or society. SMEs in particular are often dependent on cooperation with research institutions in order to translate this knowledge and use it in new practical applications or ensure it is scaled up to new market and production opportunities. Additional practice-oriented and application-oriented research and innovation processes are indispensable to actually embed the technological innovations in practice and make them applicable for organisations and society as well as to formulate new fundamental research questions from practical situations based on experience with new and, based on available knowledge, inexplicable phenomena. The cooperating universities of applied sciences are addressing this demand, in a Professional Doctorate (PD), by having candidates do research into existing technological knowledge, starting from a complex practical issue, and develop it into suitable interventions and applications in the professional domain and in society.

In the field of Technology and Digitalisation, there is an urgent need for highly educated and research-oriented professionals who know how to convert new knowledge in the field of technology into applications that can renew professional practice in a sustainable way. Some examples of the challenges in professional practice and society to which PD candidates can make a valuable contribution are:

- digital innovations to make municipal services more accessible and thus increase citizen participation.
- mixed reality technology to improve training and preparation of healthcare professionals in a creative and more immersive way.
- forensic investigation technologies that can accurately and quickly analyse the interpretation of a crime scene and allow more efficient criminal investigations.
- pluriform recommendation technologies in social media against the adverse effects of news personalisation.

- personalised technology that allows people to work on their health in an easily accessible, effective and inspiring way;
- automatic and high-level quality checks to accurately predict the operation and lifetime of microchips before they are assembled into the product.
- additive manufacturing techniques enabling hospitals to develop and customise medical devices and prostheses themselves.

2.3 Focus

Technology and digitalisation are often bracketed together, but how these concepts are interpreted and profiled differs between universities of applied sciences (UASs). Where one institution puts greater emphasis on technology, another may put greater emphasis on digitalisation. Within the PD T&D, technology and digitalisation are considered equal and complementary to each other. In technology, the focus of the UASs is on translating key enabling technologies into practical applications; a number of key enabling technologies have been defined by the Top Sectors Holland HighTech, Dutch Digital Delta and Creative Industry. Digitalisation focuses on the transition (disruptive or otherwise) of people, organisations and society as a whole, which is required to be able to take full advantage of new technological applications, and thus generate real impact. As a thinking framework, the PD T&D uses an integration of the so-called Technology Readiness Levels and Societal Readiness Levels, because PD candidates will especially need to be able to optimally and iteratively connect the technical and societal aspects of technological innovation in complex practical issues. This is an important added value of PD programmes. (Refer to § 2.4.3 for a further explanation of the levels and an explanation of the added value of PD T&D compared to EngD (formerly PDEng) and PhD.)

PD T&D is linked to the mission of Dutch innovation policy. For the coming years, this mission mainly focuses on four societal themes: energy transition, agriculture, health, and security. A Knowledge and Innovation Agenda (‘Kennis en Innovatie Agenda’; KIA) was drawn up for each theme, listing topics and research questions that are closely linked to social needs in the future. The Social Earning Capacity and Key Enabling Technologies KIAs are overarching in respect of these themes. As collaborating UASs, we integrate our knowledge and experience in these key enabling technologies with e.g., digital technology, life sciences and engineering. We combine technical issues in areas such as user-centred design, app-development, additive manufacturing, robotics, virtual reality, serious games and smart materials with change management. Focussing on innovation, we create societal impact and economic earning capacity through the PD T&D.

In the following overview, the coloured hexagons represent the themes in which the UASs are active in terms of key technologies. For the other relevant themes, cooperation will be sought at a later stage with other UASs, with universities and other relevant knowledge organisations.

