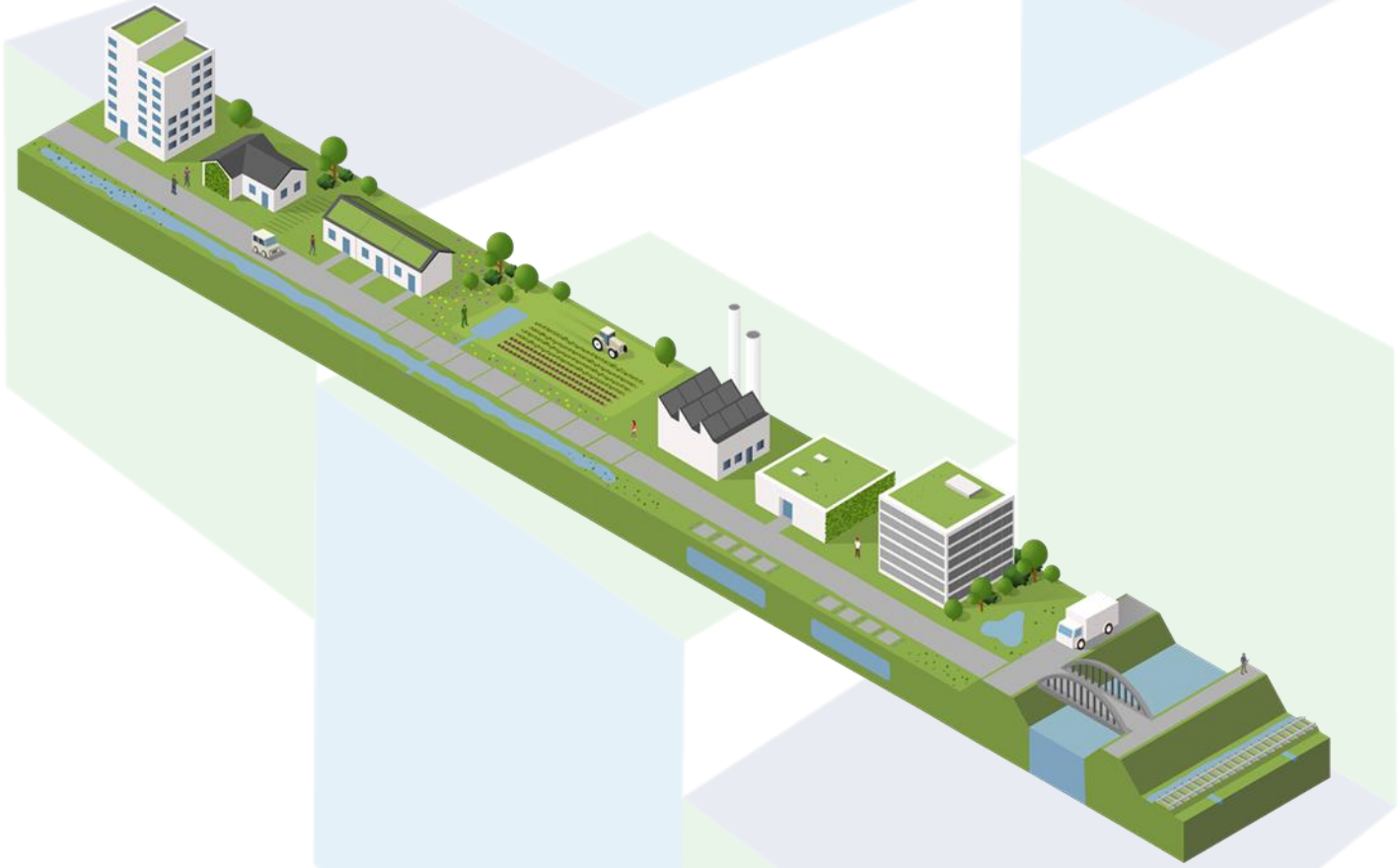
Sustainable Finance Platform



Accelerating climate adaptation

An alliance between the financial sector and government

Sustainable Finance Platform
Working Group on Climate Adaptation

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Sustainable Finance Platform

This report presents the findings of the Working Group on Climate Adaptation set up under the auspices of the Sustainable Finance Platform. The Working Group consists of representatives from ABN AMRO, Achmea, Agriver, Altera Vastgoed, Arcturus, a.s.r., Athora, AXA XL, Bouwinvest, BPF Bouw, Deloitte, ING, Ministry of the Interior and Kingdom Relations, Ministry of Infrastructure and Water Management, Ministry of Agriculture, Nature and Food Quality, Nationale Hypotheek Garantie, Nationale-Nederlanden, NWB Bank, Pensioenfonds Rail & OV, Philips Pension Fund, Rabobank, Samen Klimaatbestendig, Staf Deltacommissaris, Stimuleringsfonds Volkshuisvesting (SVn), Univé, Dutch Association of Insurers, Volksbank and is sponsored by Achmea.

The Sustainable Finance Platform is a partnership between De Nederlandsche Bank (chair), the Dutch Banking Association, Dutch Association of Insurers, Dutch Federation of Pension Funds, Dutch Fund and Asset Management Association, Invest-NL, Dutch Authority for the Financial Markets, Ministry of Finance, Ministry of Economic Affairs and Climate Policy and Sustainable Finance Lab. The members of the platform meet three times a year to forge cross-industry connections and examine together how they can prevent or remove barriers to sustainable financing and boost sustainability by collaborating in specific areas.

The Sustainable Finance Platform endorses the efforts of the Working Group. Nevertheless, the practices and recommendations described in this report are not binding for the individual financial institutions affiliated to the sectoral organisations that are members of the platform, nor is it mandatory for them to implement specific follow-up measures. The document also describes private-sector initiatives and as such contains no regulatory requirements or official government standpoints. The report is based on the knowledge in the possession of the Working Group at the time of writing and was completed on 7 November 2023.

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Name	Organisation	Role	Sub-working groups									
					Scenarios				Public-private partnership			
			Working Group	Author Group	Hotter	Drier	Wetter	Sea level	Built environment	Agriculture	Industry/Transport	Institutional investors
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Esther Egeter	a.s.r.	Chair Scenarios	✓	✓								
Bouke de Vries	Rabobank	Chair PPP	✓	✓								
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Lucas Besters	Achmea	Secretary	✓	✓								
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The list of participants is not exhaustive. We would like to thank everyone who was involved in compiling this report and in particular Remon Pot, Jaap Kwadijk and Kees van Ginkel of Deltares (knowledge institute for water and the subsurface), Peter Siegmund of the Royal Netherlands Meteorological Institute (KNMI) and Milou Wolters of the Directorate-General for Public Works and Water Management (RWS) for their observations on trends and analyses in earlier versions of the text and Anja de Jong for reviewing the text for legibility and consistency and for making a non technical summary for wider distribution.

