



Evaluation 2017 - 2022

NWO Institute DIFFER
Dutch Institute for Fundamental Energy Research

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1. Foreword by the committee chair

The charge to the committee was to assess the DIFFER institute along the axes of Research Quality, Societal Relevance, and Viability with cross-cutting perspectives on Open Science, PhD Policy and Training, Academic Culture, and Human Resources. The assessment was based on both performance during the previous assessment period and the strategy proposed for the coming years.

The advance material and site visit presentations were extremely informative and helpful to the committee. The institute management was open in their sharing and to questions posed by the committee during the site visit. In addition, they allowed the Department Heads and Group Leaders to present their accomplishments and strategies and arranged for informal discussions between the committee and representative of two critical segments of the staff—technical support and PhD students, all without the presence of institute management. This level of openness and trust is notable and commendable.

The institute faced a major change in 2015 to move the entire institute to a new physical location. This was both a challenge and an opportunity for the institute. The new physical facility is impressive and from the perspective of a brief visit appears to be well managed and, importantly, safely operated. The previous assessment period reflected this change with many transitions in personnel and research direction. The impact of the COVID-19 pandemic also impacted the implementation of both the research strategy and the human resource programs of the institute. In this sense, the coming assessment period is a critical continuation of the efforts to establish a firm foundation for the institute following this transition.

As a general observation, the committee was impressed with the facility, the staff, and the students at DIFFER. I would like to thank all involved in putting together the materials and arranging the site visit, which was very effective. The support from NWO and from Academion has also been critical to the effectiveness of the committee to carry out the evaluation. On the basis of the materials and the site visit, the committee was able to focus on the governance of the research, the environment in which it is executed, and the strategy for the future of the institute, as is detailed in the following report.

Tim Luce
committee chair

2. Procedure

2.1 Scope of the evaluation

This evaluation was carried out as part of the evaluation of the nine research institutes of the Dutch Research Council (NWO). NWO asked evaluation committees of external peers to perform an evaluation of its research institutes over the period 2017-2022. Quality assurance agency Academion acted as independent intermediary to safeguard the quality of assessment, providing secretaries for each of the site visit and helping the institutes and evaluation committees prepare and execute the site visits together with NWO-I, the institute organization of NWO.

The evaluations were carried out according to the Strategy Evaluation Protocol 2021-2027 (SEP), the protocol for research evaluations in the Netherlands, agreed upon by NWO, the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Universities of the Netherlands (UNL). The committees were requested to carry out the evaluations according to a list of questions derived from the main assessment criteria of SEP (see appendix 1). The assessment was to include a backward-looking and a forward-looking component. The committees were asked to judge the performance of the institute based on the list of SEP questions and to offer its written conclusions as well as recommendations based on considerations and arguments. The main assessment criteria are:

- Research Quality;
- Societal Relevance;
- Viability.

During the evaluation of these criteria, the committees were asked to incorporate four specific aspects relating to how the institute organises and performs its research, its composition in terms of leadership and personnel, and how the institute is run on a daily basis. These aspects are:

- Open Science;
- PhD Policy and Training;
- Academic Culture;
- Human Resources Policy.

For more information on the SEP questions, see Appendix 1.

2.2 Composition of the committee

The committee for the evaluation of DIFFER was appointed by the Board of NWO, and consisted of the following members:

- Dr. Tim Luce (ITER) - chair
- Dr. Frédéric Chandezon (CEA)
- Prof. dr. Moniek Tromp (University of Groningen)
- Dr. Fernanda Rimini (JET)
- Prof. John Irvine (University of St Andrews)
- Prof. dr. Christian Linsmeier (Forschungszentrum Jülich)

The committee was supported by Peter Hilderling MSc (Academion), who acted as secretary on behalf of Academion. Dr. Ella Bosch was present during the site visit to support the committee on behalf of NWO-I. Committee member Christian Linsmeier could not attend the site visit due to illness. His written comments were considered when preparing for the site visit and drafting the report afterwards.

2.3 Independence

Before the site visit all members of the committee signed the NWO Code of Conduct, by means of which they declared that their assessment would be free of bias and without regard to personal interest, and that they had no personal, professional or managerial involvement with the institute or its research programmes. It was concluded that there were no serious conflicts of interest. The NWO-I coordinator was present during the site visit and provided the committee with background information and context on the position of the NWO institute upon request, but did not take part in the evaluation.

2.4 Data provided to the committee

The committee received the self-evaluation report from the institute, including all the information required by the SEP.

The committee also received the following documents:

- DIFFER Strategic Plan 2023-2028
- Case studies Fusion Energy and Solar Fuels research
- Overview Facilities & Instrumentation
- Quantitative indicators research quality and relevance to society
- Quantitative indicators on research staff, funding, and PhD candidates
- Network analyses
- Overview media performances
- Selection of publications, awards and prizes and memberships
- Information on the career trajectories of PhD students

2.5 Procedures followed by the committee

The committee proceeded according to the SEP 2021-2027. The secretary instructed the committee chair on his role in the evaluation. In its first meeting on 18 September 2023, the committee was briefed by the secretary on research evaluations according to the SEP 2021-2027, and by the NWO-I coordinator on the Dutch research landscape and position of the NWO institute therein.

Prior to the site visit, all committee members independently formulated a preliminary evaluation based on the written information that was provided before the site visit. During its preparatory meeting on 21 November 2023, the committee discussed the preliminary evaluations and identified questions to be raised during the site visit. It agreed upon procedural matters and aspects of the evaluation. The site visit took place on 21-23 November 2023 (see the schedule in Appendix 2). After the interviews the committee discussed its findings and comments in order to allow the chair to present the preliminary findings and to provide the secretary with argumentation to draft a first version of the evaluation report. The final evaluation is based on both the documentation provided by DIFFER and the information gathered during the interviews with representatives of the institute during the site visit.

The draft report by the committee was presented to DIFFER for factual corrections and comments. In close consultation with the chair and other committee members, the comments received were reviewed to draft the final report. The final report was sent to the institute on 26 February 2024.

3. Evaluation of DIFFER 2017-2022

3.1 About DIFFER

The Dutch Institute for Fundamental Energy Research (DIFFER) is the national research institute for energy research, focusing on fusion energy and solar fuels. It was established in 1959 as FOM Institute for Plasma Physics Rijnhuizen as a research institute on plasma physics and nuclear fusion. The institute was renamed DIFFER in 2012 to reflect its broader focus on fundamental energy research in fusion energy and solar fuels. In 2015, the institute moved from Castle Rijnhuizen in Nieuwegein to the TU/e campus in Eindhoven.