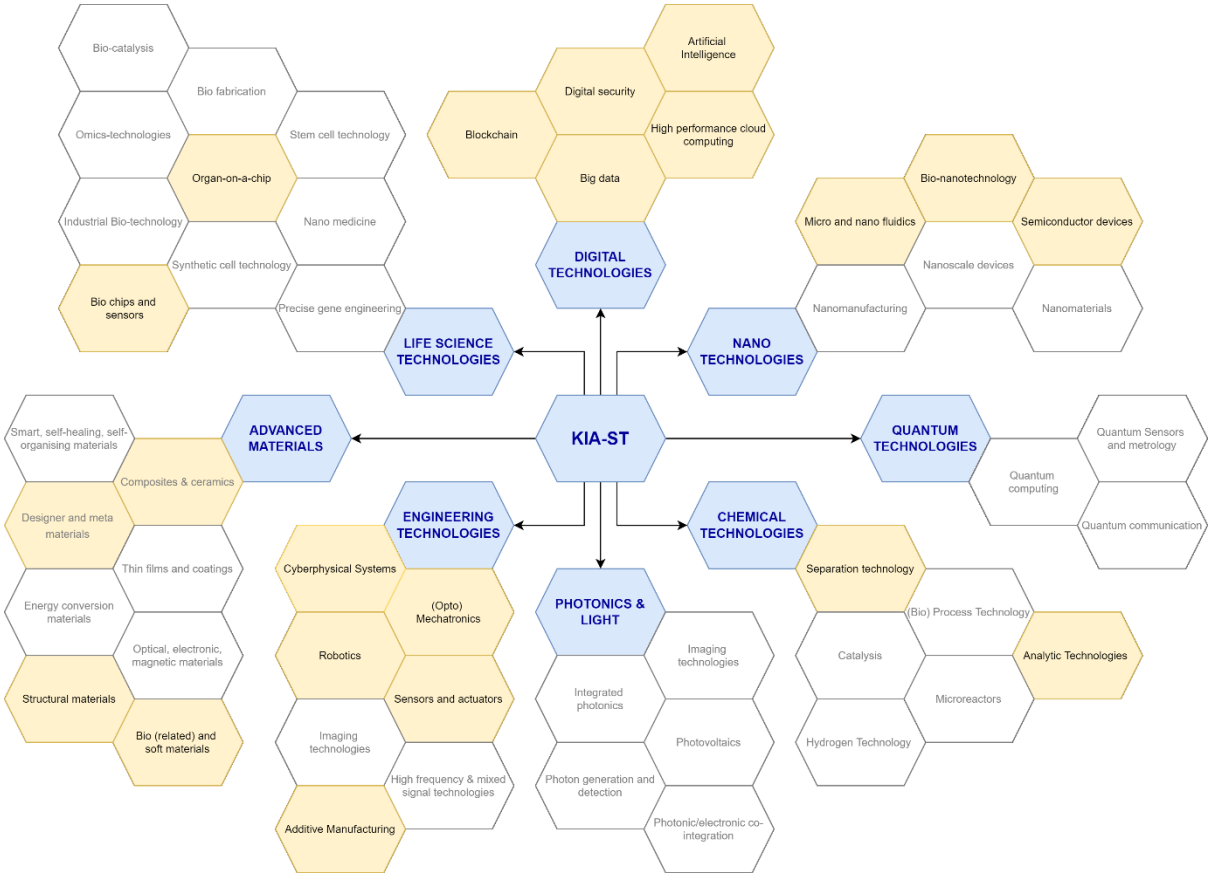

Figure 2.1: Key enabling technologies at the centre of the relevant universities of applied sciences

In addition to these key enabling technologies, UASs are also active in the area of digitalisation, such as enterprise architecture, information management, human-machine interaction, user-centred design, and behavioural change.

2.4 Programme Level

2.4.1 Entry Requirements

Candidates can be admitted to the PD programme if they hold a relevant and recognised master's degree plus demonstrable relevant work experience and understanding of the complex practice of technology and digitalisation to which the issue in the intended PD programme relates. The admissibility of candidates is assessed by the intended supervisory committee and reviewed by the Graduate Committee. Furthermore, a suitable workplace in professional practice is crucial for the realisation of the PD programme, even if candidates are affiliated to a university of applied sciences and are, for example, enrolled in a PD programme after a SPRONG application. For the pilot phase, the task force has chosen to only recruit Dutch candidates who will be working within the Dutch practice context.

2.4.2 Qualification Descriptors

All PD candidates, regardless of the domain of innovation, meet the following qualification descriptors (based on a combination and synthesis of the Dublin Descriptors and the, level 8):

All PD candidates, regardless of the domain in which they operate, meet the qualification requirements (which are based on a combination and synthesis of the Dublin Descriptors and the European Qualifications Framework for lifelong learning, level 8), some of which have already been translated to the T&D domain here:

- [1] Knowledge: Systematic understanding of the international state-of-the-art of the domain, in this case concerning (specific) key enabling technologies as well as the ability to think in a transdisciplinary way.
- [2] Problem solving: Using state-of-the-art skills and techniques to solve critical issues, in this case concerning the innovative application of (specific) key enabling technologies in organisations and society, including the ability to analyse, evaluate and synthesise new and complex ideas.
- [3] Research: Conceptualising, designing, implementing, and adapting a substantial research process in line with the international state-of-the-art.
- [4] Attitude: Sustained commitment to and substantial autonomy, integrity, and authority in innovative technological application in the service of societal impact and economic benefit.
- [5] Communication: Communicate at local, national, and international levels with peers, with the scientific community and with society on the areas of expertise, in this domain in particular promoting meaningful and effective technological development of organisations and society.

In short, all PD candidates demonstrate the highest level of insight, analysis, creation, action and communication based on investigative, innovative and co-creative abilities. A description of the domain-specific learning outcomes follows below (see §2.6).

2.4.3 Comparison

HBO (Higher Professional Education): Professional Master and Professional Doctorate
PD professionals differ from master professionals in particular in that they work in a multidisciplinary and co-creative manner, and in that they themselves develop, substantiate, test and apply innovative insights and interventions with and in professional practice. Of course, this does not mean that masters graduates do not apply multidisciplinary, creative and innovative skills in practice at all, but not on a PD-level. The practical relevance of the PD candidate's programme is not only safeguarded by the research question being articulated in close coordination with professional practice, but also by the development and implementation of the interventions taking place in this practice, so that the results of the PD trajectory are already effectuated during the trajectory. PD research thus meets the need for iterative short-cyclical innovation in society and the professional domain, also by experimenting with semi-finished products.

HBO (Higher Professional Education) and WO (University Education): PD and PhD
A (UAS) PD differs in content from a (WO) PhD. Nevertheless, both training variants are equal in level, namely level 8 of the European Qualifications Framework for Lifelong Learning (EQF). So the difference between PD and PhD does not concern the level but the orientation, namely: practice- and application-oriented versus theory-oriented knowledge development. Of course, a PhD programme can also lead to practice-based knowledge development, but this is not a requirement. Similarly, a PD programme can contribute to theory-based knowledge development, but this is not a requirement. A PhD is an academic programme that trains candidates to be able to conduct scientific research independently. These researchers create generic new conceptual knowledge that contributes to the scientific knowledge base and to pushing the boundaries of a field of science. However, PD programmes provide candidates with training to become independently researching professionals who learn to intervene innovatively and co-creatively in complex practices on the basis of a practical demand from society or the professional field, developing and validating new and generic practice-oriented knowledge, processes and products. For the T&D domain, this concerns, in particular, making new key enabling technologies applicable to organisations and society.

HBO (Higher Professional Education) and WO (University Education): EngD (formerly PDEng), PD and PhD

The main differences between EngD (formerly PDEng), PD and PhD are briefly summarised in the table below (based on the VH memo).

	EngD (PDEng)	PD	PhD
Type	Design programme training candidates to become future engineers to design in a professional context.	Professional programme training inquisitive professionals who learn to intervene in complex practices.	Academic programme training candidates to become scientific researchers to conduct scientific research independently.
Learning	Turning requirements into specifications, developing a concept, validating it and making it concrete in relation to the specification.	Working on a practical issue through action research and subsequently developing, testing and possibly also implementing interventions.	Conducting major academic research.
Output	Creation of specific new technical solutions for products, processes and systems based on functional and market requirements.	Creation of generic new actionable knowledge, processes and products for establishing and validating interventions on complex issues.	Creation of generic new conceptual knowledge that contributes to the scientific knowledge base and pushing the boundaries of the area of science.