SAMEN KLIMAAT BESTENDIG

Forewords by DNB and Achmea

Foreword by De Nederlandsche Bank (DNB)

The climate is changing more rapidly than predicted. The Netherlands is increasingly having to contend with extreme weather conditions: flooding caused by rivers bursting their banks or extreme precipitation, heat and drought as well as hail. We are all aware of this in our day-to-day lives. Quite apart from the personal suffering and inconvenience, the amount of financial loss for households, businesses and the financial sector is also growing.

It is therefore essential that we halt global warming. Yet at the same time we need to prepare the Netherlands for the consequences of a changing climate. Climate adaptation enables us to restrict our exposure and vulnerability to climate change and in turn reduce the cost of claims. Adaptation can also allow us to respond to opportunities - this might include climate-adaptive construction or climate-smart agriculture.

The Sustainable Finance Platform aims to promote the process of making the Netherlands more sustainable, from the role the financial sector can play in financing this process and making the Netherlands climate-proof. It is for this reason that I am so pleased with this report from the Working Group on Climate Adaptation. The report analyses both the impact of climate change on the financial sector (from the outside in) and the contribution the sector can make to climate adaptation (from the inside out).

After all, climate change can potentially have a huge impact on the financial sector. About a quarter of the balance sheets of Dutch financial institutions relate to real estate, meaning that institutions are exposed to physical climate risks: insurers of buildings are seeing their cost of claims rise, and lower property valuations in vulnerable areas will affect the banks that have granted the mortgages and institutional investors with real estate investments.

Accordingly, it makes sense for the financial sector to set to work on adaptation. For instance by contributing to awareness on climate adaptation among customers and developing solutions for financing adaptation measures and the insurability of climate risks. However, the financial sector cannot do this alone and for this reason it is positive that the Working Group has also examined what the government and industry can do in this respect. The report contains tangible tools for this collaboration.

This report was compiled thanks to the enormous efforts of a broad group of experts from the financial and public sectors. I would like to thank all those who were involved in the process and in particular initiating members Gijs Kloek (Achmea), Esther Egeter (a.s.r.), Bouke de Vries (Rabobank) and Anne-Marie Bor (Samen Klimaatbestendig) for this wonderful result. The Working Group on Climate Adaptation will continue to implement the recommendations and conduct pilot schemes for potential solutions. I look forward to the follow-up.

Olaf Sleijpen
Chair, Sustainable Finance Platform and Executive Board Member, De Nederlandsche Bank

Foreword by Achmea

Climate change affects the full spectrum of our society. In our role as financial sector we are closely intertwined with all aspects of society, which of course puts us in an excellent position to assume responsibility and contribute solutions. On the one hand by helping to reduce carbon emissions. On the other by working on modifications, i.e. climate adaptation.

This report provides insight into the effects of climate change and how we can respond to these via climate adaptation. The focus here is on the role of the financial sector. How can we – together with the government – stimulate climate adaptation?

Climate adaptation is an enormously important theme for Achmea. We are not only the biggest insurer in the Netherlands but also a major investor, a large mortgage provider and provider of sustainability services. Every day we work according to our 'Sustainable Living, together' vision on creating value for our customers, employees and society. This was a key reason for us taking the initiative to set up the Working Group that has written this report.

Climate adaptation will be more effective if government policy and financial services are properly aligned. Collaboration also enables us to reinforce the message to our customers and society, and promote adaptive measures via financial incentives and resources.

Thanks to the tremendous commitment of banks, insurers, pension funds, (semi-) governmental organisations, ministries, Staf Deltacommissaris, consultants and Samen Klimaatbestendig network, the topic has been investigated from multiple perspectives. This has yielded both interesting insights and tangible recommendations. For the financial sector itself, for the government and for industry. I look forward to us setting to work together on these recommendations!

Michiel Delfos
Member of the Executive Board, Achmea

Executive Summary

The need for climate adaptation

Climate change is affecting our planet. The Netherlands is becoming hotter, prolonged periods of drought and extreme rainfall are increasingly common and sea levels are rising. The effects of this range from material impact to operational challenges and vary according to sector. Controlling these effects will take a huge amount of effort and we are approaching the limits of how we currently manage water, soil and landscape in the Netherlands. Without decisive action, this could have major ecological, social and economic repercussions. We need to reduce greenhouse gas emissions (climate mitigation) and adapt to the consequences of climate change (climate adaptation). This report looks at climate adaptation.

It is crucial to implement measures collectively. This demands input from citizens, businesses, central and local government and financial institutions. As financiers, insurers and investors we take climate impact and the corresponding adaptation strategies and their consequences into account for the most relevant economic sectors that we finance and insure and in which we invest. We want to incorporate these consequences into our policy and stimulate climate resilience via our terms and conditions, products and services. In doing so we facilitate the transition to a climate-proof society.

From the Sustainable Finance Platform's Working Group on Climate Adaptation we know that increased knowledge exchange and more action are both required and possible. In publishing this report we aim to support this. The report focuses on the Netherlands, with the exception of the Caribbean region. Through the use of climate trends and adaptation scenarios, we examine the impact on our economy, specifically the domains or sectors of the built environment, agriculture, industry and transport, and identify the relevance for and of the financial sector in this respect. We also make recommendations for how, together with the economic sectors and government, we can improve society's resilience to the consequences of climate change.

Goal of this report

The goal is on the one hand to obtain insight into the impact of climate adaptation on the economy, local environment and financial sector and on the other to investigate how the financial sector, where applicable together with the government, can contribute to promoting informed and effective climate adaptation that makes a positive contribution to society. It is the result of a year-long investigation and collaboration between participating banks, insurers, pension funds, (real estate) investors, umbrella organisations and government ministries. The report is a prelude to further collaboration between financial institutions and in turn between financial institutions and central and local government and businesses. Samen Klimaatbestendig (Climate-proofing Together), a network of climate experts working on climate adaptation, supports the Working Group in this.

The report places the emphasis on both the consequences and opportunities of climate adaptation for the financial sector. It also focuses on the preconditions and opportunities for partnerships with the government, knowledge institutions and customers.

The report addresses several urgent topics but does not examine all the challenges relating to climate adaptation. On the one hand, it looks at those topics in which we believe the financial sector can contribute solutions. On the other, we list topics that financial institutions will incorporate into risk analyses due to their sizeable potential system impact. This report has been compiled based on discussions with experts from knowledge institutions, the government and via collaboration between the financial institutions themselves, complemented by a survey of the literature.