Research focuses on two major themes:

- *Fusion Energy.* The Fusion Energy department contributes to research into hydrogen fusion as clean, compact and virtually limitless energy sources. Fusion energy has the potential to stabilize the (sustainable) energy grid and offer baseline or dispatchable power. The main research efforts are related to magnetic confinement fusion in the global ITER project and the commercially viable fusion reactor design DEMO. Sustained fusion is aimed to be realized by approximately 2035. The EUROfusion consortium provides a platform for European collaboration on large-scale research facilities. Dutch researchers from Eindhoven University of Technology (TU/e) and the University of Twente (UT) participate as affiliated entities in EUROfusion.
- *Solar Fuels.* The Solar Fuels department investigates materials, interfaces and underlying processes for solar fuels through experiments and modelling. Research focuses on energy material science, computational science, (photo)(electro)chemistry and catalysis, thermocatalysis and plasma chemistry, and covers the atomic level up to device level. Additional attention on fabrication is planned in the coming years.

Staff

Per 2023, DIFFER employs 118.3 fte staff members, of which 51.4 fte is scientific staff (including 20.5 fte PhD students and 13.9 fte postdocs), 35.4 fte technicians, and 31.5 fte support staff. Research groups typically comprise of one or two tenured or tenure track scientific staff members (one of which is the group leader), and associated postdocs and PhD students. At the time of the site visit, there were ten research groups in two departments:

- FUSION ENERGY
 - Energy Systems & Control
 - Integrated Modelling and MHD
 - Plasma Edge Physics and Diagnostics
 - Plasma Material Interactions
 - Plasma Micro-Turbulence
- SOLAR FUELS
 - Autonomous Energy Materials Discovery
 - Catalytic and Electrochemical Processes for Energy Applications
 - Electrochemical Materials and Interfaces
 - Plasma Solar Fuels Devices
 - Storing Solar Energy (with TU/e)

Due to the recent departure of several group leaders in the Solar Fuels department, the institute is in the process of attracting new researchers, which is expected to lead to two additional research groups in this department.

Next to the Fusion Energy and the Solar Fuel department, the Facilities & Instrumentation (F&I) department provides technical support to both departments and DIFFER in general. This includes the design, realization, operation and upgrading of the facilities and materials for research, and the running of the user facilities (see below). Previously, technical support was embedded in within the research departments. Per 2023, all technical support was merged into the F&I department. In creating a single technical department, DIFFER aims to stimulate synergy between the two research themes, increase flexibility in technical support and improve career perspectives of technicians at DIFFER. Support is provided by the support groups Facility Management, Finance, Human Resource Management, ICT Services, Management Support, Occupational Health, Safety & Environment, and Strategic Support.

Governance

DIFFER is headed by a director reporting to the NWO-I Director. Each of the ten research groups is headed by a group leader who is also the manager of the research staff within the group. Each department is headed by a department head, who at present is also one of the group leaders of the associated research groups. All strategic decisions are discussed in the management team, which consists of the director, the institute manager and the department heads of Fusion Energy, Solar Fuels and Facilities & Instrumentation. The NWO board and institute director are advised by a Scientific Advisory Committee for long-term research strategy, and by an Institute Advisory Board on political and socio-economic topics.

Funding

The total funding of DIFFER amounts to roughly 14.5 M€ annually. Approximately 70% is covered by the basic funding of NWO, with the remaining 30% consists of competitive and contract research. On the expenses side, DIFFER spends approximately 10-11 M€ on personnel, and 3-4 M€ on material costs. In the past years, DIFFER has had a small surplus that could be added to the financial reserves intended for future investments.

Research facilities

DIFFER maintains, operates and/or develops multiple research facilities for both internal and external users. These include:

- *Magnum-PSI* is a unique laboratory facility that uses a superconducting magnet to produce and even exceed the heat and particle fluxes expected in the divertor of a fusion reactor. This capability is combined with good access to the plasma-material interaction region for diagnostics and sample manipulation. It can be used to study plasma-wall interaction processes for fusion reactors, and material studies under extreme conditions. It is a key facility for the EUROfusion programme and is used by researchers from all over the world.
- *The Upgraded Pilot-PSI (UPP)* is a linear plasma generator used for ion beam analysis of materials during fusion-relevant plasma exposures. It allows for analyzing the top few micrometers of a material during plasma exposure, being the first facility of its kind to allow for dynamic processes.
- *The Ion Beam Facility (IBF)* features a 3.5 MV Singletron ion accelerator. It is often used to provide the ion beams in Magnum-PSI and UPP experiments, but is also used in other experiments. DIFFER is currently investing in promotion of the IBF for use by Dutch universities and companies.
- *The Liquid Metal Shield Laboratory (LiMeS-Lab)* is a laboratory facility used to test the use of liquid metals in fusion reactor walls, allowing for a more efficient energy transfer through the reactor wall. The laboratory consists of a 3D printer for the printing of a sponge-like tungsten wall that can

contain the liquid metal, and a plasma set-up to test prototypes. The LiMeS-Lab is currently under construction, funded by an NWO Investment Grant Large of 2.5 M€.

- The *Solar Fuels Laboratories* house small-scale equipment and systems for materials processing, synthesis, characterization and component development, aimed at studying energy conversion and storage.
- *Pulsed Laser Deposition (PLD4Energy)* is a research infrastructure under development to produce thin films for electrolyzers and fuel cells for sustainable fuels and includes same materials characterization techniques. It is funded by a by an NWO Investment Grant Large of 4.7 M€. Development has started in 2023.
- The *computational facilities* of DIFFER include several scientific software engineering projects, such as the ITER modelling infrastructure and software for autonomous energy material discovery. Codes are also available for public use,

3.2 Mission, vision and strategy

Mission and vision

The mission of DIFFER is to perform leading fundamental research on materials, processes, and systems for a global sustainable energy infrastructure, in close partnership with (inter)national academia and industry. As a national institute, DIFFER uses as guidance principles to focus on scientific excellence, world-class research infrastructure, facilitating and coordinating the research field, and connecting science and industry in fundamental energy research.

Strategy 2017-2022

In 2017-2022, DIFFER pursued four main strategic goals. First, the institute focused on fundamental research in a programmatic and integral approach. Second, it aimed to maintain and further develop its large-scale research infrastructure facilities to serve as a national user facility) Third, DIFFER worked towards expanding its network of scientific, educational, industrial and societal partners. Finally, the institute wanted to maintain a viable, healthy organization.

