

Focus on the Future, Fast Forward Now

Strategic Agenda 2022-2025



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Focus on the Future, Fast Forward Now

Foreword

Focus on the Future, Fast Forward Now. Agility is more important than ever. Our environment is changing rapidly and unpredictability is increasing. The challenges facing society are gigantic and complex, and they require an integrated, systemic approach. Examples include climate change, sea level rise, land subsidence, salinisation, drought and pressure on space.

The point of departure for our Strategic Agenda is our mission: Enabling Delta Life.

As an independent non-profit research institute, we contribute to innovative solutions that improve life in deltas.

Looking far into the future and applying those insights to our work in the present. That is what we do on a day-to-day basis. How do we stay relevant with our knowledge and address the right questions? We have listened to what our stakeholders consider important, looked at trends we observe, and thought critically about where we are now in order to learn from the past. That has resulted in a number of broad outlines for the period 2022-2025 which we describe in this Strategic Agenda.

Like the four other TO2 institutions in the Netherlands, we are engaging in this reconsideration for the Ministry of Economic Affairs. We are looking four years ahead but this course is not set in stone. For Deltares, it is a compass that provides inspiration. Where real events require an acceleration or a change in our course, we will trim our sails accordingly. We use our annual plans to set out the specific details of how we intend to achieve our ambitions.

Deltares is in good shape and so we are fully committed to our work. Sound knowledge about water and the subsurface is urgently needed to keep our densely populated deltas liveable, sustainable and safe. Now and in the future. In the Netherlands and throughout the world.

The heart of our work is our ambition to make an impact on society by drawing on the power of our knowledge. And so we have made a switch to mission-driven work. The impact that we want to achieve will determine our agenda and priorities more. That is an important yardstick for our success.

During the coming strategy period, we will emphasise four areas where we want to strengthen and accelerate our work. We cannot do this on our own. We are eager to work in co-creation processes with partners, other knowledge organisations and clients. First of all, we will be introducing more focus to our mission-driven alliances. In addition, to strengthen our knowledge base, we will be accelerating our data and software development. In the third area, we will be further strengthening our alliances with our partners in the Netherlands. And the final area will be the strengthening of our international position.

The tasks facing us are complex and challenging, and to a large extent uncertain. We embrace that. That is why we are eager to continue our dialogue with you, with all stakeholders inside and outside our organisation.

We work with a good team and that gives us a lot of confidence.

Deltares Board of Directors and Management Team



Deltares now



We are working on the future with our knowledge of water and the subsurface

We want a safe and sustainable life now and in the future. Deltares wants to make a contribution here as an independent institute for applied research in the field of water and the subsurface. We work in a mission-driven way. Our drive is to make a contribution with our wide-ranging and in-depth knowledge about water and the subsurface to innovative and sustainable solutions for complex and urgent challenges facing society. To work with government authorities, the business community and knowledge institutes in the Netherlands and throughout the world. Our guiding philosophy is 'dare to share'.

The ambition of Deltares is therefore to be an acknowledged 'Triple A' institute in the area of water and the subsurface, both nationally and internationally. In recent years, our policy targeted excellent knowledge at the top international level, visible added value for society and strong links between our knowledge and the market. We have achieved that ambition, as can be seen in the report from the evaluation committee of the TO2 institutes.

engineering projects ever: the Zuyder Sea works and later the Delta Works. For decades, our knowledge has been contributing to the maintenance of robust dikes, dams and dunes to prevent flooding. We look not only at flood risk management but also at the quality of life. We look for natural and circular solutions. We take inspiration from the latest knowledge, and base our work on the latest technological developments such as data science and future sensing.

In recent years, we have placed an increasing emphasis in our work on life in the deltas, on the consequences for people, the environment and society. This is reflected in our mission-driven work and it is resulting in more and more alliances that extend beyond the boundaries of our field.

Deltas

Coastal areas and deltas - the dynamic areas where rivers flow into the sea - make up a small part of the world in terms of surface area. The majority of them are highly urbanised and, with respect to their size, they are inhabited by a disproportionately high number of people. They also represent enormous economic value. Levels of biological production in deltas are high and biodiversity is relatively high despite urbanisation here. All this makes deltas important around the world for both society and nature. When we talk about deltas in this Strategic Agenda, we view them in broad terms: everywhere where water management and the subsurface play a crucial role.

The evaluation committee headed by Professor Suzanne Hulscher gave Deltares the highest possible score for quality. It described Deltares as a 'top institute' that is 'unique worldwide with its breadth and depth' and an organisation with 'many highly qualified employees and unique experimental facilities'. (p. 7) 'Deltares has a cast-iron reputation in the international research world'. (p. 44) Our stakeholders also say that we are an independent research institute 'with no equal in the world in the field of delta issues'. (p. 31) Deltares can further enhance its impact by adopting a more active and leading role with its knowledge and setting the agenda more. (p. 45) Source: Evaluation study of the organisations for applied research (TO2). Final report, Deltares evaluation (2021)

1.1 | Our mission

Enabling Delta Life is our goal. We work on knowledge that supports decision-making, even when things get complicated and the interests and impact in the locality are large. For applications now and in the future.

We have been delivering reliable expertise about water and the subsurface for almost a hundred years. Our history began with the construction of the largest hydraulic-

Dare to share

We engage in scientific research, develop models, set up trials and get out into the field to test the latest insights in practice. We combine theory and practice, and make sure that our knowledge can be used by others. Our philosophy is dare to share. We share our knowledge because we are convinced that an 'open source' approach generates opportunities to do things even better. And to learn from one another.

Contribution as a TO2 institute

The applied research institutions (TO2) are important players in the Dutch knowledge and innovation ecosystem. With an extensive national and international network of companies, government authorities and research institutes, TO2 institutes are able to absorb fundamental knowledge. We have a lot of experience with the ongoing development and application of that knowledge. Deltares focuses on three core tasks that match the three main tasks of the TO2 institutes:

- The development, application and dissemination of knowledge in order to establish an understanding in good time of the challenges facing the delta and to support the government with the formulation of policy and the implementation of that policy to resolve those delta issues;
- The development, application and dissemination of knowledge that contributes to the competitive position of the Netherlands in the international 'delta market';
- Managing strategic research facilities and software instruments.

1.2 | Looking back

The main objectives of the past four years have been achieved. Contributing visibly to the international sustainability agenda was at the top of the list. In the period under review, we have increasingly adopted the major challenges facing society and transitions as the starting points for our knowledge development. This knowledge has reached our stakeholders through all kinds of channels. *The Evaluation study of organisations for applied research*, Deltares sub-report, states that the impact of our work has increased visibly in the period under review and concludes that we have a very large impact in different areas. The Deltares knowledge domain is the domain where enormous changes are taking place worldwide and the associated issues facing society are large and complex. According to the evaluation, Deltares has demonstrated that it makes a major contribution with its knowledge and research to setting the agenda and discussion about the problems in deltas, now and in the future.

Because the national government funding has increased from 9% to approximately 16% in the period under review, we have been successful in strengthening our knowledge base. This was another important area in the previous Strategic Agenda. The committee notes that the national government funding for Deltares contributes emphatically to the achievement of the policy objectives. Deltares concentrates on themes that play a role in the medium to

long terms and that are of an urgent nature for society. In this way, we help the government to develop policy and contribute to resolving delta issues by engaging in operational projects.

Another area was investment in data science and artificial intelligence. Significant steps have been made in the period under review, among other things by setting up a wide-ranging programme in the field of the development and application of key enabling technologies, internally and externally, for example through DigiShape.

More focus has been introduced to our international strategy. The regional strategy has been developed further in the period under review. The activities, the portfolio, relevant for the specific regions have been elaborated for each region.

1.3 | Knowledge base

The unique combination of highly qualified people, experimental facilities, key enabling technologies, specialist software and data products underpins the success of the research at Deltares. These are our most important assets for knowledge development and for delivering added value for national and international missions and issues facing society. We work with a systemic approach.

We nurture this knowledge base and keep it up-to-date through our continuous investment in personal development, updating of knowledge and instruments, and in the application of our knowledge in programmes and projects.

Our employees and their networks

Deltares employs a lot of highly motivated and highly educated people. About a quarter of our employees have a PhD and so they have good networks in the academic world. In addition, some twenty professors, approximately twenty lecturers (including senior lecturers) and eighty PhD candidates work with us. We also have many students every year who complete internships or graduate with us. This means we have an extensive network including research institutes and private companies at home and abroad. Every day, our colleagues at Deltares are at work on maintaining our long-term knowledge base.

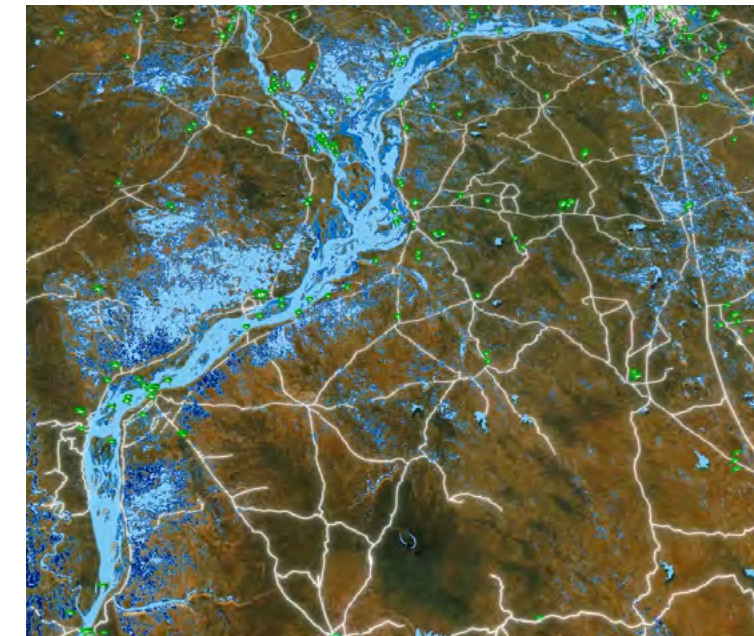
We believe that diversity in our teams is important and that it helps us to operate successfully at home and abroad. In addition to our workforce, our knowledge base comprises the knowledge facilities: our software and models, data and data facilities, and experimental facilities. The development of the knowledge facilities is strategically important for

Deltares, with the application of key enabling technologies occupying a special place.