Conclusions

The Working Group has drawn the following conclusions:

1. Society and financial institutions cannot afford to wait

Analyses by organisations such as the Royal Netherlands Meteorological Institute (KNMI), Deltares (knowledge institute for water and the subsurface) and the Netherlands Environmental Assessment Agency (PBL), complemented by insights from the financial sector, show that climate change and adaptation strategies are already having a significant impact on major economic sectors and that even more impact can be expected in the future. Prolonged periods of drought are causing soil subsidence, which in turn is causing ground collapses in the built environment. On top of damage to industrial companies in the area, extreme rainfall can also lead to environmental risks. And in the absence of proper precautionary measures rising sea levels can cause flooding, resulting in widespread damage to ports. This can result in disruption to pipelines, for example, with a negative impact on the transport of goods and, of course, also on the environment. And agriculture is increasingly facing weather extremes, such as drought, heavy rainfall and salinisation. Although there are significant uncertainties and we cannot calculate the future impact precisely, it makes sense for both society and financial institutions to act now. After all, climate change is already having financial consequences, as can be seen from the Climate Damage Monitor kept by insurers. Damage and loss are expected to increase given the trends in extreme precipitation and likely trend in the risk of larger hailstones in the new *KNMI '23 climate scenarios*.

2. Climate adaptation brings opportunities

We can identify opportunities for economic sectors and for companies that prepare themselves for climate change to seek valuable solutions for climate adaptation. This might include climate-adaptive and sustainable construction or climate-smart agriculture that makes better use of water and soil. The role and position of financial institutions in the economic system means that they can facilitate this by offering financial solutions. This will sometimes also require adjustments to government policy and regulations, for instance the introduction of stimuli in the shape of price incentives. Another example is expanding the *Temporary mortgage scheme* aimed at climate mitigation to include climate adaptation.

3. The exchange of knowledge and data is essential

The major challenges presented by climate adaptation involve uncertainties about the future types of impact with varying time horizons and mutually interacting relationships, considerable information asymmetry, limited data density and the question of who takes the initiative. By information asymmetry we mean that one party possesses more information than another party, which can lead to moral hazard and adverse selection. We investigate this aspect in this report and note, for instance, that both effects can arise if there is no accurate information about the status of a house's foundations. In this case the sale price does not give the buyer accurate information, while in the meantime the vendor or another party may well possess this information or initial indications about this. It is important that knowledge on the potential types of climate change impact – and in this case also for foundations[1] – and what can be done about them is available to all. The example of (knowledge of the risk to) foundations that we investigate here can also be widened to include (knowledge on) other physical climate risks and the corresponding provision of information. However, we concentrate mostly on this example here.

4. Broader collaboration is required

Financial institutions, together with central and local government and public and multi-lateral banks (such as NWB Bank and the European Investment Bank), want to investigate how they can help their customers to take advantage of timely measures and reduce future charges deriving from climate change.

5. Climate adaptation can already be supported

Financial institutions have a variety of instruments at their disposal for supporting climate adaptation. Where information is available, banks can take into account physical risks when defining acceptance requirements and incorporate climate adaptation and risk premiums, or offer Sustainability Linked Loans/Bonds and related products. This naturally depends on the broader context and additional impact that such measures could have. For insurers, the focus is primarily on insuring and managing climate-related risks. Informing customers, setting conditions in acceptance criteria and creating incentives for prevention are important here. For investors, the investment policy and use of shareholder voting rights are key. Investors can engage with the companies in which they invest and vote in favour of effective adaptation policies and greater transparency. Moreover, investors can invest in companies and projects that make a positive contribution to climate adaptation. Real estate investors can mitigate climate risks for existing portfolios by implementing measures at building or area level and in the case of new build projects by only buying climate-adaptive properties.

In some cases the financial sector can act independently to stimulate climate adaptation, but first and foremost support or guidance from (central and local) government is required on the basis of a clear vision and unambiguous course of action. Good coordination of sectoral terms and conditions based on the above will create clarity for structuring and implementing policy.

[1] In most situations, climate change is not the primary cause of damage to foundations. Climate change nevertheless means that – without intervention – more homes will suffer damage, and that damage will also occur more quickly.