Table 2.1: Key differences between (EngD (formerly PDEng), PD and PhD

Technology: PhD, EngD (formerly PDEng) and PD

Using the so-called Technological and Societal Readiness Levels (TRL and SRL) the differences as well as the added value of PD-T&D compared to PhD and EngD (formerly PDEng) can be explained in more detail (see also Diagram 2.1 and the explanation that follows).

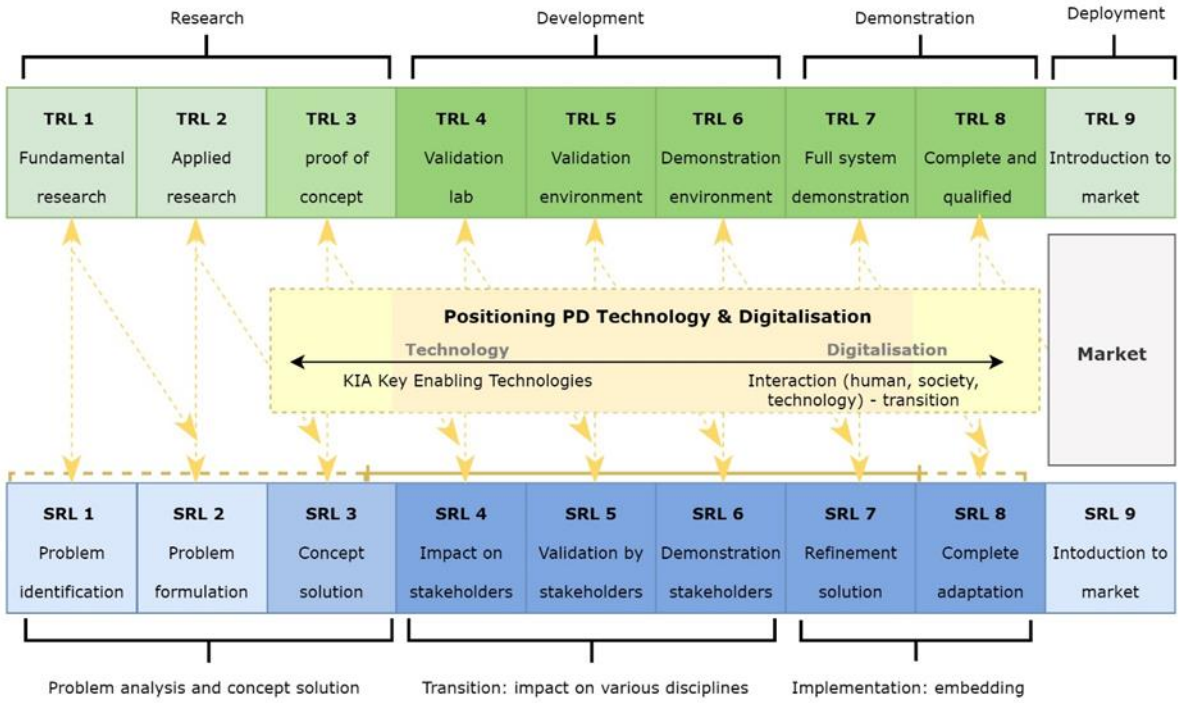

Diagram 2.1: The interconnectedness of Technological and Societal Readiness Levels in PD

Technology Readiness Levels (TRL) is a widely used model that allows organisations to determine what phase their technology development is at. The level indicates the maturity of the innovation relative to its introduction into the market or society (TRL 9) and consists of four different phases: research, development, demonstration and deployment. The phases are divided over a total of nine steps. Universities, in their academic training in scientific research (PhD) and academic training in technological design (EngD, formerly PDEng), are concerned mainly with the research phase of the TRL model (TRL 1-4). Here, the PhD focuses on basic research (TRL 1) and EngD (formerly PDEng) on applied research (TRL 2). In contrast, through their PD programmes, UASs focus mainly on the development and demonstration phase. In the development phase, *proofs of concept* from the research phase are further developed into working prototypes and validated in lab and simulated (test) environments (TRL 4-6). The subsequent demonstration phase proves the operation of the innovation in a user environment and the prototype is developed into its final form as a product, service or process (TRL 7-8).

Additionally, the TRL model suffices for the positioning of PhD and PDEng (formerly PDEng) within the domain of T&D, as it assesses an innovation purely on the basis of its technological performance. However, to adequately position the PD, another model needs to be added. This is because there are societal and business-economic innovation aspects that are not captured in the TRL model, but which do affect the embedding in the professional field and in society. In this respect, use can be made of the so-called Societal Readiness Levels (SRL), as developed by the Innovation Fund Denmark and used by the European Commission, among others. This model thus focuses on the social and also the organisational and economic aspects of T&D. The SRL model also consists of four phases: problem analysis, transition phase, implementation phase and deployment. These four phases are divided over a total of nine steps. The creation of support for the innovation and thus the interaction with stakeholders is of particular importance for SRLs (see especially SRL 4-6).

The constant optimal alignment of technological and societal/economical perspectives is decisive for and distinctive of PD programmes, in which nearly the full scope of the levels can be covered. Exceptions relate to beginning and end of cycles of TRL and SRL cycles: PD programmes usually do not focus on fundamental technology research (TRL1), nor do they usually fully engage in market introduction (TRL9 and SRL9). While an implementation plan and steps towards implementation regarding market introduction may form part of a PD programme, the focus does not lie on regular business processes such as marketing.

