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Evaluation 2017 - 2022

NWO Institute NIOZ

Royal Netherlands Institute for Sea Research

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Project code P2228

Contents

1. Foreword by the committee chair

For many different reasons, it was a great honour and a true pleasure to chair the committee for the evaluation of the Royal Netherlands Institute for Sea Research.

Firstly, one can only learn from privileged access to the inner workings of one of the world's most renowned marine institutes. The visit to Texel - and the virtual tour of Yerseke - was intense and packed with information, but overall it was a very interesting and satisfying experience for the committee members, who are all ocean scientists. Also pleasant is the outcome: the general conclusions of the evaluation are very positive. This is a well-managed institute, financially stable, with significant achievements in the past six years (a.o. the renewal of the research fleet!) and a clear vision for the future.

Secondly, we felt very welcome. The meeting was well prepared and organized. Without exception, NIOZ staff were friendly, open, honest and competent during interviews and informal discussions. We were particularly impressed by the level of expertise present in all departments and positions, the mutual respect between administrative, technical and research staff, the positive testimonies of early career scientists, the excellence, innovation potential and societal relevance of the research, and the quality of the general support services. The working atmosphere in the institute seems to be warm. We can only thank management and employees for their collaboration, and assume that all staff rightfully takes great pride in being part of this community.

Finally, we hope that our work is useful, both for NIOZ and for NWO. On behalf of the committee, I want to congratulate the institute with the outcome of the evaluation. We are confident that our findings and recommendations are to-the-point and helpful, and we wish you all the best with implementing the new strategy. I'm looking forward to future contacts with the institute, also in international networks, to reading its scientific output, and to learn about the uptake of its highly relevant science by the wider society.

I want to thank my fellow committee members for sharing their valuable insights and for their critical but always positive attitude during interviews and discussions. Peter Spijker of NWO played his role of neutral but knowledgeable and supportive observer perfectly. Fiona Schouten of Academion was a competent secretary that prepared the meeting well and drafted an accurate – and undoubtfully useful - report of the proceedings and findings of our evaluation.

Sincerely,

Jan Mees

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. Evaluation bureau Academion acted as independent intermediary to safeguard the quality of assessment, providing secretaries for each of the site visits 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 their 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 actually 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 Royal Netherlands Institute for Sea Research (NIOZ) was appointed by the Board of NWO, and consisted of the following members:

- Prof. dr. Jan Mees, Flanders Marine Institute (VLIZ), Belgium – chair;
- Dr. Ángel Borja, AZTI, Spain;
- Prof. dr. Achim Kopf, MARUM, Germany;
- Dr. Bregje van Wesenbeeck, Deltares, Netherlands;
- Prof. dr. Carol Arnosti, University of North Carolina, USA;
- Dr. Carolin Löscher, University of Southern Denmark, Denmark.

Dr. Carolin Löscher was unable to attend the site visit, but provided the other committee members with her preliminary assessment prior to the site visit.

The committee was supported by Dr. Fiona Schouten, who acted as secretary on behalf of Academion. Dr.ir. Peter Spijker was present during the site visit to support the committee on behalf of NWO-I.

2.3 Independence

Before the site visit all members of the committee agreed to 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 the committee had no conflicts of interest. The NWO-I representative present during the site visit did not take part in the evaluation, but provided the committee with background information and context on the Dutch science landscape and the position of NIOZ upon request.

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 NIOZ Strategy 2023-2028 as a separate document.

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 12th September 2023, the committee was briefed by the secretary on research evaluations according to the SEP 2021-2027, and by the NWO-I representative 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 12th September 2023, the committee discussed the preliminary evaluations and identified questions to be raised during the site visit. The committee agreed upon procedural matters and aspects of the evaluation. The site visit took place on 12-14th September 2023 (see the schedule in Appendix 2). After the interviews the committee discussed its findings and comments to allow the chair to present the preliminary findings to NIOZ staff 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 NIOZ 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 NIOZ and NWO-I 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 report was finalized on 4 December 2023.

3. Evaluation of Royal Netherlands Institute for Sea Research (NIOZ), 2017-2022

3.1 About NIOZ

The Royal Netherlands Institute for Sea Research (NIOZ) is the national oceanographic institute and the Netherlands' centre of scientific expertise for ocean, sea and coast. NIOZ has a 147-year history in seagoing marine research. It serves as the marine research platform and equipment facilitator for the Dutch research community and supports multidisciplinary fundamental and frontier-applied marine research, education and marine policy development in the national and international contexts. NIOZ is typically regarded as the natural (inter)national scientific portal to Wadden Sea, North Sea and Southwestern Delta research. Since 2012, NIOZ has employed about 50 tenured scientists within a total of 180 research staff. NIOZ operates from two strategic locations, with its headquarters in the north of the Netherlands on the Wadden Island of Texel, and a centre in Yerseke, in Zeeland, in the south-west of the country.

NIOZ operates a fleet of research vessels (RVs) that is in the process of renewal with funding from NWO. The successor to the RV *Navicula*, the RV *Wim Wolff*, is expected towards the end of 2023, and the contract for the ocean-going RV *Anna Weber-van Bosse* was signed at the end of 2022 to replace the RV *Pelagia*. A Large-Scale Research Infrastructure NWO grant helped to develop autonomous and remotely operated vehicle capabilities, which will be implemented soon.