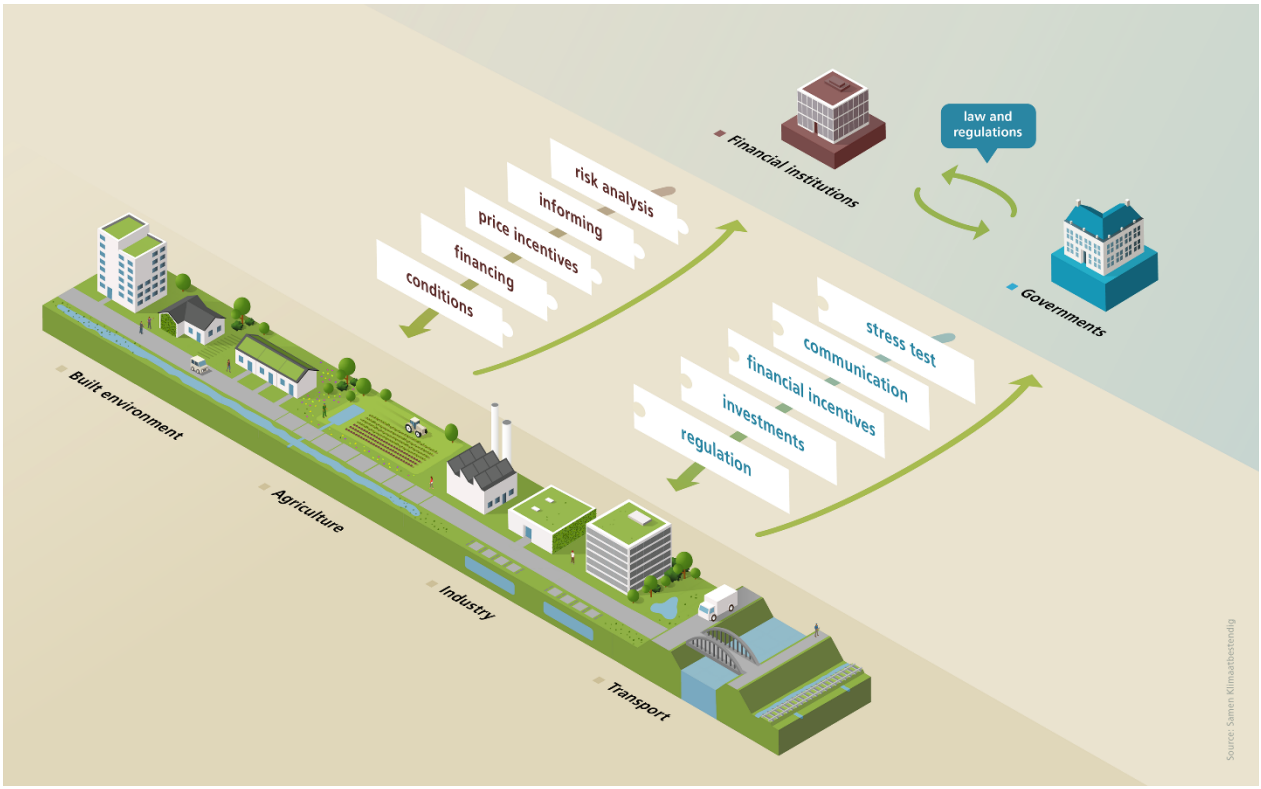


Figure 1: Opportunities for collaboration relating to the instruments that financial institutions and central and local government have at their disposal for each domain or sector. Based on: [Nederland klimaatbestendiger maken: Welke rol spelen financiële instellingen? (Climate-proofing the Netherlands: what role do financial institutions play?)](#) Samen Klimaatbestendig, 2021.

Recommendations

The Platform for Sustainable Finance's Working Group on Climate Adaptation operates on the basic principle that we collectively face the challenge of making our society more resilient to climate change and of finding solutions that can sharply reduce the impact. A great deal of work needs to be done with and by the financial sector. Below we list recommendations for the financial sector, government and industry. In light of the interdependencies and the fact that initiatives can enhance each other, we advocate all stakeholders tackling this together. The recommendations below are lines of reasoning and can be made more tangible in practice. It is up to financial institutions whether and how they subsequently implement these.

Recommendations for the financial sector:

1. Provide plenty of information.

The provision of information contributes to awareness of climate adaptation. For instance, banks and insurers can focus on the consequences and risks of climate change in sector reports or inform consumers via websites. Sectoral organisations can also inform their members about this, as can consumer organisations or associations such as Eigen Huis for homeowners. We give some examples of initiatives of this in the report. A great deal more effort will be needed in this respect in the coming years and we believe the government has an important role here.

2. Investigate expanding the number of climate adaptation-related products, services and initiatives.
Appendix 4 of this report lists some examples. This can provide valuable inspiration for (financial) institutions to continue developing their products and services. We call on each individual financial institution to examine further options for product development and activities. Competition legislation prohibits us from giving any tangible recommendations on the development and introduction of products and adjustments to product terms and conditions. Banks and funds can consult the *Regeling groenprojecten (Green Projects Scheme)* implemented by the Netherlands Enterprise Agency (RVO). Insurers can look at innovative adaptation, such as for existing buildings in areas outside the dikes other than the riverbed, such as the centre of Dordrecht or Kop van Zuid in Rotterdam. Banks and investors can develop financing solutions for repairing foundations. The gradual nature of foundation problems means that property & casualty insurance is not appropriate here and instead financing solutions are required. It is also important not to lose sight of other sustainability objectives. These might include social sustainability, as adaptation measures can be expensive and lower income groups often live in areas that are prone to heat stress, flooding or soil subsidence. There may be a role here for the National Mortgage Guarantee Scheme (NHG) and Stimuleringsfonds Volkshuisvesting (SVn, public housing fund) or Fonds Duurzaam Funderingsherstel (Sustainable foundation repair fund). This needs to be viewed within a broad context and often in conjunction with the government: who takes advantage of solutions, what is needed for these solutions to be effective and fair and who can play a role in this?

3. Start joint pilot schemes to develop and test financial solutions for adaptation and learn from any dilemmas that arise.
There are already examples of pilot schemes to restrict foundation problems in certain areas or to opt for nature-based solutions in areas that are prone to flooding. The Working Group wants to start more pilot schemes or sign up to existing schemes, with social adaptation solutions and corresponding (financing) options, to learn how financial institutions can apply these elsewhere in similar situations. Any parties that wish to join us in this are welcome to do so or at any rate apprise themselves of the outcome. These are also themes that can be addressed within the parameters of competition legislation for sectoral organisations in the financial sector.

4. Investigate as a sector and an individual institution the options for setting climate adaptation goals.
Financial institutions can play a facilitating role and support climate adaptation and potentially even accelerate it in certain respects. The recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) and parties such as the United Nations Environment Programme Finance Initiative (UNEP FI) may provide additional assistance here. Collaboration with the UNEP FI is based on a commitment to sustainable banking (Principles for Responsible Banking, PRB) and their counterparts for investors and insurers (Principles for Responsible Investment (PRI) and Principles for Sustainable Insurance (PSI)). The UNEP FI is working on guidance for banks that will be published at the end of this year. More information can be found on *the UNEP FI website*. Climate adaptation is aligned with the climate mitigation strategy that has already been initiated, as the *Paris Agreement* formulated goals for adaptation (article 7), and the financial sector can play a role in achieving these. The agreement describes the insurance sector's role in restricting damage (article 8) as well.

5. Investigate how to improve insight into the benefits of climate adaptation for individual parties.
Investments in climate adaptation can have positive secondary effects, such as on insurance liabilities or the value of real estate investments. After all, climate adaptation can reduce damage or loss caused by extreme weather or lead to lower medical expenses as a result of the effect on health. This integral approach is not yet frequently applied to portfolio management or asset liability management but could improve the risk/return assessment. The starting point for this type of assessment is clarification of the benefits of sizeable climate adaptation investments and how these work out for the individual stakeholders (including financiers). This will facilitate an informed debate on financing and make it clearer which projects will not get off the ground based purely on economic grounds.

Recommendation for the financial sector and the government:

1. Investigate in greater depth the options for a public-private compensation solution for customers behind primary flood defences.
Without the collaboration of the government it is not feasible for insurers to insure damage or loss caused by the failure of primary flood defences. In extreme scenarios, the claims are too high for the insurance and reinsurance markets to bear. However, insurers could process claims for flood damage caused by the failure of primary flood defences and bear a portion of the risk. To this end the Dutch Association of Insurers has already reviewed several scenarios and discussed these with various government ministries, which are now studying the proposals in more detail. The aim is to find a solution in which there is as much advance transparency as possible on which claims will be reimbursed. The safety net scheme that regulates the Disasters and Serious Accidents (Compensation) Act (Wts) will then need to be adjusted. One option is a new public-private insurance construction. The idea is that the public-private partnership could shorten the period of uncertainty and ensure that the damage is repaired more quickly. This will also safeguard investments and mortgage collateral and in doing so serve the broader public interest.