2.5 Programme Characterisation

On the basis of research, the PD candidate works on the development and implementation of an innovative solution to a complex and professional practice issue within the field of technology and digitalisation. This solution is based on both theoretical and practical knowledge, and it consists mainly of products for professional practice. The ultimate goal is to contribute to societal impact and economic earning capacity. The method is characterised by an iterative, short-cyclical and repetitive approach in co-creation with representatives of all stakeholders, not only professionals from various disciplines but also, for example, companies and industry associations, users and agents, experts and researchers. This requires the PD candidate to combine and integrate four roles, namely that of a (methodical) researcher, (design-oriented) professional, (co-creative) change agent and (technical and digital) innovator (see § 2.6) at level 8 of the EQF (see § 2.4.2). The PD candidate accounts for the PD trajectory and on the basis thereof advises the international scientific and professional community, and society, from the stated objective.

2.6 Learning Outcomes

A description of the learning outcomes and associated quality characteristics follows below, including brief explanations where necessary.

Learning Outcome 1

The PD candidate [verb 1.1:] articulates, [verb 1.2:] validates and [verb 1.3:] operationalises [standard 1.1:] a practical problem, challenge or opportunity within the domain of technology and digitalisation concerning the innovative development and application of key enabling technologies [standard 1.2:] aimed at meaningful societal impact and economic earning capacity [standard 1.3:] together with a representation of relevant stakeholders [effect 1:] in order to develop a substantiated and widely accepted problem definition as a basis for the PD course.

Quality Characteristics of Learning Outcome 1

- In articulating, validating and operationalising the practical problem, challenge or opportunity, the candidate involves not only T&D professionals but also representatives of relevant stakeholders, such as professional organisations and end-users.
- The articulation, validation and operationalisation the practical problem, challenge or opportunity meets scientific, professional, business and societal criteria.
- The practical problem, challenge or opportunity forms the basis for the objective and the question of the PD trajectory.

Learning Outcome 2

The PD candidate [verb 2:] intervenes [standard 2.1:] through iterative short cycles of designing, researching, testing, modulating and validating [standard 2.2:] with and in professional practice [effect 2:] directed at developing and implementing technical and digital professional products as a contribution to solving the articulated practical problem, challenge, or opportunity.

Quality Characteristics of Learning Outcome 2

- The PD candidate's interventions rely on multiple short cycles of practical research, design, testing and implementation processes.
- The technical solutions developed are commercially effective and efficient, technically structural and scalable, socially supported, sustainable and meaningful, and science based.

Explanation of Learning Outcome 2

- The assessment of the candidate's intervention should take the complexity of the practical problem, challenge or opportunity into account. A decisive factor is that the interventions (at level 8 of the EQF framework) have led to valuable practical and theoretical insights for the purpose of promoting societal impact and economic earning capacity through technology and digitalisation. Preferably, this is accompanied by successful interventions in practice, but this is not strictly necessary. Even in a PD trajectory of which the practical outcome is not as successful as hoped for, a PD candidate can demonstrate having achieved the required learning outcomes at the required final level.

Learning Outcome 3

The PD candidate [verb 3.1:] develops and [verb 3.2:] integrates [standard 3.1:] their own roles as a (methodical) researcher, (design-oriented) professional, (co-creative) change agent and (technical and digital) innovator [standard 3.2:] in an ethical, flexible, and context-sensitive manner [effect 3:] in order to realise meaningful innovations that are both technically and societally solid.

Quality Characteristics of Learning Outcome 3

- The candidate draws on state-of-the-art knowledge regarding technology and digitalisation, including relevant key enabling technologies.
- The candidate draws on state-of-the-art knowledge regarding practice research and practice innovation.
- The candidate draws on state-of-the-art knowledge regarding design processes and change strategies.

Explanation of Learning Outcome 3

- In particular, the interpretation and degree of integration of the four roles depends on the specific professional context and the specific phase of the PD programme. For example, a specific role may be more in the foreground in one phase and more in the background in

another, but in any context and in any intervention, a PD programme always concerns the integration of all four roles.

Learning Outcome 4

The PD candidate [verb 4.1:] clarifies [verb 4.2:] and justifies [standard 4:] the chosen approach throughout the PD programme [effect 4:] in order to optimise the generation, dissemination, and valorisation of technical and digital innovation.

Quality Characteristics of Learning Outcome 4

- The candidate is aware of the possible ethical, legal, political, and societal effects and implications of intended goals and interventions used and is able to handle possible areas of tension in interaction with all stakeholders.
- The candidate substantiates the extent to which the technical and digital solutions developed are meaningful for society, scientifically underpinned, societally supported and sustainable, technically structural and scalable, and commercially effective and efficient.

Explanation of Learning Outcome 4

- The clarification and justification of one's chosen approach is of course also – but certainly not exclusively – about successes. Even diversions, failures, setbacks and the like should be carefully recorded and analysed in order to generate new actionable knowledge for future innovations.
- The clarification and justification is each time adapted to the specific target group. At a scientific level, international peer-reviewed open sources are in any case also chosen, particularly with a view to wider applicability of the insights developed, including in terms of ethical, legal, political, and societal effects and implications.

Learning Outcome 5

The PD candidate [verb 5:] advises [standard 5.1:] on the possibilities of implementing and scaling up technical and digital innovation in professional practice, [standard 5.2:] on desirable or necessary follow-up research [standard 5.3:] and on the further embedding of innovation in professional education [effect 5:] with a view to promoting societal impact and economic earning potential.

Quality Characteristics of Learning Outcome 5

- The advice is based on the findings of the PD course and other relevant sources.
- The advice is based on a substantiated vision of the position of Technology and Digitalisation in organisations and society.

3 Programme Structure

3.1 Pedagogical Philosophy

'Constructive alignment' is a central tenet of the PD programme, i.e. achieving optimal consistency between learning outcomes (see § 2.6), learning processes and the learning environment (in this chapter), and the assessment programme (see chapter 4). In the alignment between learning processes and learning environment in the PD programme, the focus on workplace learning plays a central role.

Learning Processes
The PD programme facilitates high-quality learning processes necessary for achieving the required level (see § 2.4.2). These learning processes mainly take place through the intervention of PD candidates in complex professional practices at the intersection of collaborative research, innovation, and professionalisation. High-quality learning processes are characterised by independent, in-depth and co-creative learning.