After the evaluation of national institutes by NWO and KNAW in 2018, the NWO Executive Board placed more emphasis on the national leading and coordinating role that NWO research institutes are expected to take. DIFFER had to rethink their strategy and role, leading to an increased focus on collaboration with external partners on energy research and a shift in focus towards the development and exploitation of large-scale research infrastructures, while keeping scientific excellence intact. In maintaining a viable and healthy organization, DIFFER invested in guidance and supervision of postdocs, PhDs and students, diversity, particularly related to gender balance and inclusion.

The results of these strategic efforts, as well as related challenges and opportunities, are discussed in the relevant chapters in this report.

3.3 Research Quality

To assess the research quality of DIFFER, the committee considered the research output, facilities and activities at the institute. During the site visit, all group leaders presented their group's research, and the committee had the opportunity to visit laboratories and workshops and to speak with researchers. From the evidence presented, the committee concludes that the research is of outstanding quality and is well-received by the peers as well as potential industrial partners and users.

In the area of *Nuclear Fusion*, the institute has a relatively high freedom to focus on a select number of research lines. Unlike other large fusion research institutes, DIFFER has no very large infrastructures such as a magnetic confinement experimental tokamak. Maintaining such large infrastructures usually have the effect of spreading resources thin, whereas DIFFER can focus on a few specialized areas. This advantage has been exploited very effectively and DIFFER is now a clear leader in areas such as exhaust control, and modelling and experimental plasma-wall interaction. On the exhaust modelling and integrated control side, the contribution of DIFFER researchers is highly valued and welcomed within Europe. According to the committee, the groups bring a unique combination of research skills, advanced diagnostics and modelling into their collaborations. Examples are the development, application and exploitation of the MANTIS diagnostics on TCV and MAST-U, or the collaboration with UKAEA to design advanced real-time controls for the first-generation prototype fusion reactor STEP.

A particularly successful research line at DIFFER is focused on concentrating on the developing and testing of materials suitable for fusion energy applications, including handling the extreme conditions of the plasma and heat flux. The Magnum-PSI facility has the unique capacity to test materials under conditions relevant to fusion energy applications, including addressing fluence (aging) conditions in a practical time duration for the tests. This is exemplified by the tests of materials for ITER at relevant conditions considered equivalent to a year of ITER operation, which has received significant attention from the ITER organization and the fusion community. In the development area, the institute is implementing a strategy to look at novel materials to enable liquid metal solutions that potentially could allow routine operation at even more extreme conditions. The choice of these facilities well matches community needs with facilities that can be operated by an institute of this size.

DIFFER has a world-class capability for development and implementation of operational control in the fusion environment, which is enhanced by the close connection to a broader control system expertise at TU Eindhoven. The expertise of the DIFFER group is recognized by many fusion facilities in Europe and around the world by allocation of experimental time and adoption of the developed systems for routine use. The particular focus on heat and plasma flux control is synergistic with the in-house testing and development focus on the same topic.

Furthermore, the institute is a world leader in the development of reduced models that have high fidelity to state-of-the-art calculations while providing these high-fidelity results with the necessary acceleration to enable practical dynamic calculations. The focus is on transport of energy and particles in the core of magnetic confinement fusion systems but is moving also to the connection between the core and the material surfaces. This is important because it aligns well with the two other research lines mentioned above. This positions the institute to be self-sufficient for joint optimization of the coupled solution of the plasma performance and the interaction with the surrounding materials and the means to meet the challenges both with novel materials and with precision control.

The research quality in all these areas is recognized in the community, as evidenced by the adoption of the output, and is a sound overall technical strategy to play a key role in the world fusion community within the constraints of the expected funding, staffing, and physical infrastructure.

The level of outputs from the *Solar Fuels* groups is impressive with excellent societal relevance. The committee identified several highlights in the Solar Fuel research. For example, the institute has created a unique, renewable energy-driven approach for enabling electrocatalytic reactions using a plasma-activated electrolyser. This enables the sustainable production of several essential chemicals such as ammonia and nitric oxide, using basic chemical substances such as N_2 , CO_2 and H_2O . Another highlight is the autonomous

discovery of energy materials, where promising new molecules and materials to be used in energy storage and conversion are explored through computational methods and artificial intelligence. These methodologies potentially allow accelerated discovery of materials compared to the experimental methods mostly used so far. This research has contributed to the discovery of various promising candidate materials for storage and conversion of energy, such as battery electrodes, materials for H₂ storage and plasma-metal electrodes for chemical production processes. Multiple academic, industrial and public parties contribute and participate in this research line, which is recognized through various prizes and funded projects. This work moreover opens interesting perspectives for inter-groups and inter-departments collaborations at DIFFER.

Particularly interesting is a novel device approach to photoconvert humidity from ambient air to hydrogen. This could be an elegant solution to produce cheap green hydrogen in practically any location. Furthermore, the department investigates films and photoelectrodes for water splitting, using solar energy for hydrogen production, which could be an important step in the future global energy supply, using excess solar energy to produce renewable fuels. A long-term collaboration with the UT has been realized in 2021, aimed at fabrication and investigation of thin films using Pulsed Laser Deposition (PLD). In combination with the ion beam facility at DIFFER, production and fast characterization cycles for the optimization of thin film quality are possible using the new PLD4Energy facility. DIFFER will also host and run the PLD as a user facility for academia and industry. Applications are for example in the field of conversion and storage, like electrodes for water splitting, fuel cells and batteries.

Finally, the committee felt that further collaboration between the research departments on cross-cutting topics could provide a unique opportunity not available to other laboratories. Examples of areas where the research departments may find common ground are modelling strategies, algorithms, and methods, interaction between plasma science and electrochemistry, process control, and detailed measurement techniques.

National role

In terms of national leadership role, the two major research themes pursued by DIFFER vary in both maturity and nature. The fusion energy research draws on a long history of Dutch scientific and technical excellence in this field. DIFFER is recognized as the Dutch leader in this area, even though the focus of the research has evolved significantly over the last decade or two. DIFFER represents the Netherlands in large research programmes such as Fusion4Energy (ITER) and EUROfusion, which automatically results in a national coordinating role in fusion research.

In the current environment, Solar Fuels energy research is much more widely spread across the universities and research institutes in the Netherlands than Fusion and has been developing at DIFFER only in the last decade, with a significant turn-over of scientific staff. Next to various individual reasons for researchers leaving DIFFER, the institute is in a difficult position to attract and retain talent. The field of Solar Fuels is dynamic and fiercely growing, leading to a pull to talent from industry and other research institutes. There is clear recognition of leading individuals within the field; however, to what extent DIFFER has a leadership role and what form a leadership role takes are still open questions.