Recommendations for the government:

1. Ensure clarity on climate-adaptive (new) construction and reconstruction and where (not) to build. Indicate where there is space for agriculture and other economic functions in the Netherlands. Involve the design strengths of stakeholders in this spatial planning.
Guidance from the government is essential to avoiding any delay. The Working Group believes a good start has been made on this via the *Kamerbrief Water en bodem sturend (Letter to Parliament on water and soil in spatial planning)*, the *Nationale aanpak klimaatadaptatie gebouwde omgeving (National approach to climate adaptation in the built environment)* and the *Tussenresultaten Kennisprogramma Zeespiegelstijging (Interim results of the rising sea levels knowledge programme)*. It is important for local and regional authorities to translate this in turn into consistent policy. The Working Group proposes making the *Maatlat groene klimaatadaptieve gebouwde omgeving (Green climate-adaptive built environment benchmark)* mandatory (and enforcing this) and incorporating this into, for example, the Environmental Quality Decree (soon to be part of the Environment and Planning Act).

Making climate-adaptive construction mandatory would also help if the climate-adaptive repair of flood damage were to become part of the legislation on homes and business premises. When carrying out climate-adaptive repair of damage caused by extreme weather, there is greater clarity about what to expect in the repair process. Insurers would then be able to assume climate-adaptive repair in their products as well.
Moreover, the Working Group embraces involving the ideas and design strengths of the public and private sectors in the elaboration of the *National Adaptation Strategy (NAS)* and setting up a broad 'adaptation community'. There are multiple knowledge programmes at the moment and we believe it would be a good move to combine this knowledge. This is demonstrated by the *Rethink the Delta* initiative, a broad community of professionals who want to contribute to keeping the Delta region habitable for future generations. This likewise applies to the *KuiperCompagnons letter*, which with the support of other stakeholders, including those from the financial sector, calls on Minister De Jonge to combine knowledge of the future and design strengths.

2. Introduce a climate label with corresponding regulations for homes and buildings and make this label mandatory.
In doing so eradicate the information asymmetry on climate-related risks and increase awareness of the options for action in order to (partially) restrict the risks. The final recommendations of the *Beleidstafel wateroverlast en hoogwater (Flooding and high water consultation body)* note that it would be a good idea to explore the introduction of a water label for homes and buildings. The Working Group agrees with this but advocates expanding this into a climate label that includes other consequences of climate change, such as heat stress and damage to foundations. The *Dutch Authority for the Financial Markets (AFM)* recently argued in favour of this too. The climate label would then exist alongside the energy label and could have a similar impact. In addition, the government could include adaptation measures in the label and provide information on insurability in the information leaflet. It is important to provide clear and transparent information on risks to building foundations and other available home-related insights.

3. Ensure that the technical screening criteria for the EU Taxonomy for sustainable activities and related reports are workable in practice. Only then can investors, financial institutions and companies measure, steer according to and report on climate adaptation properly. Help with questions and answers and be understanding about the fact that it takes businesses time to comprehend and apply these requirements.
The Taxonomy is directly linked to reporting requirements on green investments for institutional investors and other financial institutions. The Taxonomy and other EU sustainability legislation, such as the Corporate Sustainability Reporting Directive (CSRD), provide a detailed framework for this. This framework has only recently been created. The reports of our customers will become available in the next few years. We therefore believe it is important to have adequate scope for structured feedback, and that adjustments can be made where necessary. We note that this already forms part of the EU approach but especially wish to underline the importance of this.

4. Wherever possible, unlock information on the government's adaptation policy and where to find specific climate data.
Policy on climate adaptation, water, soil, flood risks, rising sea levels and where to find data needs to be transparent. This can help businesses to make an accurate estimate of climate-related risks, what the government is doing about them and the costs and benefits of

implementing their own adaptation measures. Monitor the quality and reliability of data, such as the density of maps and stress tests.

Recommendations for industry:

1. Carry out sector and business analyses for climate impact, work together on adaptation and set to work on no-regret measures.
We call on businesses and sectoral organisations to analyse the vulnerabilities at sectoral, regional and company level as well as in the chains. Vulnerabilities might include buildings, inward and outward supply lines, personnel and reputation. We call not only for the investigation of risks but also for measures to be implemented and opportunities studied.

It is up to companies to identify the opportunities and risks for their own businesses, but in doing so they can collaborate with knowledge partners and the financial sector. Although everyone is still busy familiarising themselves with this material and there are very few oven-ready answers, the process starts with analyses and actions. This also ties in with the growing reporting obligations, increased legislation and expectations of stakeholders on what businesses can (or ought) to do in terms of sustainability.

Inventory the no-regret measures and make a start. No-regret measures can in themselves have a significant impact. These are measures that can be taken in the short term, are relatively easy to implement and almost certain to be effective, while they have no negative consequences on other measures. For this reason they are uncontroversial choices or no-regret choices. The Kennisportaal Klimaatadaptatie (Climate adaptation knowledge portal) has already published an *overview* of these.

2. Report on adaptation and align with EU legislation as this contains adaptation elements.
Reporting is already mandatory for large companies under the CSRD, for example. Smaller businesses will also increasingly receive questions on this, for instance from parties in the chain. At a later stage, smaller businesses (but not the smallest) will also come under the CSRD. Include in the reports any climate-related vulnerabilities that the company identifies for its own business or in the chain and examine the opportunities: on the potential contribution a company can make, in this case to adaptation. For instance, this might be by adjusting the company's business operations or making its business premises more climate-proof. Reporting obligations can also yield opportunities. As an example, businesses with in-depth knowledge of adaptation (and broader sustainability) in the maritime or agricultural sectors could sell their knowledge and technology in the Netherlands and abroad. The maritime sector could thereby contribute to tackling water-related problems worldwide. In addition, the Dutch agricultural and horticultural sectors could further develop and monetise climate-smart technologies. It is of course up to each individual company to decide what it does in this respect but, on top of the requirements set by the legislator, financial institutions will increasingly need to examine these aspects when assessing their sustainability performance and in risk analyses.

3. Invest in collecting insights and data.
For a company to obtain insight into its vulnerabilities, it is essential that it knows where to find climate data. A large amount of data is already available. Companies can use these data for analyses in their specific sector by linking the climate effect data to spatial planning. It is not just important to know how weather patterns are changing but also how the local area (water authorities, municipalities etc.) deals with this and how a company's premises and infrastructure are equipped to deal with the changes. Businesses can then use this information when making strategic decisions, investment and maintenance plans and in external reports. It is also important to form an idea of the impact of e.g. drought on the supply chain. Some data can be retrieved from public systems as companies and institutions report on sustainability performance, emissions, water consumption etc. to government bodies.

What next?

The journey to this report has already yielded a considerable amount of useful debate between industry peers, with the government and knowledge institutions. Despite this report being an important objective of the Working Group on Climate Adaptation, it is not an end goal. The Working Group will only be able to have a genuine impact through playing an important role in implementing the recommendations. For this reason, the Working Group on Climate Adaptation will play a coordinating role in setting up the above-mentioned pilot schemes.