Software, data and key enabling technologies

We make continuous assessments in the development of our software systems, which are strategically important for research on behalf of national and international missions and agendas. Examples are the development of the 1D2D functionality of D-Hydro for regional and urban applications. The IWRM model instruments for drought, water scarcity, water allocation and integrated water management. Delft3D FM functionalities for the 3D modelling of morphology, water quality and ecology. And the probabilistic toolbox for risk and reliability analyses of geotechnical and hydraulic structures and networks. We generally supply the software in our open-source approach for users and co-developers. Our software is used worldwide by more than 27,000 users in more than 140 countries. By using and sharing the software that we develop ourselves and with others, we make knowledge available for the development, testing and optimisation of solutions to complex issues. By doing so, we also strengthen the competitive position of Dutch business.

The field of available data, data-driven methods and computing power is advancing rapidly. This is not new for Deltares. For decades, the Deltares knowledge base has been based on experimental research, numerical analyses and statistics. In other words, on the generation and use of data, and the combination and exploration of different techniques. In the past four years, we have also delivered interesting applications for large datasets in the leading echelons of the scientific world. Since 2018, we have been furthering the use of key enabling technologies. Deltares sees digital technologies such as artificial intelligence (AI), cloud computing, high performance computing and



sensing (earth observation, measurement and monitoring) as important key enabling technologies.

As one of the initiators of DigiShape, Deltares searches for effective applications of Artificial Intelligence (AI) and Machine Learning (ML) in co-creation with the Dutch water sector.

Our knowledge base is in good shape but it also requires a larger investment. The importance of software and data for our impact and position increases all the time. Software is and will remain an important knowledge carrier and an important part of our knowledge development process. We expect that we will increasingly want to combine data-driven techniques with process-driven modelling in the near future. Moreover, we are already seeing that the rapidly expanding quantities of data and the demand for software and data services require the increasing use of cloud technology and high performance computing. It is important for our software products to be flexible so that we can continue to integrate these, and subsequent, innovations in our working methods. So that we can also contribute in the future as a leading knowledge partner for government authorities and private bodies.





Test facilities and laboratories

We have unique physical facilities at our disposal such as the Delta Flume, the iD-Lab and laboratories in Utrecht (Castel) and Delft. We also see field and monitoring activities as physical facilities because they deliver essential data. This year, we are completing the construction and testing activities for the new GeoCentrifuge. So we will soon be able to conduct the latest geotechnical trials with this facility.

Our facilities are an essential part of our unique mix of research resources and they make unique contributions to our research. The quality of our facilities is high thanks to the annual investments we make. They play an important role in knowledge development and the validation of numerical models. Research in the facilities is enormously important: it can produce savings of many millions. For example, with the trials in our Delta Flume, we were able to demonstrate that asphalt and grass revetments on dikes, for example in the case of the Lauwersmeer dike, are stronger than previously thought. That meant that an expensive upgrade operation for the dike was no longer needed.

In our field laboratories, we can execute accurate measurements and monitoring on site but also take the required action. An example is research into bioremediation, a remediation method for contaminated soil and groundwater systems. Working with private companies at dozens of locations, Deltares applies this efficient and sustainable

solution involving the use of microorganisms to break down pollutants and accelerate natural degradation processes.

The Deltares research facilities contribute to innovation, generate knowledge and have national and international appeal for public and private funding. They play an important role in the Dutch and European knowledge infrastructure in the field of water and the subsurface. They are, for example, listed on the National Roadmap for Large-Scale Scientific Infrastructure (GWI) and on the European ESFRI roadmap. These facilities are unique in the world and they play a role in helping Deltares to recruit national and international top talent.



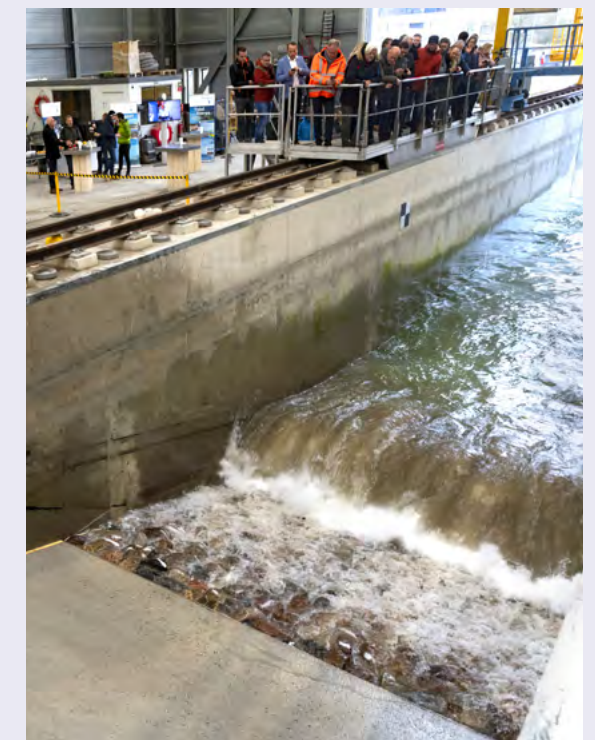
Sustainable installation and decommissioning of XXL monopiles

Offshore wind energy plays a prominent role in the energy transition. In European wind farms, more than 80% of the existing offshore wind turbines are installed on monopile foundations. The installation produces a lot of underwater noise that can be harmful to marine life. In addition, it is still the case that the piles cannot be completely removed at the end of their service life. This often means that most of the piles, which can now be up to 80 metres long, are left behind in the seabed. That represents hundreds of thousands of tonnes of steel that could be recycled if it could be recovered.

Deltares is involved in two major projects to study innovative ways of installing and decommissioning the XXL monopiles of the future (>10m in diameter). Scale tests are being conducted in the new GeoCentrifuge. The aim is to install the piles in a sustainable and cost-effective way and for all the steel to be available for recycling at the end of the lifespan of the turbines. That will take wind energy one step closer to full circularity. In addition, the new method being tested is low-noise and it causes low levels of disturbance in the underwater ecosystem.

Delta Flume

Is it possible to simulate a full-scale storm? At Deltares, we do that every day. The 300-metre-long, 9.5-metre-deep and 5-metre-wide Delta Flume in Delft is a unique facility where we generate the largest artificial waves in the world. The record is a wave 4.7 metres high! This is needed to see how structures cope with high waves and water levels. It matches what is seen on the Dutch coast. The average wave height there varies between 1.5 and 4 metres, with the latter representing extreme conditions. Deltares built a mock-up of a dike structure three times, with twelve tests being conducted between 2016 and 2019. One of the findings was that the revetment of Nordic rock filled with concrete was stronger than expected. This result alone resulted in a saving of €25 million on the Eemshaven-Delfzijl dike. And it may also lead to major savings on other dike upgrade projects. As well as a cut in carbon emissions *and* less disruption as a result of transport movements to remove and replace the Nordic rock.



1.4 | The societal context

Solving major challenges requires systemic changes in our society that no single organisation can achieve on its own. Deltares believes its role is to mobilise all forces and bring together the necessary knowledge. Water and the subsurface are everywhere and they can both establish connections and provide guidance. Particularly to address the major challenge of making our environment more climate-proof and resilient. How can we ensure that we can develop the

right knowledge to support decision-making as much as possible, for example to avoid closing off adaptation pathways?

We work where practice and science, public and private, and knowledge and the market meet. Not only do we develop 'in-depth' knowledge; above all, we also work on its application and dissemination. Together with our partners. That is why we are working with numerous stakeholders on the knowledge development needed to tackle the major

Citizen science

Deltares works in the heart of society. We are increasingly using citizen science, in which the general public contribute measurements, research data or experience. Their involvement is also important for the acceptance and embedding of innovations.

Both sides benefit. Citizen scientists learn a lot about the water system and they can sometimes take action themselves. If you learn more about water quality, it will be easier, for example, for you to make your own decision about whether you want to bathe somewhere or not. And the professionals will have more data afterwards that they can use to make improvements in management.

For example, citizen scientists in Amsterdam have measured water quality and the experience has been successful and promising. There were some 500



citizen scientists. They took their work seriously. They contributed a lot of data and most of the data by far would seem to be reliable. Without them, it would not have been possible to obtain such a high-resolution and detailed picture of water quality in Amsterdam.

challenges. They include Rijkswaterstaat, ministries, water authorities, provincial authorities, private companies, universities, research institutes, NGOs and, of course, our international partners. The evaluation committee of the TO2 organisations finds that Deltares must engage in joint efforts to develop the partnership with these parties from the 'golden circle' in order to provide even more direction for knowledge development and access to that knowledge. We are eager to take up that gauntlet and we will be devoting even more energy to that area.

Our partners: government authorities

The government is, and will remain, our most important client and knowledge partner. We work with all government authorities in the Netherlands: municipal authorities, water authorities, provincial authorities and the national government. Many of the research programmes are established in close collaboration with the Ministry of Infrastructure and Water Management, and with Rijkswaterstaat as the main operational organisation. But we also work a lot for other ministries such as Economic Affairs and Climate, as the lead partner for Deltares as a TO2 institute, for the Ministry of the Interior, for water authorities, provinces and municipalities, and for other ministries such as Agriculture, Nature and Food Quality, and Foreign Affairs. Our projects often cover multiple disciplines and involve different spatial scales, which means that multiple government authorities frequently work with us in consortiums.

We also work a lot for governments internationally. We maintain the knowledge base in our areas of expertise for

the Netherlands. The knowledge base is the foundation underlying our knowledge economy. It is also very important to be able to respond to new scientific and societal developments and to develop long-term solution options and concrete action perspectives for the short term.

Our partners: private companies

Collaboration with and for the business community, both very large and small companies, is self-evident and very important for us. Examples include engineering and consultancy firms, construction and dredging companies and SMEs. Often in the form of co-creation. We do this, for example, in the top sectors, through Joint Industry Projects (JIPs) or Public-PrivatePartnerships (PPPs), or in the form



of specialist consultancy and contract research. We actively share our knowledge on the basis of our 'dare to share' principle. In the Netherlands, we do not compete with the Dutch business community. Our focus is on looking for ways to establish contacts early so that we can make each other stronger. We are happy to collaborate with Dutch companies, for example in consortiums on tenders for government authorities in other countries, so that those companies can make smart use of our knowledge on their projects. In that way, we actively use our knowledge to help strengthen the competitive position of Dutch business.