From the discussions during the site visit on this topic, the committee found that there are several ideas and initiatives within DIFFER to expand its coordinating role in national Solar Fuels research. This includes investing in unique large-scale facilities to serve the Dutch energy research and engaging in pioneering research to further the field. The committee appreciates this, but also thinks that it will be a major challenge to fulfil a broadly recognized national role given the current scale of the Solar Fuels research at DIFFER.

Pursuing the goals of being a service provider to the Dutch energy research community by running those facilities, as well as developing an own research programme requires sharp choices and targeted investments.

The committee recognizes that recent evolution of the Solar Fuels department, with the departure of five group leaders and the forthcoming planned recruitment of two new group leaders, is an opportunity to reflect on the identity of the department and its links with the field of energy research in the Netherlands. The autonomous materials discovery approach, elaborated in the Solar Fuels department, and the link to characterization and infrastructure presented during the site visit appear interesting ways of doing this. The committee encourages DIFFER to clearly define what a national role in solar fuels research should comprise and formulate an articulate strategy to work towards its envisioned leadership goals. These goals should be aligned with DIFFER's uniqueness and strengths, i.e. the combination of nuclear and solar within one institute. All this includes aligning with all group leaders and DIFFER management in a common goal and direction, and being aware of the constantly changing landscape. Moreover, the committee thinks that the DIFFER should keep working on the acceptance and embracing of its envisioned national role for its Solar Fuels research within the Dutch research community. Hence, networking and lobbying will be required.

3.4 Societal Relevance

The committee is of the opinion that the two research themes, and the individual research topics within these themes are unquestioned in their societal relevance. In the field of *nuclear fusion*, the development of fusion energy production could have a deeply transformative impact on society by offering a clean, abundant and CO₂-emission-free energy supply. In the field of *solar fuels*, DIFFER's research contributes to the electrification of chemical process in the transition to a carbon-free, sustainable economy. An example for this societal relevance is the recent development of photoelectrochemical cells devices to convert light and humidity of ambient air into green hydrogen. The conversion efficiency is still limited (2,2 %) but the group targets a 10% efficiency and larger surface areas, which would open interesting perspectives for practical applications. Another example is the autonomous energy materials discovery approach, which was applied recently to the accelerated discovery of better performing materials for electrochemical storage and for energy conversion. To promote the use of its research results in the energy transition, DIFFER fosters collaboration and partnerships with stakeholders, including public-private research projects with over a 100 private partners.

Future strategy for societal impact

Especially in the solar fuels area, there are emerging indications that the work pioneered or developed at DIFFER is starting the transition to industrial development, such as the pilot plant for industrial hydrogen and feedstock production from methane at the Chemelot Campus. The recent recruitment of an industrial liaison officer within the institute will be an asset in supporting the DIFFER teams for this in the future. The institute has also recognized that engagement with the public is important to the success of the mission. For instance, open days have been initiated for the public to tour the facility and learn more about the work of the institute, and the institute contributed to the development of a teaching package on sustainable energy for primary schools. Furthermore, there is an enhanced focus on attracting media attention to the work of the institute, resulting in several popular-scientific publications on DIFFER research.

The committee appreciates these efforts and thinks that these contribute to furthering the societal impact of DIFFER. At the same time, it also notes that these initiatives are currently not tied to a clear strategy or prioritization. In view of the diversity of research and opportunities within the institute, the committee thinks that it is important to prioritise which aims and actions maximize impact and avoid fragmentation of the

effort. This applies to contributions to industrial development as well as to outreach. The committee thinks that it would be helpful to inform and align within the institute on what societal relevance is, as well as the key indicators for success. For instance, some presentations during the site visit only noted peer recognition as societal impact, which the committee deems too limited. Clear indicators might also contribute to a clearer view on the balance between efforts and result.

The committee realizes that fusion research is a high-risk, high-gain endeavour, and that research is still decades away from realizing an energy-positive fusion power plant. Nevertheless, it considers the DIFFER contribution in this regard to be not only important because it advances research, but also because it continues to develop a highly qualified workforce specialized in energy research, which will be needed as society moves forward towards the global energy transition. Many PhD students of DIFFER continue their career in high-tech industry in the Eindhoven region, meaning that DIFFER directly contributes to the technical workforce of the Netherlands. The committee thinks that the institute could further strengthen this effect by providing junior researchers with training opportunities in transferable skills (including ethics) that will be useful in a career outside academia.

Intellectual property

Another aspect of societal relevance is the generation and protection of intellectual property. According to the committee, this is especially important for DIFFER to address. A key element of the strategy involves opening the infrastructure investments to outside users, as well as engaging in research and development with industrial partners. The use of DIFFER infrastructure and expertise by commercial entities raises the question of fair right of return of the public for this use. Developing terms and conditions for protection is currently done on a case-to-case basis by the researchers involved, with legal advice provided upon request. According to the committee, this could be more centralized through clear guidelines and advice by the institute management as well as NWO-I, so that the burden is not placed too much on individual researchers. It understood during the site visit that the institute is already considering developing such a policy, which the committee fully supports.

The implementation of such a policy may be significantly different in the two research areas, as the timescale for commercial deployment is significantly different. For example, in nuclear fusion, the primary protection of intellectual property may be publication, since patents would in general expire before large-scale commercialization. However, in solar fuels, development to commercial market could in principle be quite rapid. The panel recognizes that the balance of public interests, societal impact, and the desire of the industrial partners is quite difficult, especially if the partners wish to protect their developments by trade secrets rather than patenting or publication. The committee can only recommend that DIFFER management lead the discussion, engaging both NWO and staff, in order to avoid this becoming an obstacle to implementation of the institute strategy and motivation of staff.

Open Science

DIFFER is striving for full open access publishing, as it believes that publicly funded research should be freely available. Starting from 70% open access publishing in 2017-2020, DIFFER was able to realize 91% open access publishing in 2021-2022. The institute management works on improving general awareness about open access among the scientific staff. The institute has developed policies and guidelines to help researchers publish their work in open access journals or repositories, and to use open-source software and tools. It also encourages its researchers to publish data sets.

The committee concludes that DIFFER is doing well in open access and praises the high percentage of open access publications that the institute has managed to achieve. It encourages the institute to continue their

efforts towards 100% open access, and to find and address, if possible, the remaining obstacles. Regarding open data, the committee found that this still in its infancy, with a few examples of the successful creation of open data sets presented during the site visit. It encourages the institute to learn from these examples and integrate best practices to promote the appropriate sharing of data. Furthermore, the institute should formulate formal objectives and procedures for open data to ensure that this is properly considered for all projects generating large data sets.