1. Introduction

Climate change is expected to cause temperatures to rise, which will in turn lead to more extreme weather and rising sea levels. Periods of drought and extreme precipitation are already occurring more frequently than in the past and this trend is expected to continue. In Europe, extreme precipitation can lead to increased river discharge and when combined with rising sea levels to a higher risk of flooding.

The Dutch government has long implemented measures to keep risks manageable. Nevertheless, the climate is changing so rapidly that these adaptive measures will not be enough to restrict the consequences sufficiently for society and the economy. We need to move up a gear.

For the financial sector it is crucial to fully comprehend the resulting change to physical risks for society and the economy and in turn the consequences for the financial institutions themselves, as these will become visible in, for example, their cost of claims and investments. It is part of the role financial institutions play in society and in their interest to contribute to (further) climate adaptation.

This report is based on our current understanding of climate change and the impact on the economy, and in turn on the financial sector. It describes the estimated impact based on the information in our possession, such as that provided by the Royal Netherlands Meteorological Institute (KNMI), Deltares and the Netherlands Environmental Assessment Agency (PBL). We do not aim to achieve the same depth in this report but rather to provide an overview.

What is climate adaptation and why is it important?

The UN (UNFCCC) defines climate adaptation as adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects. It refers to changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change. Climate adaptation can range from building flood defences, setting up early-warning systems for extreme weather and switching to drought-resistant crops to redesigning communications systems, business operations and government policy.

Climate adaptation is important because the consequences of climate change are considerable and moreover could worsen enormously in coming years. Although the effects of climate change are expected to be significant in the Netherlands, the country’s climate resilience is greater than that of less developed countries. This is because the Netherlands has the resources and

knowledge to adapt to effects such as higher temperatures, drought, more extreme precipitation and flooding.

Nevertheless, when the impact of climate change increases significantly, the limit will also be reached here in terms of what can be absorbed via adaptation measures. The effects of this range from material impact to operational challenges and vary according to sector. Controlling these effects will take a huge amount of effort, and we are approaching the limits of how we currently manage water, soil and landscape in the Netherlands, for example as argued in the report *Op Waterbasis (Limits of the malleability of Dutch water and soil systems)*. In the long term, it is essential that carbon emissions are cut sufficiently to put a stop to further climate change. In the shorter term, however, more adaptation is already required to manage the impact. This affects the economy and therefore our customers, and in turn us as the financial sector that supports these customers via loans and insurance policies.

Problem definition

In this report we have defined the problem as follows:

> *What is the impact of climate adaptation on the economy, local environment and financial sector, and how can the financial sector, where applicable together with the government, contribute to promoting informed and effective climate adaptation that makes a positive contribution to society?*

The scope of the Working Group is confined to climate adaptation. Climate mitigation in principle falls outside the scope, but where we identify opportunities for climate-adaptive measures also contributing to climate mitigation, nature inclusivity and biodiversity we list these as well. The relationship with reports (incl. the TCFD, CSRD and EU Taxonomy) is named in some places but not worked out in detail. The report focuses on the Netherlands, with the exception of the Caribbean region.

Consequences are complex and not the same for everyone

An initial survey: the consequences of climate-adaptive measures are complex and will not affect each group equally. Climate adaptation aims to restrict the effects of climate change. In some cases though this can mean that the measure moderates the risk for a large group but is negative for a small group. Say that the foundations of some houses in an area are reinforced and others not. If land subsidence, which is exacerbated by drought, causes wooden piles to dry out, they will be prone to rot. This would argue in favour of a high groundwater level, but that would not be positive for those houses without reinforced foundations. The latter houses would flood more frequently or be damper.
Another example: if the Nieuwe Waterweg shipping canal were to be closed due to rising sea levels, this would be positive for water management in the province of South Holland but negative for the Port of Rotterdam Authority.

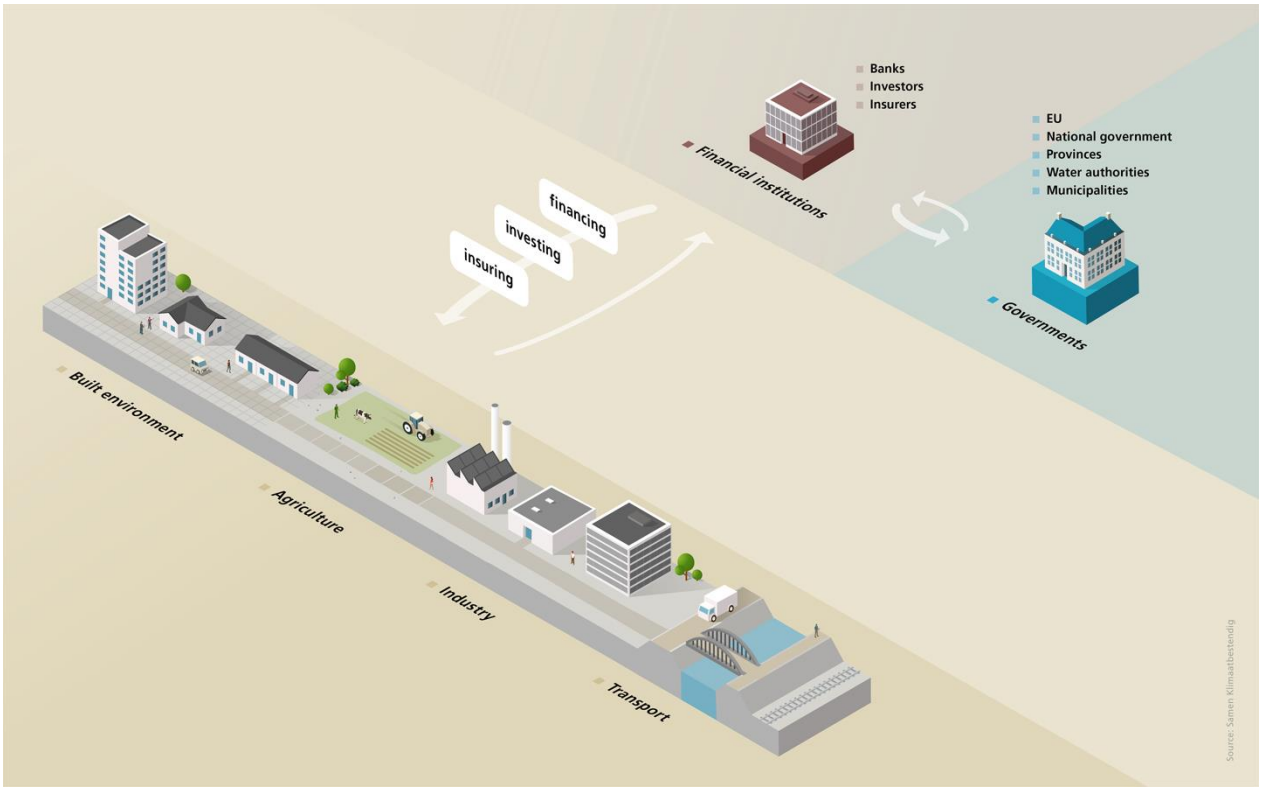


Figure 2: The products of financial institutions for their customers within domains and sectors, and the relationship with different central and local governments. Based on: [Nederland klimaatbestendiger maken: Welke rol spelen financiële instellingen? (Climate-proofing the Netherlands: what role do financial institutions play?)] Samen Klimaatbestendig, 2021.