- Learner-centred learning. The learning process of the PD candidate is central to the PD programme. Independent learning ability is based on meta-cognitive skills that enable PD candidates to regulate their own learning process, to motivate themselves and to communicate about it with various cooperating stakeholders.
- Learning by doing. Deep learning relies on the one hand, on cognitive skills for the acquisition, processing, application and creation of knowledge and skills and, on the other hand, on the reflective capacities concerning the professional and social aspects of all facets of the work, both on the intended results (meaningful impact) as well as the approach chosen (technical and social).
- Collaborative learning. Co-creative learning presupposes the ability to work and learn together with a diversity of stakeholders (boundary crossing) in innovative ways.

The high-quality learning processes envisaged in the PD programme thus rely on the development and integration of cognitive (such as analytical and conceptual) and meta-cognitive, reflective, and social skills.

Learning Environment
The PD programme is supported by a powerful learning environment. This is characterised by at least four conditions: (a) working on complex and innovative practical issues within the field of Technology & Digitalisation, (b) exchange and cooperation with a variety of stakeholders in the PD programme, (c) high-quality coaching, in which formative feedback (including feed up and feed forward) plays an important role, and (d) a continuous appeal to the PD candidate's own initiative and responsibility with regard to their own learning activities and learning processes. The learning environment is first and foremost situated in the professional practice where the PD candidate is active. Central aspects of workplace learning are participation in and reflection on work processes and thus immersion in the work culture. Workplace learning at level 8 of the EQF (see § 2.4.2) sets high demands on the workplace of the PD candidate, both in terms of the substantive challenges posed by the practical issue and the degree of supervision and support from the organisation(s). The workplace of PD candidates involves the application of key technologies in the field of technology and digitalisation and is characterised by a high degree of complexity, dynamics and tension, such as a plethora of visions and perspectives, interests and power relations, legislation and policies, funding streams and facilities. This does not only require explicit subject matter knowledge, but also more implicit and context-specific strategic actionable knowledge in order to ensure that this subject matter knowledge is applicable in specific situations. Workplace learning in particular provides a good basis for making these underlying processes visible and manageable. For the realisation of their PD programmes, PD candidates depend on authoritative sponsors within the organisation or consortium in which they are working who can, for instance, open doors and iron out problems, so to speak. Furthermore, to achieve a powerful learning environment, guidance from a research group and the embedding in the Graduate School T&D are important. In addition to the supervising UAS-professor and the supervising

practice professional, the PD candidate their self is also largely responsible for creating a powerful learning environment.

3.2 Programme Content

Explanation
With regard to the content of the training programme for PD candidates, for the time being, the T&D task force opts for customised content per PD programme. The content thereof will initially be sought within the existing range of education offered by the participating UASs. It may be possible to divert to other UASs, to universities, possibly also to education available abroad. The task force would like to advocate developing a cross-domain range of education initiated by the Programme Board for those components that are important for all PD candidates across all domains. Consider, for example, research ethics, data management, academic writing and publishing, strategic change science. To a limited extent, an offer relevant to all PD candidates for T&D may also be developed, but the exact content thereof is still subject of discussion.

The substantive core of the PD programme consists of the activities described above. As a national rule of thumb, in the T&D PD course, candidates are supposed to spend an average of approximately 12.5% of their available time on other, supportive learning activities in addition to their workplace activities. (This corresponds to 30 EC in a four-year full-time programme, but as we are not opting for a separate assessment of these learning activities, we cannot speak of credits either. If we assume that PD candidates are spending about three to five days a week working on their PD programme, this roughly corresponds to an average of half a day per week.) These learning activities may be related to courses, but this is not mandatory. Training courses, participation in networks, and self-study are also possible, to name a few alternatives. The aim is to distribute these learning activities in a balanced way across the PD programme, striving for optimal synergy between workplace PD activities and supportive learning activities. The content of these learning activities is therefore designed on the basis of the project plan of the specific PD effort which the candidate draws up in close consultation with the UAS-professor and the practice partners before the start of the project. This project plan substantiates which supportive learning activities the PD candidate expects to require for the specific project phases to ensure the optimal realisation of the project plan. Here, good alignment with learning outcomes and qualification descriptors is important.

For a good alignment between planned learning activities and learning outcomes, attention should be paid to the following points:

- [1] Problem definition. Is additional training needed so that the PD candidate can articulate, validate, and operationalise an appropriate problem definition?
- [2] Intervening. Is additional training needed so that the PD candidate can intervene methodically, co-creatively and effectively in an iterative and short-cyclical manner in professional practice?
- [3] Roles. Is additional training needed so that the PD candidate can perform and integrate the four roles of researcher, professional, change agent, and innovator?
- [4] Elucidation. Is additional training needed so that the PD candidate can articulate and justify their selected approach, not only in publications and presentations but also when using the portfolio?
- [5] Advising. Is additional training needed so that the PD candidate is able to advise on various aspects with respect to various target groups?

Attention should be paid to the following points for a good alignment between the planned learning activities and qualification descriptors:

- [1] Knowledge. Is additional training needed so that the PD candidate stays in tune with the state-of-the-art regarding T&D relevant to the specific PD project course? Is the PD candidate sufficiently informed of the technical and social aspects of the specific practical context in which the PD programme will be carried out?

- [2] Problem solving. Is additional training needed to realise technical and digital innovations in a complex practice context with diverse stakeholders in an iterative and short-cyclical manner? Is the PD candidate adequately versed in e.g. project-based design, design thinking, strategic change management, consultancy skills, etc.? (cf. intervening)
- [3] Research. Is additional training needed regarding research planning, research methods and research skills required for the realisation of the PD project? (cf. roles)
- [4] Attitude. Is the PD candidate's professional attitude sufficiently developed to function properly at this complex level? Consider, for example, dedication, integrity, diligence, transparency, responsibility, as well as aspects like self-knowledge, resilience, and perseverance.
- [5] Communication. Is the PD candidate sufficiently able to communicate orally and in writing in a goal-oriented and connecting way with a variety of stakeholders, such as colleagues, researchers and professionals from different backgrounds, managers and subordinates, lay people and stakeholders? (cf. explicate)

If necessary, the project plan drawn up by the PD candidate before the start of the PD programme can be adjusted during the course of the programme. Given the complexity of the PD programme, it is likely that this will we done several times. Planned learning activities can also be adjusted based on evolving insight.