Our partners: universities and research institutes

The challenges we face worldwide are complex and multidisciplinary in nature. As Deltares, we supply some of the pieces of the puzzle for the possible solutions on the basis of our knowledge of water and the subsurface. Universities and other research organisations such as our fellow TO2 institutes deliver other pieces of the puzzle and they are therefore indispensable partners for us in terms of knowledge development. For us, universities are the source of fundamental knowledge. We have structural and long-term working relationships with not only Dutch institutes but also their international counterparts. We absorb that knowledge by engaging in extensive exchanges of our colleagues, from professors to doctorate and

undergraduate students. We also engage in large joint research projects, both nationally and internationally, and draw up the major research agendas together. We work closely with national government institutes here, including the Royal Netherlands Meteorological Institute (KNMI), the National Institute for Public Health and the Environment (RIVM), and the Netherlands Environmental Assessment Agency (PBL). Our activities in the TO2 Federation include working with our fellow institutes and coordinating our joint actions and research with each other. You are invited to read the Strategic Framework of the TO2 Federation for more information about this area.

Our partners: top sectors

The Top Sectors were set up in order to improve the match between research and the needs of the business sector. In the Top Sectors, and particularly Water & Maritime, but also in Energy and Transport, and Logistics, Deltares continues to collaborate with the Dutch business community on knowledge development and innovations.

In recent years, the top sector policy has been housed with the Mission-driven Top Sectors and Innovation Policy (MTIB). Our mission-driven approach mirrors the missions established on the European and national scales under the MTIB. The Water & Maritime top sector focuses primarily on the theme Agriculture, Water & Food.



Trends and developments



Limits to carrying capacity

The limits to the carrying capacity of our planet are under increasing pressure and they have already been exceeded in certain areas. We are increasingly seeing the effects of climate change and, at the same time, a decline in the resilience and vitality of our ecosystem. These developments enhance each other: climate change is a stress factor for existing ecological systems, and a loss of natural resilience in river and coastal systems impairs the capacity to cope with extreme situations. For example, the coast is much more vulnerable to storms as a result of the loss of mangrove forests.

The limits to the extraction of raw materials from the system and the way we dump used materials into the system as waste are increasingly seen as an urgent problem.

There are also growing concerns worldwide about the ongoing pollution of our living environment and the effects on our health and on biodiversity. Take, for example, the amount of plastic and microplastics in the environment, excess nitrogen and phosphate, and the emergence of new substances of concern that are persistently present in the environment and the food chain.

Climate change requires a rigorous transformation. The effort required to make the transition from a global economy dependent on fossil energy to a zero-emissions economy and society is immense. To a large extent, society as a whole recognises this, as is shown by the unremitting stream of scientific publications, articles, letters and opinions printed in the media. They focus not only on combating climate change but also, and increasingly, on pleas for a firm commitment to climate adaptation. At the same time, the efforts to combat climate change are resulting in political polarisation because they will affect all sectors and everyone's daily life. The approach to the loss of biodiversity is also generating major controversies because it also has a direct effect on the economic interests of certain groups in society. The measures to address the crisis with nitrogen emissions in the Netherlands is a good example of this.

We are seeing growing support for the commitment to climate adaptation: societies are adapting to more or less water, salinisation and the increasing risks of natural disasters resulting from more extreme weather events.

Pressure on space in the Netherlands

An important and complicating factor is that the major challenges relating to housing, accessibility, nature quality, water management, agriculture and energy supplies all require space. A more active approach is needed to manage the conflicting interests. As a result, there is widespread support for a strong focus on spatial planning. In addition, the time would seem to be ripe to allow the subsurface and the water system to play a more directive role in decisions about the use of space. Ongoing land subsidence and climate change are altering the conditions for all functions as a result of increasing salinisation, desiccation, increasing vulnerability to flooding and so on. The major challenge will be establish sound links between the long term, which is by definition subject to uncertainties, with decisions made in the short term about the layout, management and maintenance of the available space in the Netherlands. Good system analyses of the links between the different factors are indispensable here.

Fast forwarding transitions

There are three developments that are driving the increase in the pace of these complex challenges.

The COVID-19 pandemic, which is resulting in disruptive change throughout the world, has led to the introduction of major support measures for society worldwide. This opens up the opportunity to fast forward transition by investing in more sustainable activities. Funds have been established in Europe and the Netherlands in which large sums have been earmarked for this 'green recovery'. The aim is to achieve a major turnaround in the next decade, even though we are seeing only limited commitment in practice to the transition to a more sustainable economy. What we are seeing is a strong focus on the importance and significance of knowledge and innovation.

There is also an increasing emphasis on health as a result of the pandemic. There will be more interest in the significance of water for good health and good food in the near future.

Secondly, as a result of pressure from regulators, the financial sector is feeling increasingly called on to account for its actions in the context of sustainability challenges. Examples are the long-term risks such as the failure to put production factors, such as water scarcity at production locations, on a sustainable basis. In addition, major investors such as the World Bank, the Asian Development Bank and FMO are setting strict standards with regard to the ecological and social impact of projects and programmes.



The final development to be mentioned here is that society itself is increasingly taking the initiative to 'enforce' sustainability, as in the case of the Urgenda lawsuit in the Netherlands about the climate objectives and the legal action taken by Mobilisation for Environment about the PAS scheme relating to nitrogen emissions. This is also a feature internationally. For example, in New Zealand, the parliament has granted the Whanganui River legal personality. In addition, more and more bottom-up initiatives are emerging in which organisations such as energy and food cooperatives work on achieving goals themselves.

Science in a rapidly changing society

The spread of disinformation and misinformation, either deliberately or not, means that science is also increasingly under attack as being 'just another opinion'. Large amounts of easy-to-share content means that people spread false information quickly. With the social media as an unmistakable catalyst. Misinformation is incorrect information that is spread without the intent to deceive. Disinformation, also known as fake news, is information that deliberately falsifies the facts in order to disrupt the process of establishing the truth. Fake news has not yet had a major impact in the Netherlands. But we cannot assume that this will always be this the case. We are also seeing the media responding to the trend. For example, NU.nl no longer allows posts that deny climate change and Instagram is barring posts from anti-vaxxers with certain hashtags.

This trend of misinformation and disinformation has been apparent for some time now. But increasingly, and also recently with COVID-19, it can quickly polarise the public debate and harden positions. That is also a feature of discussions about extreme sea level rise. It represents a challenge to which there are no easy solutions. It also puts pressure on scientists when they talk in public.

It is difficult to make a positive contribution so that scientifically established facts at least are accepted as widely as possible. Citizen science with practical input from local residents can raise trust, acceptance and impact. Transparency in working methods and research results, and the interpretation of the facts from an independent position, are important.

Scientific trends

In the time to come, we believe there will be two important scientific developments that will affect our field.

First of all, there are technological developments that are crucial now, or will be in the future, for how we work. In the years to come, we think that the increase in Earth Observation data will be the most relevant. The speed at which these data will become available in increasingly higher temporal and spatial resolution will demand considerable adaptability. In short: much more data will be available than will be actually used.

We are also increasingly running up against the limits of our current computing models. Enhanced computing power



and cloud computing represent only a partial solution. The alternative is either to make much faster computing models that leave out non-essential physics and that are designed on faster computing platforms, or to use machine learning and AI. That will be the case in, for example, domains where we think we have all the required information about the physics but where our forecasting capabilities are limited. Examples are large-scale morphology and dike stability. Or areas where we do have a lot of data but few laws with predictive capacity, human behaviour for example. These developments will impose different demands on our software, which will have to be adapted accordingly.

In addition, we are seeing shifts in the type of questions science is being asked to answer. The questions are becoming more complex and they require an integrated and interdisciplinary approach. This is seen in the case of civil engineering structures that are designed both deterministically to calculate the desired strength, and probabilistically to take the uncertainties about the composition of the subsurface into account. However, the extensive integration of exact and social sciences can also often be required, for example to calculate the effectiveness of climate adaptation measures but also the uneven distribution of those measures on society and the implementation approach required.

As far as the integration of exact and social sciences is concerned, the social sciences are increasingly taking the initiative by asking exact scientists what they need from

them, rather than the other way round. This is due to the fact that people are no longer seen merely as a cause, or merely as actors responding to changes such as increasing drought or sea level rise, but as part of the system.

In addition, the loss of biodiversity is being acknowledged as an emerging global problem. A deterioration of this kind is far less easy to determine than parameters such as the level of climate change. We will increasingly need to show the impact of projects on biodiversity or to devise projects that have a positive effect on biodiversity.

What do these trends mean?

We conclude that the urgency of tackling climate change and its consequences, as well as the loss of biodiversity, is increasing all the time. The complexity of the challenges before us and the inseparable links between them mean that we cannot do this on our own. Our knowledge has to be linked to the knowledge of other players in the knowledge field. That will require the far-reaching integration of different knowledge disciplines, and of fundamental and practical knowledge. This process will also result in different demands on the organisation of knowledge development. We are also seeing rapid changes in the knowledge and innovation system. Knowledge is increasingly being built up in co-creation processes involving different actors. The roles played by parties in this process can change all the time. Deltares is no exception in this respect. In Chapter 3, we describe our response in this area.

Water quality and health

Hormones, antibiotics and other medicines are produced to make people and animals healthier. But some of these substances go into sewers and ditches and end up in groundwater and surface water, even in areas where the waste water is treated. Excessive concentrations of these substances represent risks for people and the environment. Smart approaches to combining knowledge about these substances, monitoring and simulation models make it possible to show the risks. Monitoring with passive sampling is an effective way of establishing an accurate, early picture of these risks so that the appropriate measures can be taken. These samplers, which are suspended in surface water and groundwater for periods ranging from several weeks to months, allow us to measure even very low concentrations of substances over a long period of time. We can then use software models to predict how the different substances spread through surface water and groundwater. This gives water

managers such as water authorities and provincial authorities a better picture of water quality, which contaminants are present, and when contamination actually occurs. As a result, they can take the right measures at an early stage to limit the risk of the contamination of surface water and groundwater.

An important benefit of this monitoring method is that it is easy to use in areas that are difficult to access because the passive samplers are easy to transport and they can also be stored for long periods of time. In addition to introducing this approach in the Netherlands, we have also used it, for example, in the Citarum River near Bandung on the Indonesian island of Java. That provided us with a picture of how pesticides are used in tropical agriculture and of the use of medication by the local population. That results in important information about the measures and an understanding of the potential benefits for human health.