3.5 Viability

Considering the financial position of DIFFER, its position within the research landscape and the current staffing and leadership, the committee considers DIFFER to be well-equipped for the future. The committee noted from the interviews that the leadership has a realistic outlook on the future and is aware of its opportunities and challenges. The strategic priorities and investments as presented in the strategy for 2023-2028 are timely and relevant and are backed by a solid financial plan. Researchers at DIFFER have demonstrated to be able to secure substantial funding for their ambitions. Responsible financial management in the past years has resulted in the formation of a strategic budget, that DIFFER aims to use to realize its goals for new large-scale infrastructure.

External funding is spread somewhat heterogeneously throughout the institute. The committee thinks that this is partly unavoidable, but it also poses a risk that funding depends too much on the recognition of individual researchers. Considering the considerable turnover in staff members that the institute experienced in the past years, this poses a potential risk in the funding strategy of DIFFER. The committee thinks that the institute could consider focusing on enhancing their leadership role in consortia. Not only would this provide more stable funding for a longer period of time, it would also enhance the institutional leadership role that DIFFER is aiming for.

Future aims: Strategy 2023-2028

Notwithstanding the current strong position of the institute, as well as a positive outlook on the coming years, viability will remain a challenge for any publicly funded research. External factors always play a large role in the quantity and priorities of funding on the national and international scale.

Compared to 2017, the landscape of energy research has shifted considerably. The need for a society independent from fossil fuels has grown through an increased sense of urgency surrounding climate change, and the increased motivation for independence in energy supply. This has led to recognized need for growth in energy research globally. Furthermore, new instruments have emerged in the funding landscape, such as the National Growth Fund of the Netherlands for application-oriented energy research, and private funding for commercial nuclear fusion. As discussed earlier in the report, DIFFER aims to take a leading role in the Dutch energy research fields. While maintaining a focus on fundamental energy research, the DIFFER strategy proposes investment in new large-scale facilities, opening new and existing facilities as national user facilities including potentially commercial entities, and enhancing its relationships with academia, applied research, industry, and society in general. The committee thinks that these future goals are appropriate but advises to accompany this with a more developed investment and staffing strategy.

Investment strategy

Regarding future investments, the committee thinks that whereas investment in new infrastructure will be essential for the continuing relevance and viability of the institute, investment alone will not automatically ensure this outcome. It considers that the investment choices for new infrastructure must satisfy two key requirements for success.

First, they must be consistent with national initiatives and roadmaps to maximize their effectiveness and service to the community. As an example of this, the committee found that the planned large investment in an X-ray facility was not clearly accompanied with a perspective of how the proposed facility fits in existing and anticipated investments and facilities elsewhere.

Second, existing and proposed infrastructure should have a stable strategy for operation and maintenance. The proposed plan to open its infrastructure to a larger community of users should be implemented carefully, not only regarding the discussion on intellectual property (see above), but also regarding the envisioned balance between using facilities for its own researchers, which is crucial to furthering its mission, and serving as a national user facility. Regarding maintenance, the recent reorganization of the Facilities & Instrumentation department resulted in a more centralized team to implement and operate the facilities. The committee sees the benefits of this re-alignment for economic and functional efficiency. On the other hand, it separates the initiators for new infrastructure from the staff implementing and operating them. Some care needs to be taken to assure this does not remove any motivation from the staff to propose new facilities, and to assure that the user feedback is reflected in the operation of the facilities.

Staffing strategy

As for any research institute, the ability to maintain and enhance the reputation of the institute in the community requires sustained excellence in the field, whether in research or facility operations. The committee notes that the research staffing model at DIFFER relies heavily on early career researchers, post-doctoral researchers and PhD students. The group leaders are mostly mid-career researchers, who are attracted to DIFFER to develop a line of research, including funding of that research and recruiting of the necessary early career staff. Recognition by external peers indicates that the group leaders recruited meet the expectations of the institute. At the same time, the committee has concerns about the distribution of human resources among senior, mid-career, and early level researchers. The group leaders carry significant responsibility for creating, maintaining, and even expanding a line of research, but they must also play a role in the career development of the early career staff in their groups. As such, they become potential single points of failure of the research line. The committee would ask the DIFFER management in consultation with NWO to consider whether augmentation of the mid-career level staff would benefit the stability of the institute and the quality of career development of the early career staff, while providing a potential career path for the best early career researchers to continue within the institute.

Retention of the group leaders is a key to the reputational continuity of the institute, as noted above. It is good to see some move to other leading roles in other organizations, but it is important that the staff are suitably supported and encouraged to grow to their full potential within DIFFER. A key example of this is seen in the previous assessment period in the Solar Fuels department, where the committee is concerned that it may lack a critical mass, due to group leader vacancies. It is important to identify whether there are institutional obstacles to retention; for example, there was discussion on whether the lack of ability for group leaders or department heads to formally act as a PhD promoter encourages staff to move to academia. DIFFER management is encouraged to engage in a dialogue, especially with existing and prospective group leaders in Solar Fuels, to identify realistic changes that could be made in order to enhance the attractiveness and stability of the institute career to key staff.

In the discussion with the technical support staff, the feedback on the status was very positive, and this is reflected in the stable and long-serving workforce. However, there was a concern raised that upcoming retirements might negatively impact the available expertise in the F&I department. This may require investment beyond the immediate need to have a critical mass of junior staff that can engage in transfer of

know-how from the senior staff before their retirement. Regarding the recent creation of the F&I department, the committee found that the new mode of operation generally works well. At the same time, it was less clear how the introduction of the joint F&I department has led to new interactions between the nuclear fusion and the solar fuels departments. Most F&I staff members still feel mostly dedicated to one of the research themes. The committee realizes that this might be an effect of the recent launch of this department. However, DIFFER management should ensure that the technical staff is taken onboard in their strategy for the new department.

As the development of proposals, implementation and operation of user facilities requires a major investment from some of the staff members involved, recognizing these contributions in the evaluation of the associated staff is important. It is to be expected that these staff members will be less productive regarding the traditional research output during development, whereas their contribution is equally important for the DIFFER's overall strategy. The committee therefore recommends that the development of facilities is recognized and rewarded in evaluations similar to output in the form of research papers, in line with the principles of Recognition & Rewards (see below).

Academic culture

The institute strives for a stimulating and safe work environment where everyone feels free to share openly and debate scientific results. Academic values are transferred through the master-apprentice model, where senior scientists teach and train early-career researchers to practice academic values, such as scientific integrity and independent thinking. Staff members feel free to express their opinions and experience no pressure to work excessive hours or meet certain output criteria.