3.3 Matching and Selection of Candidates

3.3.1 Requirements for PD Candidates

The requirements for PD candidates have already been described in § 2.4.1. The actual PD project is preceded by a preliminary matching and selection process. The preliminary stage must have been completed before the start of the PD project. The duration of the preliminary stage will typically range from six to twelve months. Below, we first discuss the matching process and then the selection of PD candidates. The two aspects are closely related, as will be demonstrated.

3.3.2 Matching

The matching process is aimed at establishing a promising partnership for a PD project. This requires coordination between several agents: (1) the supervising UAS-professor and the research group, (2) the assisting practice representative and the practice organisation or consortium, (3) the prospective PD candidate, (4) the practice issue and associated professional practice. The owner of the issue – the issue being the subject of the PD programme - may be a knowledge network (including a consortium of practice partners, as may apply in the case of a SPRONG programme, for example) but possibly also (subject to specific conditions) the management level of a professional organisation.

In principle, the initiative for matching can be taken by all agents involved: a UAS-professor, a representative from professional practice, or a candidate. In all cases, the matching for a PD programme will be initiated by a challenge or an opportunity within professional practice. In all cases, the UAS-professor has final control over the matching process. The UAS-professor is responsible for the risk management relating to the project and, on the basis of a mutual dialogue, determines whether the matching process is promising. It must be plausible for the PD trajectory to be successfully completed within the stipulated period and for the PD candidate to have then satisfactorily achieved the learning outcomes (see § 2.6) at the required level (see § 2.4.2). The basis for this assessment is an open conversation between the envisioned parties: the supervising UAS-professor, the candidate, and the representative from professional practice.

If the UAS professor considers the match promising and the other stakeholders share this opinion, the intended PD candidate will prepare a project plan for the entire PD trajectory in accordance with the criteria described in this Programme Proposal. The plan describes the planning of the work, and the goal and research question of the project. Furthermore, the desired or necessary substantive support

is elaborated on and incorporated in the plan. Moments for guidance, feedback and assessment are also scheduled. The plan is drawn up in consultation with the UAS-professor and the representative from professional practice. When the selection procedure (see below § 3.3.3) is successfully completed, the plan forms the basis for a cooperation agreement between research group, professional organisation(s)/consortium and candidate. During the PD project, the plan can be adjusted by mutual agreement. Given the complexity of the PD project, it is realistic to expect that this will be required more than once.

3.3.3 Selection Procedure

The PD programme can start when a consensus has been reached on the research and innovation question, on the intended project and on the suitability of the PD candidate. Selection involves two steps:

- Step 1: The candidate writes a cover letter with resume. The UAS-professor and practice supervisor jointly interview the selected candidate or potential candidates. Essentially, this involves the assessing the candidate's entry-level competence and development competence (for which the first level of the rubrics described in the next chapter can be used). This step is taken at the beginning of the matching process, after the introduction and alignment has taken place. If this step is successful, the candidate, in consultation with the UAS-professor and the practice supervisor, can start working on developing the PD proposal. This proposal outlines the project phases of the activities the PD candidate intends to undertake, including the supporting learning activities (see § 3.2) and the embedding in the employment context.
- Step 2: When the candidate, lecturer and practice supervisor have reached an agreement regarding the PD proposal, the UAS-professor, after consulting the supervising committee (see § 3.4.1), nominates the candidate and the PD proposal to the Graduate Committee. The Graduate Committee evaluates the candidate's PD proposal and decides whether the PD project can be started or not. When this step has successfully been completed, the PD proposal serves as the basis for a cooperation agreement between the parties involved and is recorded in a formal contract.

3.4 Support and Programme Team

3.4.1 Supervision and Support

The supervision and support of the PD candidate is carried out by a supervisory committee, consisting of at least two UAS-professors (one of which acts as chairman and the other as supervisor) and a supervisor from professional practice (preferably with sufficient decision-making power and overriding authority in the practice organisation or consortium). In principle, these are the same people who also carried out the matching and selection process (see §3.3). The supervisory committee has sufficient expertise to provide adequate guidance for the PD candidate. In particular, consider the following fields of expertise: subject-specific (technology and digitalisation, the relevant key technologies, the specific field of application), didactic (guiding, coaching, assessing), research-based, change management. The supervision will take shape on the basis of the personal guidance and development plan, which is part of the PD project plan drawn up by the candidate before the start of the project. Especially in workplace learning, the quality of supervision is crucial for achieving the intended learning outcomes. Consequently, the supervision is intensive, approximately 30 days per year for the entire committee.

3.4.2 PD Community

A PD T&D community will be initiated for all PD candidates. The aim of this community is to encourage the further development of candidates through mutual exchange of experiences. The exact form of the community is still under development. Think of peer review, case discussions, current-affairs lectures and the like.

3.4.3 Supervisors' Community

A community will also be set up for the supervisors of the PD candidates, i.e. UAS-professors and practice supervisors, at least during the pilot phase. Within this community, supervisors receive support in supervising PD candidates. Consider, for example, calibration and finding standards related to assessing the progress of PD candidates. In addition, this community can be used to evaluate and discuss challenges and problems in the pilot phase. Consider, for example, calibration and norm finding related to assessing the progress of PD candidates.

3.5 Embedding: UAS Professorships and International Networks

Higher education in the Technology & Digitalisation domain is inconceivable without internationalisation, both in terms of content regarding the-state-of-the-art, and networking. UAS-professors are already part of several international/national/regional networks, which will also be integrated and possibly expanded in the Graduate Network. In light of this, the UAS-professor helps the PD candidate find and access already existing networks relevant for the PD project when the project plan is being drawn up. The candidate may also independently connect to existing networks, depending on the specific topic.