Before 2016, the institute was structured along disciplinary lines. A reorganization resulted in a new departmental, less compartmentalized and hierarchical setup to boost the potential for interdisciplinary research and new, larger projects. Currently, the four scientific departments of NIOZ are Coastal Systems (COS), Estuarine and Delta Systems (EDS), Ocean Systems (OCS) and Marine Microbiology and Biogeochemistry (MMB). The department of EDS is located at Yerseke, and the departments of COS, OCS and MMB are hosted at the Texel location. The department of National Marine Facilities (NMF) complements these scientific departments with its operation of the fleet and technology development. The department of General Support (GES) supports the institute in communications, finance, human resource management, facility management, and ICT. Each department has a head of department who is responsible for the scientific direction and/or day-to-day management. The scientific departments have weekly and biweekly meetings between Principal Investigators (PIs) and hold regular meetings with all staff. In 2021, a new NIOZ director was appointed; the Management Team (MT) was expanded with five new, younger members for more diversity and shorter lines between management layers.

3.2 Mission, vision and strategy

NIOZ aims to advance critical understanding of the changing seas, the role they play in climate and biodiversity and the way they may provide sustainable solutions to society in the future. A prerequisite for sustainable use of the sea is a better understanding of the interacting biological, chemical, physical and geological processes in marine systems. With its blend of science and seagoing operations, NIOZ aims to advance the fundamental understanding of changes in marine processes, the stability of marine systems, possible tipping points and potential solutions to address the big societal questions that are posed by the climate and biodiversity crises.

Over the past years, according to its 2020-2025 science strategy, NIOZ research has had three focus points. The first was (deep) ocean as the final frontier, since this constitutes the largest unexplored area of our planet. The second focus point was to investigate the consequences of human and natural pressures on the

Wadden systems and deltas, but also coralline or rocky coasts globally, as the 'front yards' of human settlements. The third focus was on the future and what to expect of it now that the ocean and coastal seas are changing rapidly. An important new question was how to make sustainable use of the seas, using them in mitigation of and adaptation to the effects of climate change and as a source of protein for food production.

NIOZ currently operates on its 2023-2028 strategy. This strategy is connected to the previous one, but focuses strongly on two common themes and their interactions: biodiversity and climate. The current climate and biodiversity crises cause large-scale changes in global ocean processes. The ocean-climate nexus and marine biodiversity therefore provide an institute-wide focus for research, fostering scientific collaboration and, importantly, connecting NIOZ research more directly to society's major challenges.

The evaluation committee discussed the prior and current NIOZ strategies with the management team and other stakeholders. It fully agrees with the choice for highlighting the themes of climate and biodiversity in the new strategy. This allows NIOZ to link its fundamental research to societal challenges that were less pronounced in the previous strategy. The emphasis on societal relevance of NIOZ research, is strongly endorsed by the committee. This will be elaborated below under 3.4 (Societal relevance).

The committee also learned that NIOZ would like to act as a national 'hub' for oceanography in the Netherlands in a format called "University Forum", strengthening links with and between all relevant Dutch universities as well as with the wider society. This is one of the strategic aims formulated by NIOZ (see under 'Viability'). This ambition is fully supported by the committee. As an interdisciplinary NWO institute with locations on opposite ends of the country, NIOZ is perfectly placed to act as the national marine science expertise centre. NIOZ has been working towards this aim through its reorganization, which facilitates collaboration between disciplines and institutes, and through involving the relevant Dutch universities in its new University Forum. Due to previous financial issues, a strong collaboration was set up with Utrecht University (UU) that caused an imbalance between universities. The committee advises to solve the issue by re-assessing the (perceived) privileged relationship with UU.

The committee considers the ambition to play a significant national role as an important catalyst for NIOZ regarding future viability, research quality, and societal relevance. It will therefore discuss this ambition and its impact on various places in this report.

3.3 Research Quality

Over the review period (2017-2022), NIOZ research has been characterized by a sizeable research output, which includes between 252 and 379 peer reviewed academic journal articles per year and between 8 and 14 PhD theses.

In terms of research funding, NIOZ researchers obtained a considerable number of personal grants in national as well as international competitive calls, such as two ERC grants (one starter, one consolidator), six NWO VENI grants at the postdoc level, four VIDI grants for tenure track scientists and one VICI grant for an established senior scientist. It has also been successful in obtaining grants through the Large-Scale Research Infrastructure, which allowed NIOZ to improve its experimental facilities. Overall, the amount of external funding increased from 35.5% to 47.4% of the total income, to €22.9m (see Appendix 3).

Since 2013, NIOZ has obtained two NWO Gravitation grants: the Netherlands Earth System Science Centre (NESSC) and Soehngen Institute of Anaerobic Microbiology (SIAM) research programmes have provided important continuity in research since that time. These two programmes were the largest fundamental science projects funded during the evaluation period. Aside from these programmes, all scientific

departments are involved in Horizon 2020 and Horizon Europe projects, with the department of COS coordinating two large European consortia, FutureMARES (which examines the relations between climate change, marine biodiversity and ecosystem services) and ACTNOW (which aims to combat biodiversity loss in coastal and marine habitats). NIOZ also leads several Dutch consortia in large projects, such as SEALINK, which studies the way that distribution of human pollution from land affects the Caribbean coral reefs. Another project supported by NWO via the Open Competition ENW-XL programme, the North Sea-Atlantic Exchange (NoSE) project, investigates how coastal seas link to the ocean in absorbing carbon dioxide from the atmosphere. Both projects involve university partners and strong interdepartmental collaboration within NIOZ.