The committee appreciated the attention to research integrity within DIFFER. At the same time, it notes that the master-apprentice model of transferring culture and attitudes can be vulnerable to individual differences. For instance, not all employees or PhD students that the committee interviewed were aware of the central services in place to promote academic culture, such as the confidentiality council or the research integrity courses. While most PhD students follow research integrity training at NWO-I or at one of the universities, this is not monitored. The committee therefore recommends to further promote and monitor these activities in a more centralized manner. Regarding support for individual problems and issues, the committee thinks that a more widespread promotion of support services is important to tackle any issues early on to avoid potential problems or conflicts later. For all staff members, the committee suggests setting up a new internal seminar meeting on issues related to ethics and research integrity, where also novel and relevant issues, such as for example the use of AI tools for text generation, are debated.

It is also noted that there is no formal quality control or clearance procedures on publications and presentations. An institutional process for publication review is standard in the fusion community, while it is apparently less common in the solar fuels area. The institute would do well to consider the value of such a system, with the appropriate balance of agility and timeliness for research lines that are highly competitive while protecting the institute reputation and ensuring proper acknowledgment of internal and external stakeholders.

Diversity and inclusion

DIFFER aims for a diverse and inclusive workplace. An important issue in this regard is gender balance, as the current fraction of female staff members is very low. This is especially the case at the level of tenured staff with only one female group leader out of nine. The institute has taken various initiatives to raise internal awareness to this issue. A Gender Equality Plan has been launched in 2018 and renewed in 2022, aimed at keeping gender diversity issues on the agenda. Activities include diversity training and efforts to make the

recruitment procedures more inclusive, open and transparent. In addition to gender balance, DIFFER also recognizes the importance of an inclusive environment to all areas of diversity, such as ethnic, cultural, generational and sexual orientation. Several initiatives have been taken to promote an inclusive workplace for LGBTIQ+-staff members, such as the 'Differ(ent) kinds of energy' conference for LGBTIQ+-emancipation in the workplace organized in 2021.

The committee commends the attention to diversity issues at DIFFER, but at the same time observes that regarding gender balance, there is still a long way to go. The committee acknowledges that DIFFER might operate in a difficult environment, with a relatively small pool of female talent in some fields and a high pull from industry and academia for talent, especially in the Eindhoven region. Even so, the committee is of the strong opinion that the gender balance at DIFFER needs active attention and definitive change. The open Solar Fuels positions are an opportunity to improve diversity. When these positions are opened, the committee advises to install a search committee that actively searches for suitable female candidates. The committee also wants to stress that attracting women is the start, and that an inclusive working culture is as important and should be worked on at the same time. Once a critical mass is reached, a diverse workforce and an inclusive culture can work as a driving force to attract further female talent, PhDs and staff to the institute.

Talent management

DIFFER aims to offer an open and stimulating work environment, where employees are appreciated and rewarded for their strengths at all levels of the organization. That means a pleasant work environment, high-quality support and attention to training of early-career researchers. The institute aims to have staff members excel in a variety of areas; not limited to scientific excellence, but also in creating impact, leadership and technological development and innovation. This is increasingly included in performance reviews of scientific staff along the lines of the Recognition & Rewards-programme in Dutch academia. All staff members have a personal development budget, that they can direct towards activities and courses that further their personal professional goals.

The committee appreciates the attention to talent management within DIFFER and underlines the importance of a broad recognition of academic talents as defined in the Recognition & Rewards-programme. It encourages DIFFER to continue their efforts in this regard and ensure that the principles are further integrated in the HR policies of the institute. This includes concrete steps to work towards broad recognition of staff, for instance by making performance reviews of staff members along multiple axes and the associated opportunities for promotion the standard procedure in all aspects. To provide two examples mentioned elsewhere in the report: the committee considers that work on research facilities should be recognized as an important contribution to the institute's strategy (see Staffing strategy), and that formal PhD training should include more elements related to personal development next to scientific aspects of the PhD trajectory (see PhD Policy).

PhD Policy

PhD students at DIFFER are supervised within the research groups and are trained on the job by their supervisor. As they cannot graduate at DIFFER for formal reasons, all PhD students are also associated with one of the Dutch universities. This is usually the university with which the DIFFER supervisor is associated or collaborates with. The formal promotor is either the DIFFER supervisor (in the case of a part-time appointment at a university) or a professor at the university. Next to the DIFFER supervision, NWO-I offers several training opportunities for professional and personal development of PhD candidates, including courses, workshops, seminars and other activities, and covering topics such as scientific writing, presentation, project management and scientific integrity. Furthermore, each PhD is encouraged to visit at

least two international conferences during their PhD project to broaden their network. A PhD Council organized for and by DIFFER PhD's provides a platform for PhD candidates to express their opinion and concerns within the institute, and for all kinds of social events.

The committee studied the PhD policies and training of DIFFER and spoke to a number of PhD students. It concludes that PhD students generally feel at home at DIFFER and are well-supported during the execution of their PhD project. The committee noted that supervision seems to be mainly focused on the scientific side of the projects. To what extent PhD students are engaged in personal development, such in additional topic specific training or involvement in teaching, heavily depends on the own initiative of the PhD students and the support of the supervisor. Opportunities are offered through the NWO-I courses, but not strongly encouraged or structurally embedded in the PhD trajectory. This also depends on the role and involvement of the PhD supervisor at the university, being more formal or being actively involved in the research. Moreover, many of the DIFFER staff are not associated at a university and are therefore dependent on the engagement of the university supervisor.

The committee thinks that the PhD supervision and training could be further developed. It suggests developing a DIFFER-specific PhD policy to further structure support and supervision of PhD students. This should at least include a development plan for all PhD students that includes scientific and personal development goals, which is regularly discussed with the supervisor and a mentor. This could cover soft skills, career development and possibly involvement in teaching, as well as courses and trainings PhD students are expected to follow. PhD students should be supported in finding and following these courses. Furthermore, the institute could revitalize the mentor system for PhD students, which the committee understood was in place before the COVID-19 pandemic. PhD students are supervised by staff members who are not always daily available at the institute, which relates to the recommendation above on the benefits of increasing the mid-career staff. The mentor programme should focus consultation on matters of progress in their work, skills and career rather than the technical development. Such a mentorship programme could also be useful in an adapted form to other junior staff at the institute, including postdoctoral researchers, tenure track researchers and possibly even bachelor's and master's students employed at DIFFER for a longer period.

Furthermore, some PhD students felt that onboarding at DIFFER could be improved. There is no formal onboarding programme, with the result that some PhD students felt lost in their first months at the institute. The committee recommends setting this up, not only for PhD students but for all new employees at DIFFER. For PhD students specifically, the mentor could play an important role in this onboarding process.