These complex effects have direct and indirect consequences for society and the financial sector as risks are often insured and affect risk statistics. Yet even if the risks are not insured, there is a risk for the value of the collateral on a mortgage. Moreover, the consequences of climate change can also affect corporate profits and in doing so push down the value of loans or investments. This is relevant because lenders grant these loans in the form of mortgages. Pension funds and insurers invest in loans, mortgages, bonds, equities and real estate. In short, all these financial activities can be affected by climate change and climate adaptation. This is illustrated by way of a diagram in figures 2 and 3.

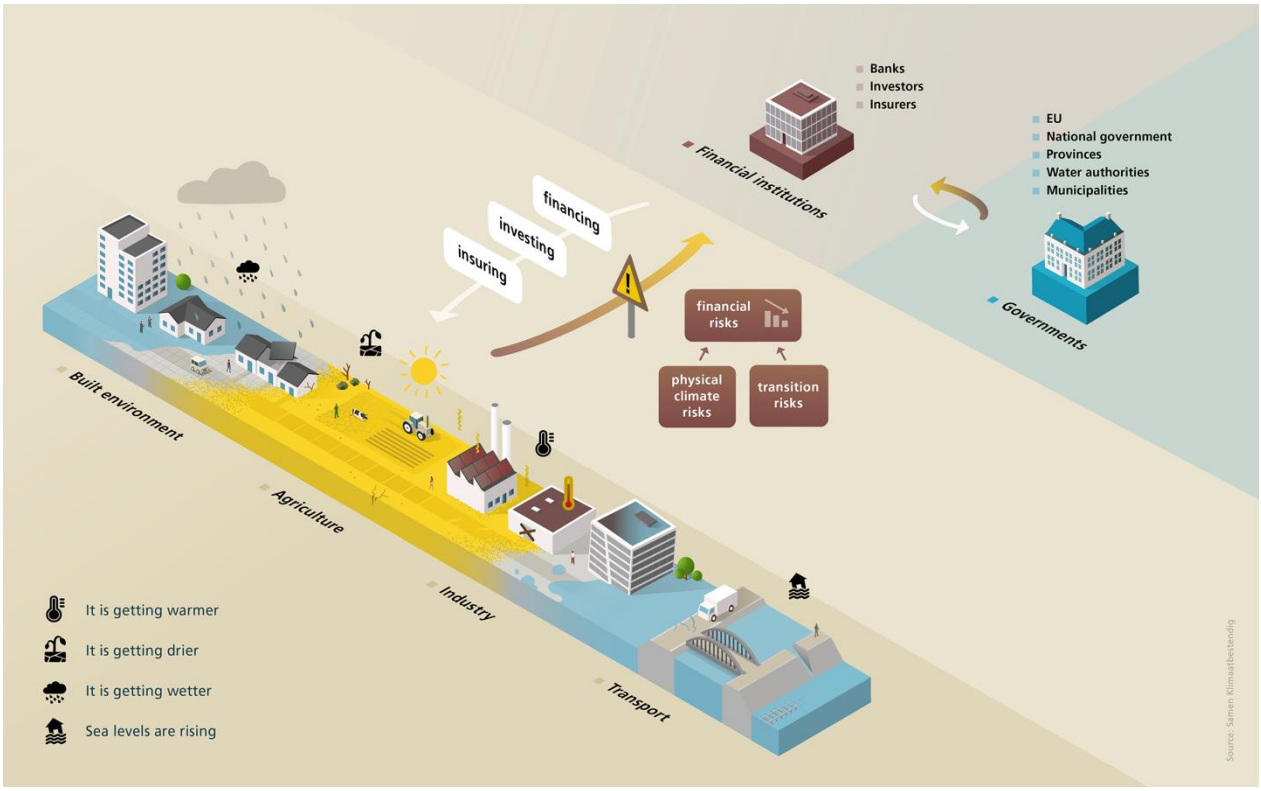


Figure 3: Risks of the consequences of climate change for the financial sector. Based on: Nederland klimaatbestendiger maken: Welke rol spelen financiële instellingen? (Climate-proofing the Netherlands: what role do financial institutions play?)

Incentives, risk-sharing, financial products: there are multiple angles

As mentioned above, it is important for the financial sector to contribute to climate adaptation. The financial sector's role in climate adaptation was in fact noted in the Paris Agreement too. Yet this requires further clarification. The financial sector can perhaps provide customers with more information via sector reports and, for instance, incorporate more incentives into financial products that encourage customers to implement specific measures and by doing so promote prevention as well. Insurance and other types of risk-sharing can help to further restrict the financial impact of climate change for customers (see also Appendix 4 for the individual instruments and examples of solutions provided by financial institutions).

Regulators such as the ECB, EIOPA and DNB have increasingly focused on climate adaptation in recent years. In annual reports, the EU Taxonomy is a new standard for sustainable investments in economic activities with climate adaptation as one of the environmental goals. Once the future charges of climate change are priced more accurately, whether or not via requirements set by these regulators, the financing of climate adaptation will become relatively more beneficial. It should then be possible to finance funds and bonds with a substantial contribution to climate adaptation at a lower rate on the international market compared to similar bonds without this type of contribution. Financial institutions and network organisations can work together with regulators on this. Climate adaptation can be stimulated via multilateral banks too, as is already the case via the social impact loans issued by the European Investment Bank (EIB).

Climate adaptation can lead to the creation of more financial products that do not yet exist, such as loans or insurance policies containing greater incentives to implement climate-adaptive measures. And some problems do not even have a solution yet. In these cases, the financial sector and government can investigate with the aid of a public-private partnership whether a financial solution can be developed. Figure 4 shows the relationship between the individual instruments for sectors/customer groups, from the financial sector and from the government.