NIOZ scientists hold 23 professorships at different universities in the Netherlands, representing half of the institute's senior scientist population. Through its scientific cruises, NIOZ often leads larger consortia involving national and international collaborations. NIOZ has several memoranda of understanding with similar institutes worldwide. Its main collaborators are the Woods Hole Oceanographic Institution (WHOI), the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), the GEOMAR Helmholtz Centre for Ocean Research Kiel, the MARUM Centre for Marine Environmental Sciences, the Alfred Wegener Institute for Polar and Marine Research (AWI), the Leibniz Institute for Baltic Sea Research Warnemünde (IOW), the National Oceanography Centre (NOC), the Flanders Marine Institute (VLIZ), and the French Research Institute for Exploitation of the Sea (IFREMER). NIOZ is a member of the Partnership for the Observation of the Global Ocean (POGO), where common challenges for ocean observations are discussed, and of the European Marine Board.

In line with its current focus on climate and biodiversity, NIOZ is involved in developing existing and new programmes on these themes, participating in the Dutch Climate Research Initiative (KIN) and the Biodiversity XL consortium (a consortium of NIOZ, Naturalis, the Royal Netherlands Academy of Arts and Sciences-Netherlands Institute of Ecology (KNAW-NIOO) and the KNAW Westerdijk Fungal Biodiversity Institute). There is an increasing representation of NIOZ scientists on editorial boards and scientific committees, nationally and internationally. NIOZ researchers obtained peer recognition awards that included the Ammodo Science Award for fundamental science for a mid-career scientist, the Alfred Treibs Award, a high honor of the Geochemical Society for a senior research leader, and the BOU Godman Salvin Prize awarded by the British Ornithologists' Union for a senior research leader.

The committee concludes that nationally and internationally, NIOZ has an excellent research reputation. NIOZ is successful in attracting funding individually and as an institute. NIOZ scientists are visible and productive, publishing in widely recognized and diverse journals. NIOZ has a strong reputation in various science disciplines. The MMB department showed a strong development through attracting much external funding, resulting in a variety of outstanding publications on topics such as biomarkers and their paleo-oceanographic and modern applications, archaea and the microbiology of diverse marine environments, the microbiology of the plastisphere and oceanic distribution of plastics. Overall, the cross-disciplinary approach is paying off as it allows NIOZ researchers to collaborate on climate and biodiversity related themes between departments. NIOZ scientists coordinate and are part of EU consortia and contribute also within the Netherlands to climate and biodiversity programmes. Their visibility is further highlighted through their association to several Dutch universities, as well as collaborations with other leading ocean institutes.

Added to these general markers of research excellence, NIOZ also boasts valuable long term data sets, such as the jetty time series and other long time series of plankton, benthos, fish and birds, both in the Wadden Sea and in the Dutch Delta, as well as all standard measurements collected during cruises, that stand out through their runtime. The committee feels that these could be emphasized more by NIOZ and presented as

one of its unique strengths. Furthermore, the committee observed during its visit to NIOZ's Texel location (which included a virtual introduction to the Yerseke location) that the institute has excellent facilities in terms of technical and support staff, as well as labs and equipment. NIOZ's in-house technicians develop new measurement and sampling equipment that is innovative, efficient, and targeted at specific uses which significantly boosts research of NIOZ scientists and enables data collection under a wider range of conditions. From small chips to be carried by migratory birds to Niskin bottles with innovative opening and closing valves for deep-sea research, NIOZ's in-house technical development clearly boosts the efficiency and quality of research.

According to the committee, NIOZ is clearly well-positioned within the Netherlands to fulfil its ambition of being the focal point and acknowledged centre of expertise for marine biodiversity and the role of the ocean in the climate system. NIOZ plays a leading role in larger projects and consortia and provides key infrastructure through the use of research vessels. Its professors are linked both to NIOZ and to relevant universities, and NIOZ has a large network of national stakeholders. Internationally, the committee still sees some opportunities. Participation in international networks is now often person- or project-based, whereas much can still be gained from international cooperation. International collaboration on deep sea areas is also important for the full valorization of the new RV Anna Weber-van Bosse. The committee advises NIOZ to formulate an institute-wide internationalization strategy in view of its general strategic ambitions, in order to formalize and boost its ambitions and further strengthen its research.

3.4 Societal Relevance

Societal relevance of NIOZ research
With its focus on climate and biodiversity, NIOZ clearly touches on issues and themes that are highly societally relevant. This is visible in the many collaborations with national and international partners such as Rijkswaterstaat (RWS), the Ministry of Infrastructure and Water Management, TNO (the Dutch Organization for Applied Scientific Research), and a range of industrial stakeholders.

As an example, NIOZ is involved in in projects investigating the use of seaweed as a protein source, and exploring possibilities to increase shellfish production by providing artificial reefs that can be colonized and enhance biodiversity. It also monitors benthic life in the Wadden Sea in collaboration with RWS, the executive agency of the Ministry of Infrastructure and Water Management, and Nederlandse Aardolie Maatschappij (NAM), providing an essential check on the possible impacts of gas exploitation on the ecology of the Wadden Sea. In addition, NIOZ is leading a national consortium with TNO to investigate the potential release of methane from shallow gas fields in the North Sea, commissioned by the Dutch State Supervision of Mines (SodM). Several PIs from the department of MMB are involved in research into plastic pollution in the oceans and investigation of the pathways of decomposition in the marine environment. NIOZ's bird ecology and tracking programme has resulted in the setting-up of a joint centre with, among other partners, the University of Groningen. It is an international centre for research and education in the field of climate change, using the behaviour of birds to determine and understand the changes in our environment.