Building with nature is possible everywhere

Calls for building with nature are getting louder and louder. We see nature-based solutions, the term used internationally, as the infrastructure for the future. Durable, adaptive and resilient. But what role can nature actually play in reducing the impact of floods, typhoons and tsunamis? How well do trees break waves? Does circular clay work as a material for dike reinforcement? More knowledge can help to protect both nature and people better.

Grey/green

We often use these natural, green solutions in combination with traditional grey solutions such as dams, dikes and barriers. These are often indispensable but, at the same time, they often disrupt important natural processes or cycles. Dams capture sediment, with downstream erosion and ecological deterioration as a result. In turn, rivers enclosed by dikes transport sediment too quickly to the sea, the surrounding area gets lower and lower, and floods are more likely.

Examples of green-grey solutions are vegetation or salt marshes in front of sea or river dikes, naturally ripened dredged material that we re-use for the construction of civil engineering structures, or city parks that we connect to the nearby river or tidal area.

Developing knowledge

Deltares helps to develop knowledge for the large-scale implementation of nature-based solutions. We do that in our laboratory, experimental facilities or in field experiments. We investigate what happens with water, vegetation and sediment in extreme conditions such as storms or intense rainfall. We always do this in collaboration with our knowledge partners and clients from the field. The technical understanding of the processes in the delta area is the basis for our research but the issues always require a multidisciplinary approach.



Strategic directions



During the coming period, we will be working on four areas where we want to strengthen and accelerate. First of all, we will be introducing more focus to our mission-driven work in the fields where we want to make an impact on society in collaboration with other partners, other knowledge organisations and clients. Secondly, we will be strengthening our knowledge base by moving ahead faster in the field of our data and software. Thirdly, we will be strengthening the alliances with our partners in the Netherlands. And the fourth area will be the strengthening of our international position. Our knowledge base continues to be crucial here.

3.1 | Area 1: focus in mission-driven work and alliances

Deltares is giving the global, European and Dutch agendas and missions a central position in the thinking and activities of our organisation. Our mission-driven approach will therefore fully mirror the missions under the MTIB. They constitute a starting point and source of inspiration in our day-to-day work and provide the perspectives underlying our work. At the same time, they embody the long-term goals and impact on society that we target and where we want to make a contribution. Mission-driven work introduces focus and cohesion to our work.

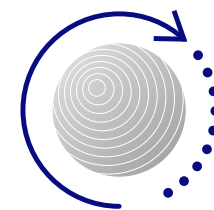
Our mission of Enabling Delta Life targets safe, sustainable, future-proof living in deltas, coastal and river areas: how do we make our living environment safe and sustainable in the short term and how do we keep it liveable, safe and sustainable in the long term?

We have defined four mission areas that serve as four perspectives for the way we see the delta and that we use as yardsticks for our work in the delta. The four perspectives are not separate. The future studies in Future deltas provide frameworks for robust, future-proof solutions relating to current policy intentions, and measures to address issues facing society. Those solutions are elaborated in Sustainable deltas, Safe deltas or Resilient infrastructure. Together, they cover the domain of delta technology. They use different, but partly overlapping, scales for time and space.

In Future deltas, our question is: how will deltas, and the linked coastal areas and catchments, develop as a result of changes in the supplies of water and sediment, rising sea levels and land subsidence? But also as a result of changes in the size of the population, economic development and new technology? By properly describing these processes and developments in long-term scenarios, it is possible, despite the uncertainties, to make sound assessments of how to act now in order to keep deltas, coastal areas and catchments safe and resilient. This knowledge is essential, if only to ensure that the Netherlands will remain the world's best protected delta in the long term. We want to use this knowledge to help ensure that action perspectives are also available elsewhere in the world and that the right measures are taken.

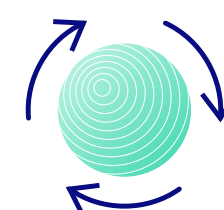
The main question addressed by Sustainable deltas is: which action perspectives can we develop to ensure that ecosystems and natural resources will continue to be available for future generations in the urbanised deltas?

Future deltas



How do deltas change in response to sea level rise and land subsidence, population growth and economic growth?

Sustainable deltas



How do we ensure that ecosystems and natural resources will also be available for future generations?

Safe deltas



How do we protect the growing population and economy from extreme events linked to water and the subsurface?

Resilient infrastructure



How do we make our infrastructure resilient on land and water? Adaptive where necessary while preserving functionality.

Figure 3.1 The four mission areas, four perspectives, for how we see the delta and that we use as yardsticks for our work in the delta

Water and the subsurface, for example, play an important role in the missions for the energy transition and sustainable food production. Through this mission area, we contribute to the structuring and management of water systems in such a way that energy and food can be produced sustainably.

In Safe deltas, we focus primarily on the following question: which action perspectives can we develop to protect the growing population and economy from extreme events, extreme weather and geological extremes? This mission area focuses on determining, predicting and managing risks, crisis management and disaster management resulting from extreme natural phenomena such as drought, flooding, extreme erosion and landslides. This also includes the consequences of extreme geological events such as tsunamis and earthquakes due to land subsidence

The Resilient infrastructure we need for the functioning of a sustainable and climate-resilient world, as well as for protection from extreme events, is at the heart of this mission area. We have knowledge about the system and the objects but we already have to take major uncertainties and more extreme events into account.

The principal question here is: how can we make our infrastructure more resilient in such a way that it will continue to operate effectively in the decades to come and so that can be adapted quickly in response to climate change or changes in boundary conditions linked to water and the subsurface? This mission area is about the management and maintenance of hydraulic engineering structures such as our flood defences and the use of nature-based solutions. The subsurface and the water system are at the heart of the use of space in delta areas. Deltares uses the systemic approach as an integrated guiding principle for the analysis of issues relating to current and future land use.

We look at long-term developments and the implications for the action perspective now. We continuously switch between integrated approaches and local solutions. A unique knowledge domain.

We have developed fifteen programmes for this purpose – see our 2021 activity plan – which, taken as a whole, encompass our knowledge base:

- Area-based programmes: these programmes are built up around related issues that have specific area characteristics. Examples are seas & coastal systems, river systems, rural areas and dynamic urban areas;
- Thematic programmes: water availability, land subsidence, flood risk management, the infrastructure replacement task, natural disasters, ecological sustainability, the energy transition and so on;
- Methodological programmes: risk approach, adaptation strategies, operational information and so on.

In order to secure and develop the knowledge at Deltares and its partners, we have a range of knowledge facilities at our disposal. The knowledge facilities both facilitate and inspire. We facilitate the needs of the mission areas in terms of the functionality and deployment of knowledge facilities. On the other hand, the facilities provide inspiration by offering new technologies and experimentation opportunities to make an impact in our mission areas.

Moonshots as a way of delivering challenges, cohesion and result-driven thinking

We will be elaborating our mission-driven approach further for the coming strategy period. We will do this by formulating challenging goals in the form of moonshots for our mission areas and the related programmes. These moonshots will therefore be the building blocks, and the results, of our mission-driven work. They are stories exemplifying dossiers where we wish to lead the way in the years to come, while targeting the impact on society. In that way, we are implementing mission-driven working further in our organisation and introducing even more focus. As well as directing the deployment of our strategic research resources. We also use the moonshots to build strategic alliances with



clients, other knowledge institutes and market parties. At the same time, this also involves leading the way and setting the agenda where knowledge about water and the subsurface makes the difference in the major challenges and transitions. So we need to demonstrate thought leadership to address bottlenecks and action perspectives in good time.

Deltares cannot do the work on these interrelated mission areas alone. We therefore always work with other knowledge partners, government authorities and market parties in the knowledge and innovation network to address these complex, interrelated tasks.

We have a major impact but, until now, our approach to that impact has been primarily narrative and exemplary in nature. We describe many wonderful examples. Although this approach is very illustrative of our work, it is difficult to quantify and monitor the objectives. The evaluation committee referred to above has therefore advised us to monitor our impact more systematically. We are eager to take up that gauntlet and we will be doing so in consultation with, among others, the Ministry of Economic Affairs. The mission areas and the associated moonshots are an excellent way of measuring our impact in a more methodological way. We will also be looking much more closely at the expected effects in the early stages of the development of our research questions. That will involve consultation with our clients and the world in which we operate.

By way of illustration, we have elaborated a first moonshot in this Strategic Agenda. It relates to one of the dossiers to which we, as an organisation and as a workforce, feel enormously committed and motivated to make a difference.

‘We continuously switch between integrated approaches and local solutions. A unique knowledge domain’