In addition, for the positioning of the PD T&D with regard to internationalisation it is important that it is not only and not primarily about academic or scientific impact but mainly about a social and organisational impact, and that the PD programme is thus is less of an academic or scientific route and more an 'executive' and a 'practitioner' route. While knowledge and research at the level of the international state-of-the-art are important, they mainly are of practical relevance for innovation. In this, PD candidates go back and forth between the local and international levels. They start their PD project from local issues, relate them to national and international research agendas and delve into the international state of the art, design local solutions based on these, and then investigate to what extent these solutions can be generalised into a contribution to the theoretical and practical state-of-the-art in an international peer-reviewed journal.

3.6 Study Load and Duration

The study load and duration of study requires a balanced consideration between ambitions and feasibility. The PD T&D trajectory is based on the assumption that it will take an average of approximately 4 years (3 to 5 years) and that PD candidates can devote a minimum of 3 net days per week to the programme (preferably more). The feasibility of this planning largely depends on the quality of the PD project preparation: the matching and selection by the intended supervisory committee (see § 3.3) and the project plan of the intended PD candidate. Because of the dominant role of workplace learning, a distinction between full-time and part-time variants is not relevant: all candidates follow a similar programme; only the number of hours per week that can be spent on this will differ for each PD candidate.

3.7 Procedures

The procedure regarding the selection of suitable PD candidates, in conjunction with the development of the PD project, is described in § 2.4.1 and § 3.3.2. The procedures concerning the supervision of PD candidates are described in § 3.4.1. The procedure regarding the assessment of PD candidates is described in the following chapter, under § 4.3, in conjunction with the format of the assessment.

4 Assessment

4.1 Assessment Philosophy

The assessment of the PD programme is designed according to the concept of programmatic assessment (Baartman, van Schilt-Mol, Van der Vleuten, 2020). Programmatic assessment relies on collecting evidence (data points) that the candidate uses to clarify the own learning process and to demonstrate learning outcomes. The candidate's development is assessed at different points in time. In (low-stake and intermediate-stake) assessment moments, the learning process of the PD candidate takes centre stage; (high-stake) decision moments are accompanied by progress decisions or the awarding of the (as yet not legally recognised) title, in which the attainment of the learning outcomes at the expected level must be demonstrated. The programmatic-assessment concept is in line with constructivist learning theories, according to which learning is regarded as a joint and active process of knowledge acquisition. Within the design of the PD programme, we implement this concept in the form of (a) a strong appeal being made to the control of the student fuelled by reflection and feedback *(learner's agency and accountability*), (b) the interim assessments not only serving the final decision but also contributing to the development process of the PD candidate and (c) the high-stake decision on the awarding of the PD title to the candidate being based on a wide range of sources and perspectives.

PD candidates demonstrate learning outcomes by collecting supporting documents (evidence) in a portfolio (see § 4.3). The different supporting documents are assessed using so-called single point rubrics. These rubrics consist of success criteria that concretely describe what is expected of the PD candidate to demonstrate the intended learning outcomes (see § 2.6) at the expected proficiency level (see § 2.4.2). The rubrics are robustly formulated, provide sufficient benchmarks for candidates' self-assessment, and provide sufficient room for assessors to rate the progress of PD candidates with respect to the relevant facets.

4.2 Assessment Programme

In addition to the frequent low-stake assessment moments, the assessment programme also consists of one intermediate-stake assessment moment and two high-stake decision moments, namely an interim progress decision and a final decision on the awarding of the PD title.

The intermediate-stake assessment moment generally takes place nine to twelve months after the start of the PD programme. This is an interim assessment of the supporting documents collected in the portfolio. In a meeting with the supervisory committee, the PD candidate receives constructive feedback on the progress of the own PD programme. If progress does not meet the expectations, the PD candidate will receive a remedial recommendation from the supervisory committee.

The first high-stake decision usually follows about three-quarters to a full year after the medium-stake assessment, i.e. one-and-a-half to two years after the start of the PD programme, and is 'go/no-go' in nature. The decision is based on a holistic assessment of all the portfolio documents selected by the PD candidate. The PD programme can be continued if the PD candidate meets the expected progress. Otherwise, the decision will be made to end the programme.

Following the advice of the educational experts involved, we deviate from the national guideline in terms of the deadline for the first high-stake decision. The educational experts are of the opinion that it is not possible to make this decision after just one year.

The PD programme is successfully completed if the PD candidate has met all learning outcomes and is able to function independently in the roles of researcher, innovator, professional and change

agent at level 8 of the EQF. The final high-stake decision then leads to the awarding of the (as yet not legally recognised) PD title (see § 4.4 for the related procedure).

4.3 Assessment Tools

The PD programme uses a digital portfolio. The portfolio simultaneously has a function in the development and in the assessment of the PD candidate. The portfolio therefore consists of a development portfolio and an assessment portfolio. The development portfolio primarily functions as a tool for the PD candidate and the supervisory committee to record and monitor the progress within the PD programme. In preparation for a progress interview, the PD candidate compiles an assessment portfolio. This assessment portfolio consists of a selection of the supporting documents of the development portfolio, aimed at demonstrating mastery of the learning outcomes at the expected level.

In a dialogue with the supervisory committee, the candidate determines the desired content of the portfolio around the start of the PD programme. The supervisory committee and other stakeholders in the PD course provide regular feedback on the evidence collected. Also, under the direction of the PD candidate and in close consultation with the supervisory committee, an initial schedule of supervision and assessment moments is drawn up, which may be adjusted if called for during the PD process (if required also on a regular basis). If necessary, the PD candidate asks the supervisory committee to give feedback on the portfolio, and the supervisory committee shall give regular feedback regardless thereof. The content of the portfolio and the overall planning of contact moments are incorporated in the personal supervision and development plan (see § 3.4.2).