NIOZ researchers participate in and contribute to societal and governmental bodies, including the Intergovernmental Panel on Climate Change (IPCC), policy documents of the European Marine Board, the 'Waddenacademie' and the International Seabed Authority. As one of the founders of the 'Blauwe route', the maritime and marine part of the Dutch National Science Agenda, NIOZ collaborates with partners in setting up projects with high societal relevance, for example on increased space constraints in the North Sea due to wind park expansion or sand extraction. With industrial stakeholders involved in setting up new wind parks in the North Sea, NIOZ researchers engage in setting up ecological impact and ecological improvement

studies. Similarly, NIOZ provides input in designing and establishing Marine Protected Areas. Its scientists are involved in research to investigate the potential impact of deep-sea mining on the biodiversity of the deep sea, and are also directly involved in supporting the negotiations on a new treaty as part of the Netherlands government's delegation. For ten years NIOZ facilitated the Caribbean Netherlands Science Institute (CNSI) located in St Eustatius in the Netherlands Antilles, which will become a network organization, DuCarp (Dutch Caribbean Research Program), in 2023.

As an institute, NIOZ also contributes to education, both at universities (BSc and MSc level) and through offering courses, internships, and summer schools aimed at students from high schools and vocational colleges to universities of applied science and research universities. In various projects, such as WATLAS (Wadden Sea Advanced Tracking and Localisation of Animals in real life Systems), NIOZ researchers engage in citizen science.

NIOZ has a small, but highly effective communications department that translates the institute's science and initiatives to a wider audience, and that has contributed to making NIOZ a household name with the Dutch public at large. NIOZ scientists have been consistently present in Dutch (as well as international) news media. The communications department links scientists to news media and provides them with assistance and, when required, training in bringing across their work to a wider audience. The communications department is currently planning the development of a new corporate website (late 2023) to provide a consistent picture of NIOZ activities and research potential, as well as a communication strategy that ties in with the new overall strategy. It is also preparing for the launch of the new research vessels as well as NIOZ's 150th anniversary in 2026 as moments for raising public and scientific awareness. The review panel applauds the communication department for their excellent work covering all important formats with limited personnel, which in no means falls short of other oceanographic centres with more staff.

The committee concludes that NIOZ research has strong societal relevance, and that the new strategy's clear and explicit focus on biodiversity and climate change is likely to increase this relevance even more. While the institute intends to retain its focus on fundamental research, this does not preclude capitalizing on and communicating about the relevance of its research. The committee thinks that it is very much in line with NIOZ's ambition to become a leading national sea research centre to stimulate and develop its societal orientation and relevance. The committee suggests enhancing societal relevance through increased and structural stakeholder involvement. NIOZ should look for opportunities to transfer knowledge and bring it to relevant external stakeholders, and in co-creation with such stakeholders, both locally and world-wide. The committee further points out that there are various opportunities NIOZ could tap into to enhance societal relevance of its research, such as the UN Decade on Ecosystem Restoration and the UN Decade on Ocean Science for Sustainable Development.

It became apparent to the committee over the course of the evaluation that the Yerseke centre and its EDS department play a particularly important role in the societal impact that NIOZ has had over the past period. For historical reasons, this centre is deeply embedded in local structures, governments, and boards. Stakeholder involvement is stronger there than on Texel. The department of EDS has recently started participating in the Delta Climate Centre (DCC), which is an innovative collaboration between several education and research institutes in Zeeland. The focus is on water, energy, food and biological resources. The DCC is expected to provide NIOZ in Yerseke with new opportunities to perform societally relevant research and provide stronger embedding in the local knowledge infrastructure and links with industrial partners. The committee recommends cherishing the unique contribution of the Yerseke centre to the societal impact of NIOZ research, and ensuring that this location is retained in spite of the occasional organizational difficulties in running a bi-location institute. The committee considers the two locations an

asset of NIOZ, since they provide opportunities to tap into different funding sources and for substantially larger stakeholder involvement nation-wide.

Open science
Open science is a focal point that NIOZ's new management strongly emphasizes. NIOZ has a policy on research data management which focuses on safeguarding and sharing data, and an open-access data policy in accordance with the FAIR principles. The efforts made recently to improve open access publications have paid off: the open availability of published articles improved considerably over the past period. In 2022, 97% of all papers were published either in an open-access journal or a preprint made available through the NIOZ repository, versus 66% in 2017.

To help researchers manage and share their research data, NIOZ maintains an institutional data archive, DAS (Data Archive System), for the long-term storage of data. During the evaluation period, the data policy led to an increase in the number of published datasets with a Digital Object Identifier (DOI), from 20 in 2016 to 138 and 75 in 2021 and 2022. NIOZ is working on preserving and opening up older data sets to avoid that they disappear with the retirement of the responsible researcher(s).

The committee appreciates the changes that have been made and the progress that was booked regarding data management and open access. It applauds the development of DAS, which it was told by NIOZ scientists works well in collecting and storing data internally within the institute. The committee commends the ICT department, which is small in size, for implementing DAS institute-wide with a two-person team, thus managing and improving centralized data access and storage.

According to the committee, work is yet to be done on the findability and accessibility of data for those external to NIOZ, and the management of research data. At present, it is difficult or not possible for non-NIOZ scientists (or the general public) to access research data sets. In terms of storage, there is no inventory of all data and data sets available at NIOZ and outsiders are not able to learn what is available. Data sets that are available are opened up in a variety of ways, some of which include NIOZ scientists or support staff granting access.