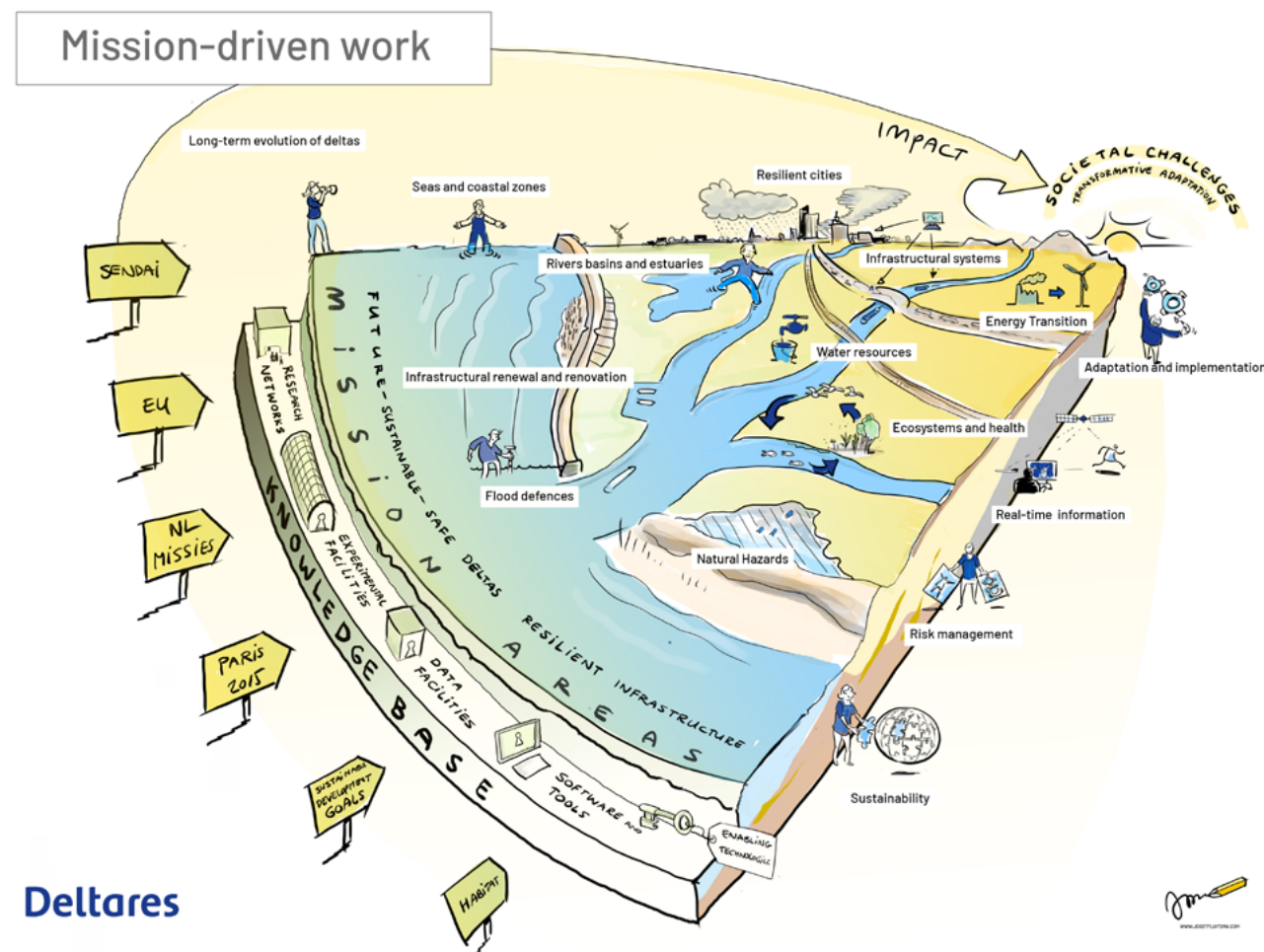


Figure 3.2 Mission-driven work at Deltares We have adopted national and international ambitions and missions as our point of departure and stated them in terms of four mission areas: four perspectives for how we see our work in the delta.

MOONSHOT: deltas remain habitable, even with two metres of sea level rise, land subsidence and climate change

Throughout the world, deltas and low-lying areas are contending with increasing urbanisation and spatial pressure on rural areas. In the Dutch Delta, we are facing the challenge of building one million extra houses. In addition to other planning issues with major spatial consequences, such as the transitions involving energy, agriculture and nature.

And more is coming our way. The land is subsiding, the sea level is rising and climate change is also altering weather patterns. These phenomena restrict the space available for solutions. All this means that deltas worldwide are facing complex planning challenges. The planning challenge facing the Netherlands requires an integrated approach that strikes a balance between living, working, nature and agriculture in a changing landscape. Much of our work is geared to determining how long we can continue with the current structure of our soil and water systems. How long we will be safe behind our flood defences, and how long we can continue to deliver enough fresh water? Adaptive delta management translates the uncertain future into time intervals for the future. During that process, it maps out how much longer we can continue on the existing road.

In this moonshot, Deltares provides a picture of the pathways we can take for the long term. This starts with understanding the physical and socio-ecological changes of the future in densely populated delta areas. That applies not only to the Netherlands but also to foreign deltas. It involves looking at the possible

situation of deltas in the future if the sea level rises by two metres. We do not know when this will become a reality but we are going to work out the details of what we will have to do then. Because knowing what we can or must do in response to this challenging transformation will give us the opportunity to make the best use of the time we still have.

We provide the scope of solutions needed to take innovative measures to reduce land subsidence, and to adapt to sea level rise and a changing climate. Within this framework, the infrastructure must also be built and replaced on climate-robust lines and we are developing a new strategy for coping with salt water.

A detailed and confidence-inspiring future with two metres of sea level rise. That is at the heart of our mission: safe, future-proof, sustainable with resilient infrastructure.

In this moonshot, we want to ensure that the South-western Delta of the Netherlands is ready for the future. At the same time, it allows us to learn lessons for and from other areas, gives professional specialists the opportunity to expand their knowledge and allows for the formation of a new generation of hydraulic engineers.

This involves close collaboration with the national government, our knowledge partners, engineering firms, contractors, nature organisations and regional administrators.

To continue down that road, modern data-driven technologies and cloud developments need to occupy a self-evident position in the wide range of Deltares knowledge facilities.

There has not only been an enormous expansion in the questions that are being asked; the same applies to the corpus of knowledge from different domains: from

atmosphere to subsurface and from energy to governance. Alliances and the combination of domains are reflected in, among other things, a number of large digital platforms that are under development. Two important examples are the European Destination Earth and Microsoft's Planetary Computer. Digital platforms are also being established on a smaller scale. A number of initiatives have also emerged at Deltares, including Blue Earth.

Global Water Watch: worldwide water data available in almost real-time

Unreliable water supplies represent a threat to societies and economies. Worldwide water information is essential for sustainable water use, sound management and timely action. To improve access to water information, Deltares has been nominated for financial support - together with our partners WRI and WWF - by Google.org for the development of an application that makes global water data available in high resolution, and in near real-time.

With the information from the Global Water Watch, we can establish an understanding of how water is distributed around the world and we can better manage floods and droughts, which are more frequent because of climate change. The proposal is for Deltares to build the platform on the basis of AI algorithms that translate earth observation data into relevant water information. We also establish links with local measurements. Water data derived directly from satellite images, without proper interpretation, are inadequate for decision-makers. They want answers to questions like 'How much water can be stored in my reservoir?', or 'Have we enough water

this year to irrigate crops?' The planned platform generates this water information. The aim is to establish greater transparency between riparian states, regardless of sector boundaries and for all groups in society, with greater equality as a result.

This initiative is possible thanks to financial support from the 'Google.org Impact Challenge on Climate'. "We received an overwhelming number of applications, and we and the expert jury were convinced by the Deltares approach. We are delighted with how Deltares uses technology to tackle challenges such as climate change and how this can help to establish a greener and more resilient future."

The proposed development of the Global Water Watch is one of the examples that will help us achieve the objectives relating to software and data. It complements the objectives for the development of the Blue Earth platform. It also ties in with our ambitions relating to open data and the implementation and practice of machine learning techniques and cloud computing environments.

3.2 | Area 2: fast forwarding data and software development

With the existing software, models and data facilities, Deltares has a sound knowledge base on which to build. At the same time, we have seen that a higher gear is needed in view of our role as an important knowledge partner for government authorities and market parties using the opportunities afforded by new technology. That is why we are making major investments in strengthening our data and computing infrastructure, as well as our agility and speed in the field of data-driven methods and software development.

We see the use of these technological developments *and* the possibilities of co-creation with others in that area as the key to continuing to supply and develop relevant knowledge.

Knowledge that is needed to find solutions for the enormous challenges we face transcending different domains and boundaries. To develop, test and optimise innovative solutions that work in practice.

New technology and co-creation in software and data
Technological developments, particularly in the field of earth observation, artificial intelligence (AI), visualisation, digital twinning, and cloud computing, are having a major impact on the work of Deltares. Cloud computing, for example, is becoming more accessible, faster and more affordable. Datasets are becoming available in more and more temporal and spatial detail. By combining data analysis and numerical models, we can process and use data at different scales. Deepening our system knowledge and allowing us to make it even more accessible.



Flexible range of instruments

In order to continue reaping the benefits of internal and external developments such as AI, new forms of visualisation, cloud computing, the rapid growth of data and co-creation in software, we must be in a position to respond flexibly with our instruments. This means that technological developments also require ongoing collaboration between domain experts, data scientists, and ICT and software experts.

It should be pointed out that we are not alone here. Other technological organisations in the Netherlands and throughout the world are facing similar challenges and making plans to respond effectively to the opportunities offered by new technologies and co-creation. We and they need to work together in far-reaching ways. In the areas of both creativity and the coupling of instruments.

'The scope and speed of developments [AI and ML] also generate challenges [...], in particular regarding the necessary know-how that needs to be established, the software and hardware infrastructure that needs to be developed, and the integration of machine learning and conventional tools within the prediction workflow'

(ECMWF, Technical Memo, 2021).

Investing in digital transformation

To achieve the necessary acceleration, we are investing in a digital transformation during this strategy period. The aim is to make our software products robust and flexible for the purposes of co-creation and rapid developments, to make optimal use of the available computing and data facilities for mission-driven work and to broaden the knowledge that the people working for Deltares have in the areas of data-driven techniques, cloud computing and data management. In the years to come, we will be earmarking capacity and resources to achieve this goal. Dare to share is and remains our motto here, and that also applies to software and data.

This digital transformation will be a major assignment requiring a lot of time and resources. Deltares draws on its own resources but they cover only some of the investment required. We are looking for external financing to achieve our ambitions. We are therefore advocating, together with our partners in the knowledge coalition, more investment in knowledge development. The fund recommended by the evaluation committee for investments in the research infrastructure, for example, would be a welcome contribution in this respect.

3.3 | Area 3: strengthening national alliances

Solving complex issues requires intensive collaboration. We cannot deliver those solutions on our own. This is an area where we work with policymakers, administrators, research institutes and the business community, often in co-creation alliances.

We have a central position in this field, and strong relationships with all parties. We will continue to be fully committed to these activities. In the coming strategy period, we will be placing emphases on alliances that we intend to strengthen.

Alliances. Deltares works with the market and government, with fundamental science and applied fields. Our position can take different shapes: a single position in the field is increasingly rare. That position depends on our role in a consortium, in a specific assignment and often on the complexity of the specific problem. Our contribution sometimes targets the development and introduction of the long-term perspective. We sometimes work in close collaboration with the field, in order to work and learn with consultancy firms and therefore to inspire our own knowledge development. The consultancy firms sometimes work closely with us on the joint development of knowledge that they can then apply directly themselves. We sometimes team up with universities and work on the societal valuation of fundamental research.