Of the 38 PhD's that started between 2014 and 2018, 25 (66%) completed their project within the expected 4 years, and 28 (74%) within 5 years. The average PhD duration is approximately 4,5 years. The committee considers this to be a very good average and encourages the institute to continue on this path.

4. Executive Summary

Conclusion

The research conducted at DIFFER is of outstanding quality and is well-received by the peers as well as potential industrial partners and users. DIFFER is a clear leader in areas such as operational control, developing and testing of materials for fusion energy applications, and modelling and experimental plasma-wall interaction, the autonomous discovery of energy materials, photoconversion of humidity from ambient air to hydrogen and films and photoelectrodes for water splitting. In terms of national leadership role, the two major research themes pursued by DIFFER vary in both maturity and nature. DIFFER is clearly recognized as the Dutch leader in fusion research, whereas the leadership role in solar fuels is, notwithstanding the individual recognition of researchers, is more diffuse. The committee recommends to clearly define the national role it envisions within the field and formulate and articulate strategy to work towards this role. This includes aligning with internal and external stakeholders. Current vacancies in the Solar Fuels departments provide an excellent starting point for a stronger identity of the Solar Fuels research at DIFFER.

Both research themes at DIFFER are unquestioned in their societal relevance. Nuclear fusion holds the promise of a clean, abundant and CO₂-emission-free energy supply, whereas the electrification of chemical processes pursued in the field of solar fuels contributed to the transition to a carbon-free, sustainable economy. In solar fuels the relevance is already visible in (pilot) projects with commercial partners, and in both themes DIFFER contributes by educating the high-tech workforce in energy research. To further promote societal impact, the committee recommends to unifying in a few priority areas in both industrial development and outreach to avoid fragmentation, and balance efforts and results. Another element that requires attention is the further development of a strategy for the generation and protection of intellectual property. Regarding open access, the institute is nearing full open access publishing, and is starting to generate attention towards open data. The committee encourages the institute to continue their efforts in this area and formulate formal objectives and procedures as well as best practices regarding the creation of open data sets.

The committee considers DIFFER to be well-equipped for the future, both in terms of financial position, its position in the research landscape, staffing and leadership. The strategy for the coming years is appropriate relevant and backed by a solid financial plan. The committee thinks that this strategy should also be accompanied by a more developed investment and staffing strategy. The investment plan should ensure that the envisioned infrastructures for the energy research community in align with national roadmaps and initiatives and have a strategy for a stable operation and maintenance of these facilities. The staffing strategy should reconsider the current reliance on early career researchers as well as the vulnerable central position of group leaders and include actions for retention of research staff.

Research integrity has sufficient attention within DIFFER but could be more structured to prevent individual differences between supervisors and groups. The committee recommends promotion of existing services, and additional attention to research integrity beyond junior researchers, such as through internal meetings on relevant topics and quality control on output. DIFFER aims for a diverse and inclusive workplace and undertakes several initiatives to promote this. Notwithstanding the efforts, gender balance in particular is highlighted as a priority for improvement. The committee recommends a more proactive search for female candidates, and a diverse and inclusive work climate that can work as a driving force to attract further female talent. The committee furthermore encourages DIFFER to continue their implementation of the Recognition & Rewards principles in its HR policies. This could include ensuring that implementation and

operation of user facilities is recognized and rewarded equally to other forms of scientific outputs, and that personal development and mentorship is structurally embedded in all PhD trajectories, and possibly that of other staff members as well. PhDs generally feel at home and well supported at DIFFER and complete their PhD with a minimal delay. There are many opportunities for further training and development, although this can depend on the initiative of the PhD student and the supervisor. The committee recommends further structuring this.

Main recommendations

1. Clearly define the national role envisioned in solar fuel research and formulate and articulate strategy to work towards this role.
2. Prioritize aims and actions in industrial development and outreach to avoid fragmentation in efforts and formulate clear indicators and goals to work towards.
3. Complement the strategy 2023-2028 with a more developed investment and staffing strategy. The investment plan should ensure that the envisioned infrastructures for the energy research community in align with national roadmaps and initiatives and include a strategy for a stable operation and maintenance of facilities. The staffing strategy should reconsider the current reliance on early career researchers as well as the vulnerable central position of group leaders and include actions for retention of research staff.
4. Further develop the procedures and policies for the generation and protection of intellectual property.
5. Continue efforts towards 100% open access publishing and formulate formal objectives and procedures as well as best practices regarding the creation of open data sets.
6. Investigate whether transfer of knowledge in the upcoming retirements in the F&I department is safeguarded and monitor whether the new structure of the department contributes to the envisioned new interactions between the two research departments.
7. Increase efforts to improve the gender balance, including a more proactive search for female candidates, and a diverse and inclusive work climate that can work as a driving force to attract further female talent.
8. Continue implementation of the Recognition & Rewards principles in HR policies, such as ensuring that implementation and operation of user facilities is recognized and rewarded equally to other forms of scientific outputs, and that personal development and mentorship is structurally embedded in all PhD trajectories, and possibly that of other staff members as well.

Appendix 1: SEP Questions Evaluation NWO institutes

The 3 main criteria:

1. Research quality:

- How does the assessment committee assess the scientific quality of the institute, in light of its own aims and strategy? Central in this assessment are the contributions to the body of scientific knowledge. The assessment committee is asked to reflect on the quality and scientific relevance of the research. Finally, the academic reputation and leadership within the field is assessed. Looking ahead into the future, which recommendations can the committee give to the institute regarding their research quality?
- How does the committee assess the institute's place in the national and/or international research landscape? Is the institute a frontrunner or a follower in its field? Does the committee see untapped opportunities?

2. Societal relevance:

- How does the committee assess the societal relevance in terms of impact, public engagement and uptake of the institute's research in economic, social, cultural, educational or any other terms that may be relevant? The assessment committee is asked to reflect on societal relevance by assessing an institute's accomplishments in light of its own aims and strategy. Looking ahead into the future, which recommendations does the committee have for the institute regarding its societal relevance?

3. Viability:

- How does the committee assess the extent to which the goals for the coming six-year period remain scientifically and societally relevant? It is also asked to assess whether its aims and strategy as well as the foresight of its leadership and its overall management are optimal to attain these goals. Finally, the assessment committee is asked to assess whether the plans and resources are adequate to implement their strategic plan. The assessment committee is also asked to reflect on the viability of the institute in relation to the expected developments in the field and societal developments as well as on the wider institutional context of the institute.
- How does the committee assess the way the institute fulfills their national role and does the committee have any recommendations regarding this?¹
- How does the committee assess the way the institute contributes to the vision on 'Dutch research in 2030' as is written down in the NWO Strategy 2023-2027 and does the committee have any recommendations?