The committee discussed these matters with NIOZ management and stakeholders. It learned that the institute is currently undergoing a culture shift towards a more fundamental open access mentality, whereby data and scientific products are opened up and made available instantly and in an easily accessible way according to the FAIR principles. The committee strongly endorses this shift. In order for the organization to practice open science in line with the NWO strategy and the broader tendencies among Dutch universities, NIOZ should effectuate this change on the very short term. The committee recommends expanding the current ICT department in order to create a dedicated research data management team that, together with the data stewards in the different departments, is geared towards collecting all NIOZ research data and opening them up broadly to other scientists as well as the public at large. The committee believes that taking immediate steps in this direction will be of great value in boosting NIOZ's position as a national hub for sea research, and in improving its visibility in the national and international science community. Apart from its research data, NIOZ should also consider sharing the technical innovations in research and equipment that it develops in house. By making the blueprints of such innovations available to others, NIOZ could further strengthen its international presence and perhaps initiate future collaborations.

3.5 Viability

Scientific strategy
As mentioned above, the committee endorses NIOZ's scientific strategy for 2023-2028. The focus on biodiversity and climate change, and the movement towards becoming a national 'hub', will allow NIOZ to increase its scientific and societal relevance. The new, cross-departmental structure boosts interdisciplinary cooperation and is conducive to attaining these aims. The committee also supports the strategic goals and action points that NIOZ defined for the 2023-2028 period in line with its new strategy:

- Improve understanding of the coast, seas, and oceans; from the perspective of the scientific unknowns to the understanding of their role in global climate and biodiversity.
- Maintain NIOZ's scientific drive and excellence and continue to create suitable conditions for this, at the level of both the working culture and technological and experimental capabilities.
- Work as the national lead centre of expertise with Dutch universities to strengthen marine science in the Netherlands.
- Expand the involvement of the University Forum in strategic planning.
- Interact with policy, stakeholders and industry to provide and produce knowledge to make sustainable use of the seas and oceans.
- Achieve a healthy work environment culture where diversity, inclusion and recognition of individual talents are part of standard operating procedure.
- Achieve net-zero carbon emissions by 2030 by reducing energy use and switching to non-fossil fuel energy carriers at sites and on ships.

While the committee thus appreciates NIOZ's strategic repositioning, leadership, and aims, it also points out that these aims have been formulated in a rather broad and general manner. The committee recommends formulating concrete and quantifiable performance and management indicators for every goal and action point, to enable NIOZ management to measure the progress made over the coming period.

Financial stability
As one of the NWO-I institutes and in view of its current fleet renewal, NIOZ is well-prepared for the future and seems to be financially stable. This is a clear improvement in comparison to a decade earlier, when NIOZ was in an uncertain financial position. The new research vessels provide more space for scientists to join cruises, and allow NIOZ researchers to work with state-of-the-art equipment. The fleet also offers ample opportunities for cooperation with other research institutes and universities in the Netherlands and abroad. As an example, one of the two Gravity projects entailed a cruise on the RV *Pelagia* in collaboration with Utrecht University and including Wageningen University researchers; the NICO expedition that NIOZ and NWO organized in 2017 allowed researchers (and students) from the Dutch academic, public and private sectors to execute individual research proposals during an RV *Pelagia* cruise.

The committee applauds NIOZ's financial stability and the necessary investment made by NWO-I. Thanks to NWO's basic funding, NIOZ's stability is not threatened by fluctuations in project funding. The two NWO Gravity projects will be concluded in 2024, causing a significant part of NIOZ's external funding to terminate, but this will not impact the permanent staff or facilities. Since NIOZ has proven itself quite successful in acquiring large as well as personal grants, and is well positioned to continue being successful in the future with its new fleet, the committee expects no dramatic changes even after 2024. The financial compensation NIOZ derived from the cooperation with Utrecht University will probably end in 2024 and does not impact viability, since it is not linked to permanent staff positions either. However, the fleet and the risks that come with it, such as maintenance and exploitation remain points of attention. At present, the research vessels are

owned by NWO-I, which also carries the risks coming with this ownership. The fleet currently faces a steep increase of operational costs due to market developments. To cover the costs, NWO-I also charters research vessels to third parties. During this time, the ships are not available for NIOZ research. In addition, acquisition of uncrewed vehicles including gliders and autonomous underwater vehicles (AUV), as well as the possible acquisition of a remotely operated underwater vehicle (ROV), will increase these risks, as they require additional technical staff with specialized expertise for their effective operation, thereby increasing costs of cruises.

At present, it is unclear how NIOZ will accommodate these extra costs. The committee advises NIOZ and NWO-I to consider a construction that mitigates the risks of owning and operating a fleet of seagoing vehicles, and to prioritize coming to a decision on how to deal with operational costs (incl. staff).

Academic culture
Promoting a thriving and open academic culture is a focus of the new management team's strategy. The aim is to keep staff on board and promote collaboration in and between departments and between support and scientific staff. As mentioned before, a reorganization has resulted in a relatively flat, clear structure. The management team itself has been expanded with five new, younger members to improve diversity, and actively tries to stimulate decision-making at the working level rather than at management level. In case of contested issues, the management team ensures that all staff members have the opportunity to share their views, and accounts for the final decision taken. For instance, in preparation of the decision to stay involved with some projects aimed at the energy transition but funded partly by the fossil fuel industry, a transparent process was organized within NIOZ that allowed everyone to participate, and in which the final decision of the MT was explained in public meetings at both Yerseke and Texel.