Above all, we plan to strengthen our relationship with the Dutch government. As a research institute for water and the subsurface, we operate in crucial policy areas, particularly those of the Ministry of Infrastructure and Water Management. Our knowledge also plays a role in policy areas covered by the Ministries of Economic Affairs and Climate, Agriculture, Nature and Food Quality, Internal Affairs and Foreign Affairs. The four-yearly evaluation committee noted recently that the impact of Deltares can be greatly increased by involving Deltares more at a strategic level. The committee therefore advised the government to revive the strategic dialogue between Infrastructure and Water Management/Rijkswaterstaat and Deltares about its strategic course, strategic research and the activities. However, the same applies to the other ministries. We are happy to respond to that call. For our part, we will ensure that we use our knowledge to address the strategic issues of the day after tomorrow, such as climate adaptation and land subsidence. In that process, we also establish links with the operational level. We want to provide an understanding of the consequences of changes in the long term, as well as an understanding of the consequences for the management of water and subsurface in the years to come. In this way, we provide the government with the knowledge it needs to develop good policy.



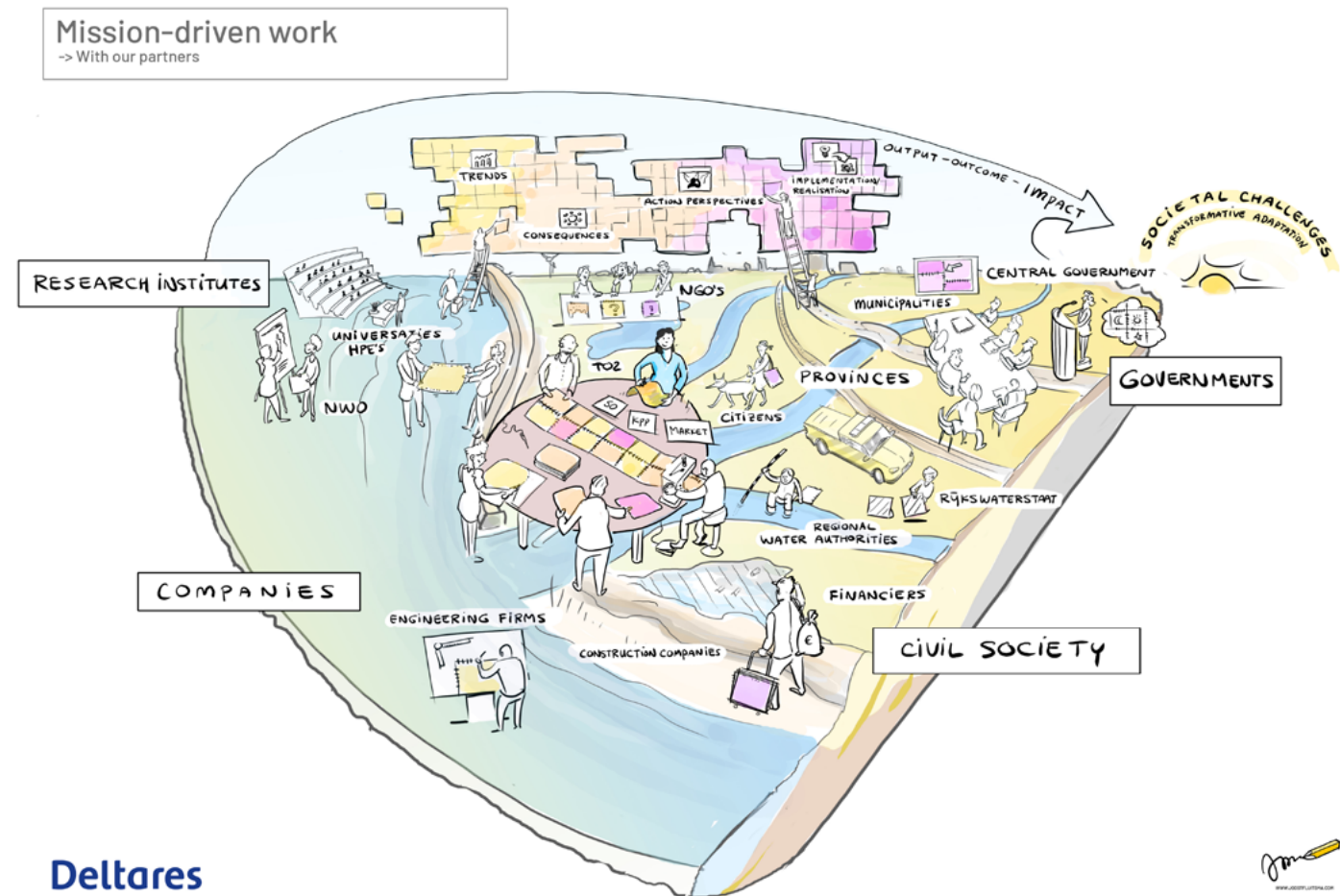
Our knowledge base is developed with SITO financing from the subsidy scheme for institutes for applied research. However, a significant proportion, and particularly the impact of the knowledge base, comes from our work with the Ministry of Infrastructure and Water Management/Rijkswaterstaat and other government authorities. The testing of our knowledge in practice is extremely relevant: by working in the field, we can determine whether the further deepening of knowledge is still contributing to the solution, or whether the crux is to be found elsewhere. Moreover, knowledge and new, innovative solutions have a real impact only if they are applied in practice. That is why we want to strengthen contacts with parties (in the government and the market) that are closely involved with implementation and practical applications. In this way, we ensure that we can respond quickly and adequately if new insights or unexpected problems arise. And that we can together establish connections between different projects and the different phases of those projects.

Practical experience is also a factor that directs the further development of our knowledge base. Here, we focus explicitly on involving private bodies and the government at an early stage of knowledge development in order to develop and implement innovations and measures. A new covenant was

concluded with NLingenieurs in 2020 for this purpose. The basis of this covenant is that we will get each other involved earlier on in processes and that we will collaborate more on both the development and implementation of knowledge and innovation projects. In general, we use co-creation for that purpose.

In addition to our work for the national government, we work extensively with and for regional and local authorities: provincial authorities, water authorities, drinking water companies and municipal authorities. These are sometimes concrete, defined, operational projects. For example, all water authorities in the Netherlands use our software. But increasingly, these parties believe that an integrated and area-based approach is more important. For example, in order to determine the effects of climate changes or the effect of measures, we need to understand how the system works in a given area.

We work at different spatial and temporal scales. In other words, we switch between local solutions and an integrated systemic approach. We can look a long way into the future and apply those insights to our work in the present. Specific areas or tasks play a central role here: the water and subsurface system has no administrative boundaries and



Deltares

Figure 3.3 Alliances with our partners

the overall picture has to be taken into consideration in order to produce solutions. That is our strength. The knowledge we acquire for various government authorities is brought together in our knowledge base. In turn, that knowledge base is available to all government authorities. In the coming strategy period, we will be strengthening a number of working areas for the Dutch government. They include task-oriented work, for example droughts or land subsidence. And area-oriented work, such as the South-western Delta, North Sea and major rivers.

In addition to strengthening the relationship with the Dutch government, we will further strengthen alliances and the orchestration of research with fellow research institutes, including the partners in the TO2 federation and with the National Research Institutes. By doing so, we ensure that our knowledge development is complementary to that of our partners. Examples are research in the field of climate adaptation (with KNMI), the energy transition (with the Netherlands Organisation for Applied Scientific Research, TNO), and in the field of spatial planning and the relationship with water and the subsurface knowledge, for example factors such as land subsidence and the future of peat areas (with Wageningen Research).

In the time to come, we will also endeavour to achieve optimal coordination and collaboration with regional knowledge clusters and institutions of higher education.

We work with SMEs and start-ups to apply our knowledge. SMEs already make extensive use of our knowledge and software, our geo-software being one example. We recently established a desk for this purpose specifically for SMEs and start-ups so that they can turn to us with their knowledge and innovation questions. During this strategy period, we will look at how this works and whether any adjustments are needed. SMEs and start-ups can also make use of the 'Technology Surgery' (a one-day consultation) free of charge and Deltares is providing increased access to the experimental research facilities (using SME vouchers) for the testing and validation trials of SMEs and start-ups. In this way, Deltares aims to make its knowledge and expertise more accessible to these entrepreneurs. Deltares, with the other TO2 institutes, is also strengthening the relationship with the organisations representing the different branches of business and start-up environments in order to reach more SMEs and start-ups.

3.4 | Area 4: strengthening international position

Deltares is active in virtually every part of the world. At present, approximately 30% of our total turnover is generated outside the Netherlands. We have good reasons to work internationally: we want to use our knowledge to generate impact not only in the Netherlands but also around the world. That is why we also make our knowledge available elsewhere.

Through our international projects, we develop knowledge that we can also use in the Netherlands. That strengthens our position in our home country. We encounter conditions internationally that we do not (yet) see on an everyday basis in the Netherlands. Examples are severe rainfall, wind, strong waves or drought.

In our knowledge base, we group our knowledge and expertise about all the world's deltas. That is how we establish action perspectives and solutions for our Dutch delta and deltas worldwide.

Our international activities make a significant contribution to our knowledge position and so they are important for our work in the Netherlands. Internationally, we see growth opportunities, while aiming to maintain a healthy balance between national and international projects. We want to be involved in international projects and, at the same time, be optimally available for our Dutch clients. That is entirely possible, with our focus being on international growth and a target for international turnover of between 35 and 40%.

We work as a single organisation. Although we do have a number of small international offices to facilitate working in other countries, we do not want to have large numbers of large branches. Our international position is fundamentally different from our position in the Netherlands. As a consultant, we execute projects there with other parties. Our role in many of these projects is that of a specialist consultant. That is where we put our knowledge into practice and make it available. We acquire most international projects in competitive tenders. We prefer to work with Dutch business outside the Netherlands and we often team up with organisations that operate locally and internationally.

The opportunity to work internationally makes Deltares an attractive employer and contributes to the development of our staff. In addition, it allows Deltares to retain top talent. We also need those talented people to address the issues in our Dutch delta. The diversity of our workforce ensures fruitful interaction and it is important to generate innovative insights and solutions worldwide.