The steps taken during the PD project in connection with the portfolio:

- Detailing the portfolio plan: feedback from the supervisory committee
- Low-stake assessment moments: retrieving feedback from relevant stakeholders
- Medium-stake assessment moment: feedback from the supervisory committee
- High-stake decision moment: decision by the decision committee

For the purpose of accessibility for the assessment and decision moments, the portfolio is structured on the basis of learning outcomes. For each learning outcome, PD candidates add substantive supporting documents and a process description. This results in the basis of the content of the portfolio: the PD candidate collects evidence demonstrating that they meet the learning outcomes at the expected level. The portfolio can consist of various forms of evidence, the so-called data points. Data points may be derived from practice, such as the report of an analysis of a practical issue or the design of a prototype or professional product. Data points can also consist of formal evidence such as a realised outcome in supporting learning activities. Examples of data points include: research plans, written analyses, innovation designs, implementation activities, essays, and research publications in professional or peer-reviewed scientific journals, reports, exhibitions, heuristics, and algorithms. Stand-alone data points become valid supporting documents in the portfolio only when they are adequately related to the learning outcomes at the expected level and provided with (a) theoretical and practical substantiation, (b) feedback from relevant stakeholders and (c) reflection from the PD candidate on the iterative and short-cyclical process of research, innovation and learning, on the feedback received and on the relation with the learning outcomes. Evidence, in short, necessitates that the PD candidate justifies why the information collected and selected is relevant to demonstrate the learning outcome and why this information meets the expected level.

The so-called ‘VRAACQ’ criteria (Dutch: ‘VRAAKT’) apply to the preparation of the portfolio, which are:

- (V) Variation. There is sufficient variation of data points (triangulation). The greater the variation of different types of performance, of contexts and of stakeholders' perspectives at different times, the more evidence the supporting document provides.
- (R) Relevance. The data points are relevant to key aspects of the learning outcomes in question.
- (A) Authenticity. The data points are authentic. The supporting documents are a reliable reflection of the activities, experiences, and competence of the PD candidate.

- (A) Accessibility. The portfolio as a whole has a clear structure and is clearly written.
- (C) Current. The data points are sufficiently up to date; they are based on recent activities.
- (Q) Quantity. The evidence is well dosed. The data points do not contain redundant or irrelevant information.

As the candidates, supervisors and assessors may be unfamiliar with the programmatic assessment programme, portfolio composition, and assessment with (single point) rubrics, it is desirable to develop a range of training programmes to be offered in the preliminary or initial phase. It may be possible to collaborate with other domains in parts, in a national initiative.

4.4 Assessment Procedures

Before the final high-stake decision is made, the PD candidate provides the following documents in consultation with the supervisory committee:

- The final and complete assessment portfolio.
- A positive recommendation from the supervisory committee, based on the intensive guidance throughout the PD programme as well as on the final version of the portfolio.
- A written argument based on a substantiated vision of the domain concerning one's own view on the possibilities of and pitfalls in implementing and scaling up the developed professional products in practice, the desirability of follow-up research and the relevance for professional education.
- At least one article for a professional journal plus one article for a peer-reviewed scientific journal explaining the professional and social relevance of the products delivered as well as the research in this respect (the articles have been submitted with a realistic chance of acceptance, but do not necessarily already have to be accepted at the time of the final assessment).

In line with the chosen assessment philosophy (see §4.1), we do not refer to an 'assessment committee' but a 'decision committee'.

To make the final high-stake decision, the Graduate Committee shall form a so-called decision committee for each PD programme. In the pilot phase of the PD, the members of this decision committee consist of:

- A member of the Professional Doctorates Validation Committee (VaCo-PD) as chairman.
- A member from the community of UAS-professors from the domain.
- Three members reflecting relevant stakeholders in the PD programme, including at least one content-expert researcher and one content-expert professional.

The supervisory committee may nominate candidates to serve on the decision committee. The candidate can also nominate a candidate in consultation with the supervisory committee. However, conflicts of interest should be avoided, and independent assessment ensured. Ultimately, the Graduate Committee decides on the composition of the decision committee.

After receipt of a positive assessment from the decision committee, the PD candidate will organise, in cooperation with the research group and work field, a (mini) conference which will be chaired by the PD candidate. Representatives from the fields of science, professional practice, the profession, professional education, and society are invited to this conference. A debate based on the argumentation of the PD candidate is central to this conference. The conference therefore opens with a presentation by the PD candidate, the content of which is made accessible for all stakeholders. The PD candidate concludes the conference with a summary of the main conclusions and advice. Then the decision committee withdraws to formulate the final opinion, noting that the conference cannot overturn the initial positive assessment. After pronouncing the positive opinion, the accompanying UAS-professor pronounces the laudatio. The conference will conclude with a reception.

Several procedural issues require further detailing, preferably at the national level:

- Can a PD candidate appeal a negative recommendation from the supervisory committee, regarding the initiation of the final high-stake decision?
- Can a PD candidate appeal a negative assessment by the decision committee?

4.5 Quality Assurance

The quality of programmatic assessment is based on the quality of the decision instrument (the portfolio), the quality of the decision-makers (i.e., the examiners of the decision committee) and the quality of the decision procedures, in addition to a clear separation between supervision and decision. The quality of the decision instrument in the form of the VRAACQ (VRAAKT) criteria described above is derived from the quality criteria for qualitative research. The decision makers are responsible for assessing the portfolio against these criteria. These decision makers are content experts in the domain at level 8. They are also trained in portfolio assessments, in programmatic assessment and in working with single point rubrics. Moreover, they participate annually in calibration sessions at domain level. The decision procedure is carried out transparently. The quality of programmatic assessment is monitored by the Graduate Committee.

5 References

Andriessen et al. (2021). *University of Applied Sciences Professional Doctorate: Een beroepsopleiding waarin praktijkgericht onderzoek centraal staat*. Netherlands Association of Universities of Applied Sciences.

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