Various policies, bodies and practices are in place to safeguard and promote academic culture, a number of which have been introduced recently. NIOZ has two special internal counsellors who can be approached in case of conflicts and issues of social safety. An external counsellor is also available. The institute has a works council that investigates employee satisfaction through anonymous questionnaires. Furthermore, NIOZ has recently installed a Diversity and Inclusion Team to advise the institute director and the MT on diversity issues. Several self-organizing groups, such as Scientists for Future, the NIOZ sustainability committee and Inclusion, Diversity, Equity, Accessibility (IDEA), have their own meetings and regularly seek contact with HRM or the institute director to discuss issues related to strategy, societal responsibility, diversity and inclusiveness. NIOZ has a zero-tolerance policy for (sexual) harassment in place, which not only includes its two locations but also the work conducted offsite (during field work including research cruises). In 2023, NIOZ intends to include a code of conduct with the onboarding process of new employees. The committee was convinced by the natural, self-evident way the points were discussed with many members of staff that the working environment at NIOZ is excellent.

The committee interviewed staff members employed at NIOZ and learned to its satisfaction that they consider NIOZ to be a safe and open environment. The institute's current governance structure boosts interdisciplinary collaboration between departments and stimulates teamwork, also between scientists and support staff. There is a sense of community and mutual respect which is enhanced by regular department and institute-wide staff meetings, where both scientific and technical staff can present their work. Multiple interviewees pointed out that the culture at NIOZ had clearly changed for the better during the period under review. The committee applauds this improvement.

Human resources policy

The NIOZ management team is currently working on creating a clear structure for the guidance, training and education of all of its employees, both scientific and non-scientific. In the past, this was largely left to the various PIs and departments, and this resulted in different approaches across NIOZ. At the request of the institute director, a senior research leader and two HRM staff members have developed a NIOZ-wide talent management plan. The plan includes measures such as developing a clear onboarding procedure for new personnel, setting up portals to select and register for courses and, in the longer term, making talent management an explicit component of the annual review and other assessment procedures. As a first step towards the implementation, NIOZ opted for the establishment of an online learning portal: NIOZ Academy. At the moment, the NIOZ management team is looking to invest in the further development of effective and harmonized team management skills among managers as well as team employees by developing a learning line for team management and making tools and guidance available to teams. This is done at all levels (PhD candidates to senior management) and within the full range of expertise (technical to scientific staff).

The committee fully agrees with the NIOZ MT's efforts at creating and streamlining a talent management strategy, and encourages it to continue shaping and implementing it. It learnt from mid-career and senior staff members that they appreciate the options already open to them, such as leadership trainings and the learning portal. According to the committee, on top of these guidance and development initiatives and in line with the talent management plan's ambitions, NIOZ should formulate a clear and shared approach to career advancement and support structures. The plan should further take into account the appreciation of scientific activities other than research, such as societal collaborations and teaching, in line with the Dutch Recognition & Rewards programme and the overall NWO strategy. This will help NIOZ employees plan their career paths, identify learning goals, and give them clarity concerning the expectations and possibilities available for them, both at NIOZ and outside. As a part of this approach, the committee suggests providing structural support for writing grant proposals, so that NIOZ scholars are no longer at a strategic disadvantage with respect to their colleagues at the universities. It also points out that more can be done to provide PhD candidates, postdocs and other junior scientists with career orientation options, also outside academia.

NIOZ aims at promoting diversity. In this context, it is positive that NIOZ staff in general are quite diverse in terms of background, and that female membership of the NIOZ scientific staff is around 50% of the total. However, it is evident that the higher-up positions are predominantly filled by males and that the flow of younger female PIs to senior positions is still limited. NIOZ recognizes this as an urgent issue and has begun taking measures. A gender and equality plan was prepared and made public in 2022. Each year, the figures of the institute's gender ratios are reported and evaluated. The promotion of female talent is encouraged, for example by means of the so-called Women in Science Excel (WISE) and Aspasia grants. However, the lack of diversity in the highest functions and salary scales is not so easily mended. The committee understands that this is a problem which NIOZ has inherited, yet it encourages the institute to do more in order to fix it. Positive action is required and the effects need to be monitored carefully. The committee suggests formulating clear targets regarding diversity in certain positions in order to fix the 'leaky pipeline'.

PhD policy and training

Since NIOZ as a research institute cannot award PhD degrees, its PhD candidates always have a supervisor in their supervision team who is a professor at one of the Dutch universities, where they defend their thesis. As a result, PhD candidates have to comply with the norms and regulations set by that university, for instance regarding courses they take. In spite of these varied backgrounds and affiliations, the PhD candidates at NIOZ primarily see themselves as NIOZ PhD candidates and experience a clear sense of community here.

They are embedded in a NIOZ research group and their supervisors are often also working at, or visiting, NIOZ. Daily supervision is located at NIOZ.

PhD candidates interviewed by the committee mentioned that until recently they found there were noticeable differences in treatment and guidance between supervisors and research departments. However, this is currently being addressed by the MT. The institute has recently (2022) introduced a new PhD policy to structure PhD guidance and harmonize procedures. The policy provides a clear structure for every PhD trajectory, with clear milestones, rules and regulations for monitoring, and support and resources available for NIOZ PhD candidates. Monitoring protocols and 'four eyes' supervisions are now part of the PhD programme. Recently, a 'go/no go' decision in the first year was added to assess early on whether a project should be continued. The committee applauds the introduction of the PhD policy and the harmonization and structure this entails. It learned from PhD candidates that it is appreciated.