The evaluation committee acknowledges that we have introduced more focus to our international activities in recent years. At the same time, the committee encouraged Deltares to be more selective and to opt for an in-depth strategy: focus on excellent research while also looking to establish relationships with the leading international partners. *Noblesse oblige* and the committee states that, working with these partners, we should lay a stronger claim the position of thought leader and set the agenda more. That is the case, for example, in Europe with regard to the





Green Deal and in international strategic alliances with organisations like the World Bank. We will work with the Global Center on Adaptation (GCA).

What are we working on?

We believe that Deltares has two roles that are mutually reinforcing: the role of strategic knowledge partner and the role of project consultant. As a strategic knowledge partner, our ambition is to be a logical partner for discussions with international organisations. We want to continue building up our relationships with those organisations.

Our ambition is to advise them about strategic developments and scientific insights relevant to them. By developing knowledge and setting the agenda, we can further strengthen the leading role that the Netherlands plays in the field of water and the subsurface.

We work internationally on issues where we can offer added value with our expertise in the field of water and the subsurface. These are the same issues we address in the Netherlands: flood risk management, land subsidence, coastal development and protection, resilient infrastructure and the management of rivers and groundwater. We are also active internationally on the Water, Peace and Security dossier, collaborating closely with, among others, the Ministry of Foreign Affairs. For the coming period, we also expect to see demand for our knowledge in the field of clean and healthy water.

What will we strengthen?

You achieve impact by developing the right knowledge, setting the agenda and applying knowledge in practice. The ambition of Deltares is to play a leading international role in the area of water and the subsurface. In order to use our knowledge to make a difference for the challenges of today, tomorrow and the distant future, both in the Netherlands and internationally, our knowledge must be in the global top flight. That ambition implies working with and for organisations in that top flight. Because we can only do that with others, and we must be willing to engage with them.

We collaborate with national and international partners who lead their fields, such as the USGS (United States Geological Survey), the WRI (World Resources Institute), the NWS (National Weather Service) and the NUS (National University of Singapore). Furthermore, we often team up internationally with Dutch business, internationally oriented research institutes such as the IHE, and NGOs. We are also committed to strengthening our position in Europe. In addition, we aim to provide major financial institutions such as the World Bank, the Asian Development Bank, the European Investment Bank and regional development banks with strategic advice. That is because we want our knowledge to have an impact, and these institutions play an important role in policy and implementation internationally. Our International Advisory Board provides us with support to achieve this ambition.

Our objectives mirror the Dutch water ambition and we team up internationally with the ministries of Foreign Affairs, Economic Affairs and Climate, and Infrastructure and Water Management.

Where do we work?

Deltares works worldwide. Outside the Netherlands, the regions where we have the most projects and turnover have traditionally been Asia and Europe. We also believe these two regions will be important in the future. The map here provides an overall picture of where we work and what we do there. On the basis of the nature of the projects, the alliance partners and clients, we choose the countries where we want to work and which projects we take on. In the years to come, we will devote extra attention to Europe and Africa.

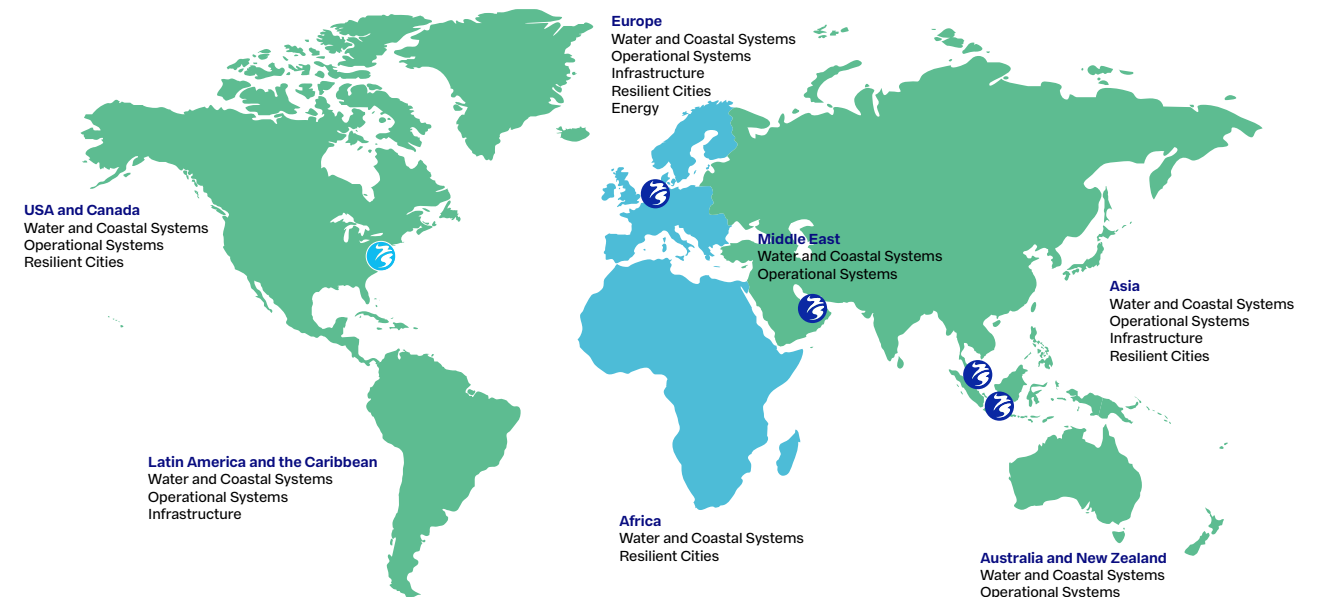
We aim to invest extra energy in helping to make Europe more sustainable and adaptive. We want to contribute to the priorities of the European Commission while focusing on the ambitions set out in the European Green Deal. Deltares is also emphatically committed to working with and applying key enabling technologies. This is in line with the digital ambitions of the European Commission.

The Green Deal and the COVID-19 recovery funds are opening up opportunities to make this contribution in the coming years. We want to do this for European organisations but also for financiers such as investment banks. In addition, research alliances and setting the agenda will continue to be important in 'Horizon 2020' and its successor 'Horizon Europe' (2021-2027). This is not solely about executing projects and winning project proposals: we are also eager to contribute to the direction of strategic agendas and work programmes. The Green Deal has a knock-on effect not only in Horizon Europe also in a large number, if not all, European instruments, including the Resilience and Recovery Fund. Deltares believes it has an important role as a specialist consultant for the programming and spending of these funds. Where possible, we are strengthening the EU-Africa partnership at the same time.

To achieve these ambitions, we will work more intensively than we have until now with European partners.

We expect rapid developments in Africa in the coming years. That is why we want to devote extra attention to this region, which is a relatively new one for us. The challenges facing Africa are daunting: climate change, migration and population growth to name just a few. With our knowledge, we are willing and able to contribute to solving and preventing problems. We can have a major impact here and contribute to a better and sustainable world. Working in Africa also offers opportunities since developments are rapid and the population is young.

We can tackle new developments with partners, and a young and rapidly developing continent opens up great opportunities and possibilities in this respect. At present, we mainly work for international financiers. To develop our position further, we will tackle a number of areas: the targeted development of a local network and teaming up with a limited number of strategic partners. We have selected a limited number of countries. We are explicitly looking at the possibility of working with Dutch partners such as NGOs, the Ministry of Foreign Affairs and the Dutch business community. We are therefore making a switch from an opportunistic to a strategic approach in the region.



Floods and droughts

In collaboration with the World Bank, Deltares has drawn up an approach for the combined management of flood and drought risks. It provides water managers and government authorities with support for coping better with the risks of drought and flooding. We have developed an operational framework for this purpose focusing on the use of knowledge, models and the role of various stakeholders. The new method has been described in a Flagship Report, a joint report from the World Bank and Deltares. In this way, Deltares is contributing to the safer and more sustainable management of water systems throughout the world.



Our organisation



Excellent people in excellent teams

This is where we see the strength of our staff and our organisation and this is an important condition for the achievement of our ambitions. After all, our staff are the people who ensure that we can make 'Enabling Delta Life' a reality. With the power of evidence-based knowledge in the area of water and the subsurface and our passion for a sustainable environment.

We have a wonderful springboard: at Deltares, we work with talented, professional and motivated people. Together, we are the guarantors of high scientific quality. In our work, we place social interests above individual interests.

We are generous with respect to sharing knowledge and we collaborate to produce innovative solutions that we use to serve the greater interest: being in the best possible position to cope with the challenges of the future.

4.1 | Organisational development

Our strategic course involves: introducing more focus to our mission-driven work in order to have an impact on society, strengthening our knowledge base by accelerating the development of our software and data, reconsidering our relationship with the Dutch government and strengthening our international position.

To achieve this, we as an organisation will be developing our profile further in the coming years in order to make an impact, enhance our agility and further an inclusive culture.

Deltares Entrepreneurship Challenge

There is a healthy entrepreneurial spirit at Deltares. More than forty colleagues in ten teams, from juniors to experts from various organisational units, are participating in the first Deltares Entrepreneurship Challenge. They are challenging themselves to develop their entrepreneurial skills further: working on innovative ideas, expanding networks inside and outside the organisation and learning from each other's knowledge and skills. The participants are being encouraged to focus primarily on the added value that their ideas have for society as a whole.

An important component of the process is co-creation. It is valuable to discuss ideas and their possible application with colleagues, intended partners and users in the early stages. The conversations with our contacts show that this is appreciated. At the same time, it speeds up the further development process and makes successful implementation and use more likely. Conversely, we also invite our contacts to get together to look at their innovative ideas.

In this challenge, every participant is a winner because everyone develops and grows in their collective and individual skills and networks. "Sharing ideas with others, with partners and potential clients generates most energy and it is great that we are being given the opportunity, and being encouraged, to go down this road."

4.1.1 Enhancing impact and profile

Working with others is essential if we are to achieve our ambition relating to our impact on society and to strengthen our relationship with the Dutch government. At present, collaboration is in our blood but the complexity and integrated nature of the issues require us to work increasingly in co-creation with our strategic partners in the Netherlands and internationally. That is a process in which we provide direction, learn and innovate together in order to make an impact. We will therefore be continuing to invest in the coming years in strengthening our co-creation skills, our sensitivity to how society works, and stakeholder management.