¹ With respect to the reports from the PCNI, the portfolio committee and (where relevant) the exploration reports.

In addition, there are 4 important aspects contributing to the success of the institute:

4.1 Open Science

The assessment committee is asked to consider to which extent the institute opens up its work to other researchers and societal stakeholders in the context of its strategy and policy. Furthermore, the committee is asked to consider whether the institute reuses data where possible; how it stores the research data

according to the FAIR principles; how it makes its research data, methods and materials available; and when publications are available through open access. The committee is specifically asked to give the institute and NWO-I recommendations on their Open Access and FAIR data and software policy. The assessment committee is asked to reflect on the current policies, and the practices with regards to the open availability of the publications, research data and methods and assess them in light of NWO's high ambitions (e.g. is the institute a frontrunner in its field with regard to Open Access and FAIR data and software?).

4.2 PhD policy and Training

- The assessment committee is asked to consider the supervision and instruction of PhD candidates. Furthermore, the committee is asked to consider whether the quality assurance system is functioning properly. The committee is asked for recommendations on how to enhance the supervision and education of PhDs (together with the universities), also in light of the three main criteria.

4.3 Academic Culture

- *Openness, (social) safety and diversity & inclusivity:* The assessment committee is asked to consider the openness, (social) safety and diversity & inclusivity of the research environment. The assessment committee is also asked to evaluate the actions and plans for the future of the institute with regards to (social) safety, diversity & inclusivity.
- *Research integrity:* The assessment committee is asked to consider the institutes policy on research integrity as well as the way the institute facilitates the relevant actions and requirements formulated in the Netherlands Code of Conduct for Research Integrity. For both themes: Looking ahead into the future, which recommendations does the committee have for the institute regarding their academic culture, also in light of the three main criteria?

4.4 Human Resources policy

- *Talent Management:* The assessment committee is asked to consider the institute's policies on talent selection and development in relation to its aims and strategy. More specifically, it is asked to evaluate the institute's recruitment policies, opportunities for training and development, coaching and mentoring, as well as career perspectives for researchers and research support staff in different phases of their career. An important aspect of this is the (inter)national cultural change regarding Recognition & Rewards in academia that NWO-I is implementing. What are the institute's plans to further the desired cultural change and which recommendations does the committee have for the institute and NWO-I?

Appendix 2: Programme of the site visit

Tuesday 21 November 2023

17:00 – 18.30	Welcome, introduction and discussion with NWO Board
18:30 – 19.30	Private kick-off meeting committee
19:30 -	Committee dinner

Wednesday 22 November 2023

09:00 – 09.15	Welcome
09.15 – 11.30	Presentations and discussion Science – Fusion Energy
11.30 – 13.00	Introduction technical staff and tour of the premises
13.00 – 14.00	Lunch with the technical staff
14.00 – 15.40	Presentations and discussion Science – Solar Fuels
15.40 – 16.15	Break and internal discussion committee
16.15 – 17.15	Open discussion with research staff
17.15 – 18.15	Internal discussion committee
18.30 -	Committee dinner

Thursday 23 November 2023

09:00 – 09.30	Discussion with Management Team
09.30 – 10.30	Discussion Organisational aspects (Open Science, Academic Culture, HRM Policy, PhD Policy and Training)
10:30 – 10.45	Break
10:45 – 11.15	Presentation and discussion Societal Relevance
11:15 – 12.00	Presentation and discussion: Outlook to the future and funding
12:00 – 13.00	Lunch and poster session PhD-candidates
13:00 – 14.00	Discussion with Management Team
14:00 – 16.30	Private concluding meeting committee
16:30 – 17.00	Presentation of provisional findings
17:00 – 18.00	Closing and drinks

Appendix 3: Quantitative data

Quantitative data on the institute's composition and funding, as described in SEP Appendix E, Tables E2, E3 and E4:

6.1 | Staff composition

	2017	2018	2019	2020	2021	2022	2023
SCIENTIFIC STAFF	FTE	FTE	FTE	FTE	FTE	FTE	FTE
Group leader	9.1	9.3	8.8	8.8	8.8	8.8	8.6
Senior staff	6.8	6.8	6.0	7.1	6.1	5.2	5.0
Full staff	2.7	3.1	2.7	3.4	3.5	4.1	2
Junior staff	0	1.0	2.4	3.6	1.6	0.6	1.4
Postdoc	7.0	13.8	15.8	16.8	12.2	10.9	13.9
PhD candidate	21.5	44.6	36.7	31.2	34.0	26.0	20.5
Sub-total	47.0	78.5	73.3	70.9	66.5	55.6	51.4
OTHER STAFF							
Technical staff	37.0	37.0	39.5	35.8	36.3	33.6	35.4
Support staff	21.0	25.0	23.1	25.4	30.7	31.0	31.5
Visiting fellow	8.65	27.6	23.6	26.8	44.1	31.2	41.1
Total	113.7	168.1	159.5	158.9	177.6	151.4	159.4

6.2 | PhD candidates

ENROLLMENT				SUCCESS RATE					
STARTING YEAR	MALE	FEMALE	TOTAL	≤4	≤5	≤6	≤7	NOT YET FINISHED	DISCONTINUED
2014	8	1	9	3	2			3	1
2015	5	1	6	5				1	
2016	3	0	3	3					
2017	11	4	15	10	1	1		3	
2018	5	2	7	4				2	1
2019	2	0	2	1				1	
2020	6	0	6	1				5	
Total	40	8	48	27	3	1	0	15	2

6.3 | Funding

	2017		2018		2019		2020		2021		2022	
FUNDING	K€	%	K€	%	K€	%	K€	%	K€	%	K€	%
Direct funding	11.317	67	10.370	62	9.400	64	9.872	68	10.358	72	10.323	70
Research grants	1.232	7	1.939	12	1.748	12	1.845	13	1.494	10	873	6
Contract research	3.403	20	3.433	20	2.825	19	2.166	15	2.276	16	2.837	19
Other	967	6	1.109	7	621	4	687	5	301	2	618	4
Total funding	16.919		16.851		14.594		14.570		14.429		14.651	
EXPENDITURE												
Personnel costs	9.365	60	10.452	68	10.762	78	11.267	75	10.025	78	10.102	72
Material costs	6.356	40	4.821	32	3.031	22	3.677	25	2.871	22	3.844	28
Total expenditure	15.721		15.273		13.793		14.944		12.896		13.946	
Result	1.198		1.578		801		-374		1533		705	