Over the past period, PhD completion rates were low (cf. Appendix 3). The committee considers these rates should be a point of attention for NIOZ. It appreciates that the covid-19 pandemic has impacted the current generation of PhD candidates significantly, leading to delays and contract extensions. Still, the committee feels that more can be done to enable NIOZ PhD candidates to graduate within the allotted time or with minimal delays. In this respect, the new PhD policy and streamlined process should prove effective. The committee has some additional suggestions for improvement based on its conversation with PhD candidates. It learned from them that expectations concerning the number of chapters/articles included in a PhD thesis vary between supervisors. Supervisors can be tempted to encourage the PhD candidate to do more work than might fit in the PhD timeline. This lack of clarity on what is expected of a PhD candidate should be discussed NIOZ-wide, and guidelines should be developed to help supervisors in the supervision processes. Also, the committee recommends providing the supervisors with specific training to support them in their role. In addition, the committee thinks that the supervision 'triangle' between the PhD candidate, their NIOZ supervisor, and the university supervisor can be further optimized. This could for instance be done by appointing a contact person for every university, who helps the NIOZ PhD candidates navigate the university, its regulations and expectations. The committee expects that these measures, combined with the already implemented PhD policy, will have a positive effect on PhD completion rates in the upcoming period, and recommends closely monitoring if this is indeed the case.

4. Executive Summary

4.1 Conclusion

With its renewed fleet and financially stable position, its excellent research and innovative technological developments, NIOZ is perfectly placed to act as the national hub for sea research in the Netherlands and to play a key leadership role in the national network and among universities. Its renewed focus on climate change and biodiversity underlines the societal relevance of the fundamental multidisciplinary research done at NIOZ. The review committee sees excellent opportunities for further international cooperation and more prominent societal collaborations, strengthening NIOZ's profile and position, both nationally and internationally. NIOZ has a vibrant and welcoming academic culture and is working on present day challenges, such as increasing diversity in higher management, harmonizing PhD and HR policies, and streamlining talent management. The culture change towards an open science mentality and policy is a priority for the near future, as is the viability of the institute in terms of fleet operations and mitigation of associated risks. The committee congratulates NIOZ with the excellent work done over the past period, and looks forward to seeing the promising new developments set in by the current management come to fruition in the near future.

4.2 List of recommendations

1. Open up data and research management policies and create a truly open and accessible data infrastructure. This includes not only open publications but also open data, infrastructures, equipment, software, etc. Invest in promoting a culture of sharing with the academic community at large, as well as with non-academics.
2. Keep the structural underfunding of the fleet on the agenda as a continuous point of attention. Explore opportunities to mitigate the risks involved. Reconsider the further investment in a large fleet of seagoing platforms since they pose a financial risk given the large demand in expert personnel to operate ROVs, AUVs, gliders, etc (during cruises, and for shore-based maintenance and development).
3. Invest in consolidating and expanding the societal relevance of NIOZ's fundamental research through structural stakeholder involvement.
4. Formulate an institute-wide internationalization strategy to formalize and boost ambitions in this respect and to further strengthen NIOZ research.
5. Formulate concrete and quantifiable performance and management indicators to enable NIOZ management to measure the progress made in attaining its strategy over the coming period.
6. Closely monitor the effect of the new PhD policy to reduce drop-outs and time to degree, and increase completion rates. Strive for uniformity and discussion among supervisors both at NIOZ and at the universities, and invest in the career planning of both PhD candidates and postdocs.
7. Continue investing in diversity policy and practice through positive action. Formulate indicators to measure success, and monitor closely whether these are achieved.

Appendix 1: SEP Questions Evaluation NWO institutes

The 3 main criteria are:

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 also 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 difference phases of their career. An important aspect of this is the (inter)national cultural change regarding recognition and rewarding 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 12 September 2023

17.00 Private kick-off meeting of the committee attended by NWO representative and Academion secretary.

Wednesday 13 September 2023

08.45 Welcome and brief introduction NIOZ
09.00 Opening session with institute director, institute manager and Management Team
09.45 (Coffee & tea) break and internal meeting of the committee
10.10 Interviews about NIOZ strategy 2023-2028
11.00 Online tour labs and facilities scientific department of EDS
11.15 Tour of NIOZ Texel labs and facilities scientific department of OCS and department of NMF.
12.25 Internal meeting of the committee
12.45 Lunch with selected members of University Forum-NIOZ
13.30 Interviews with representative selection of PhD candidates
14.20 Interviews about Open Science and Data Management
15.10 (Coffee & tea) break and internal meeting of the committee
15.30 Tour of NIOZ Texel labs and facilities scientific departments of MMB and COS.
16.40 Interviews about Human Resources Policy (talent management, PhD policy and training)
17.30 Internal meeting of the committee

Thursday 14 September 2023

08.45 Welcome by institute director
09.00 Interviews about research vessels and research equipment
09.50 (Coffee & tea) break and internal meeting of the committee
10.20 Interviews about Academic culture
11.10 Interviews with representative selection of postdocs
12.00 Internal meeting of the committee
12.30 Lunch with selected members of the Institute Advisory Board (IAR)
13.15 Concluding session with institute director, institute manager and Management Team
14.00 Internal meeting of the committee
16.00 Communication preliminary findings by committee chair
16.25 Closing site-visit

Appendix 3: Quantitative data

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

Table 1. Research staff in #/FTE

NIOZ	2017 [1]	2018	2019	2020	2021	2022
Tenured staff	42.42	40.82	42.72	39.12	42.42	46.12
Tenure track scientist	10.60	12.60	13.60	12.60	9.10	5.30
Postdocs	25.98	28.48	28.40	35.40	50.90	49.30
PhD candidates	51.32	64.12	63.12	66.40	69.80	77.00
Total research staff	**130.32**	**146.02**	**147.84**	**153.52**	**172.22**	**177.72**
Crew	22.00	22.00	25.90	25.00	25.00	25.00
NMF service & technical staff	19.22	18.52	18.92	18.62	19.82	22.32
Service & administrative staff	41.27	44.16	40.77	43.33	43.52	45.39
Scientific support staff	43.00	43.50	47.10	43.16	41.96	40.21
Non-tenured scientific support staff	10.57	14.60	11.80	11.05	19.00	26.20
Total support staff	**136.06**	**142.78**	**144.49**	**141.16**	**149.30**	**159.12**
Total staff	**266.38**	**288.80**	**292.33**	**294.68**	**321.52**	**336.84**
Visiting fellows [2]	91	85	112	100	76	84

[1] For each calendar year, the reference date is 31 December.
[2] Numbers for visiting fellows are individual numbers, not #/FTE.