The pursuit of impact also has an effect on how we work with the outside world. We want to encourage and facilitate the appropriate discussions with decision-makers with sound knowledge and with knowledge that generates an appeal. Not to take over from decision-makers. But we believe that it is our solemn duty, if an issue requires it, to draw attention to important issues on the basis of a robust knowledge base and to put those issues on the agenda. That means Deltares is taking up a more central position in the social debate. Consequently, in addition to in-depth substantive knowledge, we are also focusing more on the political-administrative sensitivity of our organisation. Precisely because we have knowledge that allows us to draw attention to what is needed in society. But we also know how to do this in such a way that what we have to say reaches the right ears and strikes the right tone. The underlying principles



here are the preservation of our professional authority based on facts, integrity and an independent position. Precision and accuracy come first. As well as being transparent in our working approaches and our research results.

In order to have more impact and fulfil the important task of sharing knowledge and promoting dialogue, we see communications as a part of the primary process. An active media policy is helpful in this regard. Our staff are our most important ambassadors and figureheads for getting the message across. They have a particular role to play in terms of further strengthening support for Deltares and our image as a renowned research institute. That is why, during the years to come, we will be investing in the development of skills in the field of stakeholder management, media awareness and communications. We will also continue to build on our profile in our social media communications and employer branding.

4.1.2 Increasing agility

Our ambition is to strengthen our knowledge base by accelerating the development of our software and data. To achieve this, Deltares will be making investments throughout the organisation in the years to come in the development of the knowledge and skills of our staff in the field of key enabling technologies, data, software and models. Where that is required, recruitment can also boost the acquisition of new knowledge.

In addition to substantive knowledge, we need to be more agile in order to respond to fast-moving external developments. That is important for areas such as accelerating the development of our software and data, a strategy that we are using in order to maintain our ability as a research institute to deliver innovation and added value. This requires a different approach to collaboration between the substantive specialists and the software and data specialists: fast, flexible and agile. It also requires the ability to listen carefully, be open to other perspectives and connect complex issues. It requires teamwork!

We will further shape the effect that all of this has on our organisation and our decision-making processes in the years to come, focusing on training, staff coaching and working in teams. Taking cultural factors into account so that this transition will be implemented effectively.

A hybrid approach to working contributes to flexibility and agility in collaboration. Deltares will make full use of the possibilities offered by digitalisation to support this process. This relates not only to the primary work process but also the further optimisation of port processes with the aim of relieving the administrative burden on staff. We do all this in the context of the appropriate and necessary cybersecurity and knowledge security arrangements.

4.1.3 Inclusive culture

In order to be agile as an organisation, to keep in touch with new developments and to create space for innovation and entrepreneurship, an inclusive culture is important. This also applies to achieving our international ambitions.

This topic certainly has our full attention but there is always room for improvement. We will therefore continue to invest in diversity and inclusion in order to allow our rich resources of creativity and innovative strength to flourish. Forty-one nationalities currently work at Deltares and 14% of our employees come from abroad. The numbers tell only part of the story. It is not just a question of who is present at the table but also about those people being heard. We will therefore encourage inclusive and adaptive leadership and strengthen an inclusive culture so that all our staff feel they are being given the room to get the most out of themselves.

The organisation will therefore be investing in the coming years in awareness and skills that contribute to a committed, open culture where there is room for curiosity, different views and diverse communication styles. This also makes us an even more attractive employer and alliance partner.

4.2 | Corporate Social Responsibility

Our ambition is to make a positive contribution to sustainable development. Not only in the Netherlands but also on the global stage. Corporate Social Responsibility (CSR) is therefore inherent in our work. Making a positive contribution to today's major issues is an important reason for many employees to work at Deltares.

Our work helps with the achievement of global climate goals and it focuses on a number of specific United Nations Sustainable Development Goals (SDGs) where our added value is highest. We want to implement our consultancy projects in such a way that we can also determine the impact of projects on the climate and the SDGs, and minimise the negative effects. We also want to have our

own house in order. That is why *leading by example* is an important pillar of our corporate social responsibility policy. We want to minimise the impact that our work has on the climate. For example by making our campus in Delft climate-neutral. And we compensate for our carbon emissions from air travel. We do this by executing projects at our own expense that contribute to the reduction of greenhouse gas emissions.

Our Deltares Code of Conduct complies with the basic corporate principles outlined by the UN Global Compact. We have included these principles in our corporate values, and in how we work and do business. This means working in a way that at least complies with the fundamental responsibilities in the areas of the environment, corruption, labour and human rights. Compliance with this Code of Conduct is essential to the success of Deltares and we therefore pay a great deal of attention to this area.

4.3 | Science Council

Deltares has a good scientific position and we must maintain it. The new Science Council plays an important role here. Its main task is to supervise the scientific implementation of mission-driven work at Deltares. And to advise on the deployment of strategic research resources to develop the knowledge base required for that purpose. The Science Council will have a diverse membership and it will consist of a mix of Deltares professors and a number of inspiring, iconic, employees who have a high profile in both society as a whole and the scientific world, nationally and internationally. As Deltares figureheads, they can convey the messages of scientific quality and social relevance, and strengthen our international relationships.

In the coming strategy period, we will also be working with a Young Science Council. We see this as an important source for encouraging and using innovation and creativity. The Young Science Council will consist of employees who can play a pioneering role in the transition to the new technology that leads to new knowledge, and who challenge the organisation to take *leaps into the unknown*.

4.4 | Healthy financial management

Deltares is a non-profit organisation. Turnover and profit are not goals in themselves. Our objective, in addition to safeguarding continuity, is primarily to improve quality and impact. Our turnover is currently €120 million a year. We do not foresee any significant changes in the coming years. An estimated 60% of the total turnover can be classified as 'non-economic activities'.

Deltares has a sound financial basis at present. To maintain this financial position, we aim to generate a return of 2% on turnover. This puts us in a position to invest in our knowledge resources, such as software and research facilities, in order to keep them up-to-date. In this way, we increase the impact of our research institute for our clients, partners and society.

Over the past ten years we have invested in the innovation of the physical facilities and the campus in Delft. In addition to the necessary investments in replacements, no major new investments are expected in the coming period. Investments are expected to approximately match the level of depreciation in the coming period.

The national government funding for maintaining and strengthening our knowledge base currently accounts for 16% of turnover. We use this contribution to expand the long-term knowledge base and to maintain the knowledge facilities.

The acceleration of the digital transformation (see section 3.2) will require a development budget of €20-40 million in the years to come. We have to conduct maintenance on our existing assets at the same time as we develop new systems. The consequence is that we need more funding. We will meet some of the costs by reviewing the priorities in Strategic Research and by drawing on our own resources. However, additional resources will be needed. Deltares will be talking to the government and other stakeholders about how to address this.

Deltares is fundamentally a Dutch institute. In order to further strengthen our leading position internationally, we need to be internationally active. Given the role that Deltares plays in the Dutch knowledge and innovation ecosystem, the focal point of our activities will continue to be in the Netherlands. As stated above, we are targeting international turnover of between 35 and 40%.

Spending on R&D in the Netherlands has been low from an international perspective for years, and particularly given the ambition to play a leading role in innovation. The same applies to the financial resources for applied research. In the case of Deltares, the national government funding compared with turnover is on the low side relative to other research institutes. We are therefore advocates, with our partners in the knowledge coalition, of more investment to strengthen innovation in the Netherlands further. The evaluation committee of the TO2 institutes also asked for a Matching Fund to be considered. The limited amount of available matching resources for participation in European programmes sometimes puts too much pressure on participation in European framework programmes. The partial compensation of the matching resources through a matching fund is therefore recommended.

In conclusion



This Strategic Agenda brings together many conversations, thoughts, discussions and decisions about the directions for development at Deltares. Many people inside and outside Deltares have made contributions. It is therefore also an important process for me. To reflect together about where we stand as an organisation and how we see the future and wish to serve.

Focus on the Future, Fast Forward Now is the title of this Strategic Agenda.

Focusing on the future is inherent to our domain of water management and the subsurface. Climate change will inevitably lead to long-term change. We need to describe the slow processes of land subsidence, sea level rise, changing river discharges and water quantity and quality in terms of their relevance for today's world. And take steps to ensure that we will move forward quickly *today* on steps to take that future into account. Fast forwarding the fight against climate change *and* fast forwarding the adaptation of our living environment.

Focusing on the future is needed for the digital developments that can bring us into a revolutionary different world. And although it is impossible to describe that world in every detail, we are convinced of the need to move ahead faster in terms of data management, software development and modelling. Focusing on the future is part of being aware of national and international developments in the world and the societies in which we operate. Global geopolitical and economic developments show the direction we need to take to accelerate the strengthening of our position in the Dutch knowledge and innovation system, starting today. And it takes us to new parts of the world where we are willing and able to contribute to sustainable, safe and healthy living with our unique knowledge.

Focusing on the future also requires adaptation. For example, we did not foresee a pandemic two years ago. We will therefore always follow this strategic course with an open mind and, if necessary, reconsider it in the annual elaboration of our annual plans.

Together, we make Deltares, the quality and resilience. We are working with you on Enabling Delta Life. With the ambition to deliver the best that we can.

As an agile organisation, to face the future alongside you.
Focus on the future. Fast forward now.

On behalf of the directors and staff of Deltares,

Annemieke Nijhof, general director



Abbreviations

- AI** Artificial Intelligence
- CSR** Corporate Social Responsibility
- ESFRI** European Strategy Forum on Research Infrastructures
- FMO** Entrepreneurial Development Bank
- GWI** Large-scale Scientific Infrastructure
- IHE** Institute for Water Education
- JIP** Joint Industry Project
- KNMI** Royal Netherlands Meteorological Institute
- ML** Machine Learning
- MTIB** Mission-driven Top Sectors and Innovation Policy
- NGO** Non-Governmental Organisation
- PAS** Dutch Programme for Tackling Nitrogen Pollution
- PBL** Netherlands Environmental Assessment Agency
- PPP** Public-Private Partnerships
- R&D** Research and Development
- RIVM** Dutch National Institute for Public Health and the Environment
- SDG** Sustainable Development Goal
- SITO** Subsidy arrangement for applied research institutes
- SME** Small and medium-sized enterprises
- TO2** Applied Research Organisations
- WRI** World Resources Institute
- WWF** World Wide Fund for Nature



Credits

Printing

Deltares, May 2021

Editing desk

Deltares communications department
afdeling-com@deltares.nl

Design and production

Deltares Visualisation Department

Translation

Pete Thomas

Photography

Deltares
Adobe Stock

* some photos were taken before the COVID period.

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