Table 5.1 Funding and Expenditure

NIOZ in k€	2017	2018	2019	2020	2021	2022
Funding:						
Direct funding [1]	22,042	21,277	22,462	23,276	25,436	25,470
Research grants [2]	3,537	3,037	3,287	3,572	4,082	5,858
Contract research [3]	7,704	9,220	7,794	10,181	9,708	16,500
Other [4]	782	2,537	397	1	3,388	566
Total funding	**34,065**	**36,071**	**33,940**	**37,030**	**42,614**	**48,394**
Expenditure:						
Personnel costs	17,908	18,707	22,500	23,626	24,320	24,968
Other costs	12,330	14,789	12,971	12,659	13,344	20,716
Total expenditure	**30,238**	**33,496**	**33,471**	**36,285**	**37,664**	**45,684**
Financial income and expenses			78			
Result before profit appropriation	**3,827**	**2,575**	**391**	**745**	**4,950**	**2,710**
Profit appropriation						
Result after profit appropriation	**3,827**	**2,575**	**391**	**745**	**4,950**	**2,710**

NIOZ in %	2017	2018	2019	2020	2021	2022
Funding:						
Direct funding [1]	64.7	59.0	66.2	62.9	59.7	52.6
Research grants [2]	10.4	8.4	9.7	9.6	9.6	12.1
Contract research [3]	22.6	25.6	23.0	27.5	22.8	34.1
Other [4]	2.3	7.0	1.2	0.0	8.0	1.2
Total funding	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Expenditure:						
Personnel costs	59.2	55.8	61.2	65.1	64.6	54.7
Other costs	40.8	44.2	38.8	34.9	35.4	45.3
Total expenditure	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Direct funding (basisfinanciering / lump-sum budget)
[2] Research grants obtained in national scientific competition (e.g. grants from NWO and KNAW).
[3] Research contracts for specific research projects obtained from external organisations, such as industry, government ministries, European organisations and charitable organisations.
[4] Funds that do no fit into the other categories.

Table 2. PhD candidates

NIOZ Enrolment [1]									
Starting year	Enrolment (male / female)		Total (M + F)	Graduated in year 4 or earlier	Graduated in year 5 or earlier	Graduated in year 6 or earlier	Graduated in year 7 or earlier	Total graduated	Not yet finished
2008	2 M	10 F	12	0 (0%)	3 (25%)	2 (41.7%)	0 (41.7%)	7 (58.3%)	5 (41.7%)
2009	5 M	14 F	19	0 (0%)	5 (26.3%)	3 (42.1%)	4 (63.2%)	14 (73.7%)	5 (26.3%)
2010	8 M	6 F	14	1 (7.1%)	4 (28.6%)	2 (42.9%)	3 (64.3%)	11 (78.6%)	3 (21.4%)
2011	4 M	13 F	17	0 (0%)	2 (11.8%)	5 (41.2%)	1 (47.1%)	12 (70.6%)	5 (29.4%)
2012	3 M	5 F	8	1 (12.5%)	1 (25%)	1 (37.5%)	2 (62.5%)	7 (87.5%)	1 (12.5%)
2013	3 M	7 F	10	0 (0%)	1 (10%)	4 (50%)	1 (60%)	7 (70%)	3 (30%)
2014 [2]	4 M	10 F	14	2 (14.3%)	2 (28.6%)	4 (57.1%)	1 (64.3%)	10 (71.4%)	4 (28.6%)
2015	2 M	10 F	12	0 (0%)	6 (50%)	4 (83.3%)	0 (83.3%)	10 (83.3%)	2 (16.7%)
2016	6 M	6 F	12	0 (0%)	2 (16.7%)	1 (25%)	0 (25%)	3 (25%)	9 (75%)
2017 [3]	6 M	13 F	19	0 (0%)	2 (10.5%)	1 (15.8%)	N.A.	3 (15.8%)	16 (84.2%)
2018	7 M	14 F	21	0 (0%)	1 (4.8%)	N.A.	N.A.	1 (4.8%)	20 (95.2%)
2019	5 M	13 F	18	0 (0%)	N.A.	N.A.	N.A.	0 (0%)	18 (100%)
2020	2 M	12 F	14	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
2021	9 M	11 F	20	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
2022	10 M	10 F	20	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

[1] Within the years 2017-2022 an inventory has been made of what happened with the PhD candidate contracted between 1 January 2008 – 31 December 2022. Reference date of the figures in this table is 31 December 2022.

[2] 14 PhD students started in 2014. Of these, two candidates were awarded PhD within 4 years, another two candidates were awarded PhD within 5 years, another four candidates were awarded PhD within 6 years and another candidate was awarded a PhD within 7 years. The percentages in the success rates columns are cumulative.

[3] N.A. = undefined. This table was generated on 31 December 2022. That was less than 7 years since 1 January 2017, so graduated in year 7 or earlier could not yet be determined.