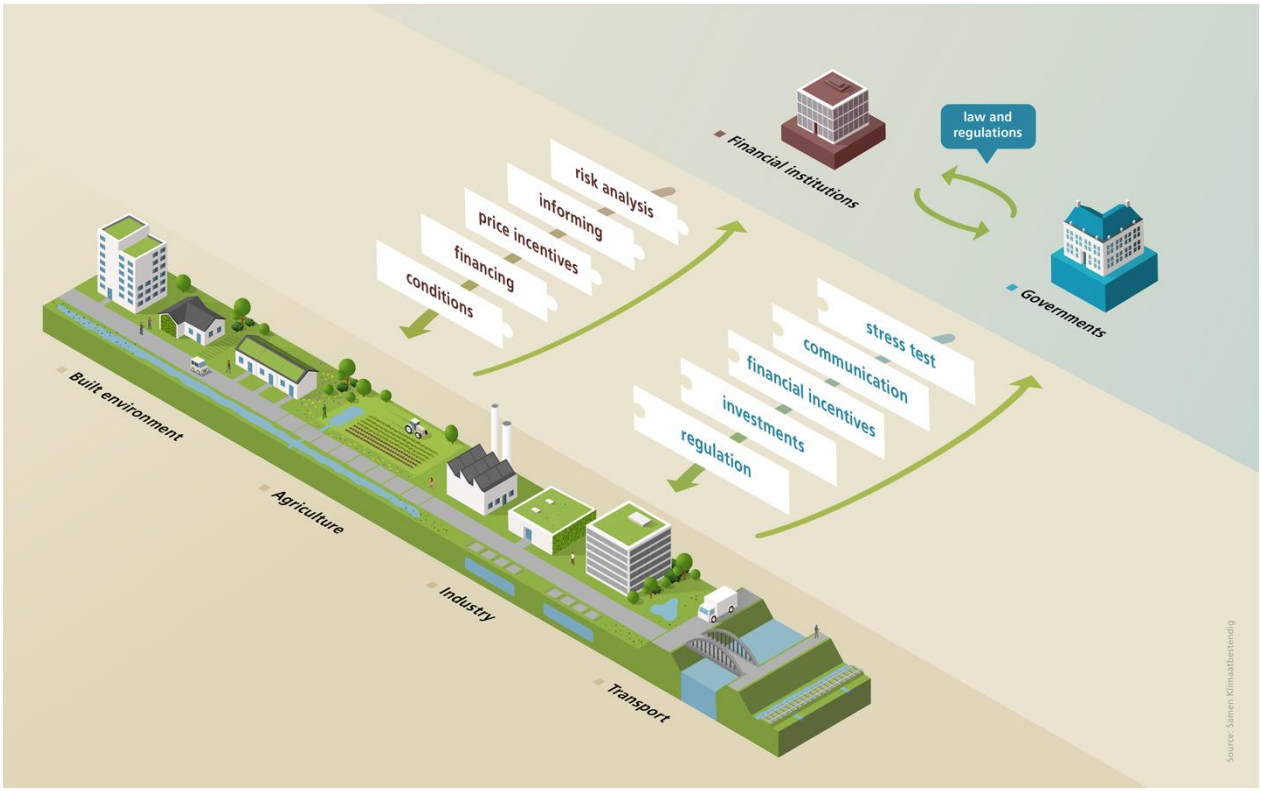


Figure 4: Opportunities for collaboration relating to the instruments that financial institutions and central and local governments have at their disposal for each domain or sector. Based on: Nederland klimaatbestendiger maken: Welke rol spelen financiële instellingen? (Climate-proofing the Netherlands: what role do financial institutions play?)

Structure of the document

The report comprises two parts. We start with the 'outside in' perspective in section 2. Here we discuss climate trends, the adaptation scenarios/strategies that have been published, consequences for society and the economy and the relevance of and for the financial sector. The second perspective is 'from the inside out'. In section 3 we describe the solutions that are possible or could be studied for the problems named in section 2. We end the report with a closing message in section 4. The appendices contain a glossary of terms, list of references, analysis of the impact of trends in climate change on the economy and an overview of examples of products and services associated with climate adaptation.

Other reports on climate adaptation for the financial sector

Parallel to writing this report, a report was also compiled by the Deloitte Impact Foundation (Deloitte). The Deloitte report looks at climate adaptation and the role of the financial sector as well. There is a difference in scope, however. Two cases are worked out in the Deloitte report: Limburg and Rotterdam. The Deloitte report makes recommendations to the financial sector and the government. This report by the Working Group on Climate Adaptation has a broader scope and was written by employees at financial institutions in collaboration with government employees. The Working Group on Climate Adaptation's report was also discussed within the financial institutions. During the compilation of both reports, frequent consultations took place between the two groups of authors. The Working Group on Climate Adaptation was represented in the Deloitte advisory group and authors from Deloitte are members of the Working Group on Climate Adaptation.

In addition, the chief economists of ABN AMRO, ING and Rabobank are writing a report on the changes in the residential property market in which climate adaptation is likewise an important theme.

Guide to reading the report

This report is aimed at a variety of target audiences. On the one hand at the financial institutions themselves to improve insight into the effects of climate change and climate adaptation on the risks to the institutions themselves, as well as to better understand how the institutions can contribute. On the other the report is also directed at the government, industry and interested residents of the Netherlands to understand how financial institutions can contribute to climate adaptation.

Readers with prior knowledge of climate change can skip section 2.1. Depending on their individual interests, in section 3 readers can select: flood risk to the built environment (3.2), land subsidence for the built environment (3.3), agriculture (3.4), industry (3.5) or transport (3.6). The appendices contain a glossary of terms (Appendix 1), list of references (Appendix 2), an overview containing the impacts per trend (Appendix 3) and examples of existing products associated with climate adaptation (Appendix 4).

2. From the outside in

From the 'outside in' perspective, the Working Group inventoried the main current and expected climate trends and current and potential future adaptation strategies. Next, the Working Group investigated the (potential) effect of each climate trend, including the relevant adaptation scenarios, on important economic sectors and the consequences for the financial sector as a facilitator of the economy.

2.1 Trends

The KNMI distinguishes four climate change-related trends in its report on climate scenarios published in 2014 (KNMI'14 climate scenarios):

- It is becoming hotter;
- It is becoming drier;
- It is becoming wetter;
- Sea levels are rising.

The KNMI recently published the KNMI'23 climate scenarios. These are based on the scientific insights in the 2021 IPCC report, which in turn builds on the previous IPCC report that formed the basis for the KNMI'14 climate scenarios. The KNMI'23 climate scenarios are based on the most up-to-date and detailed climate models and data. The main changes in the KNMI'23 climate scenarios versus the scenarios from 2014 are:

- For the first time there are also climate scenarios for the islands in the Dutch Caribbean, the special municipalities of Bonaire, St Eustatius and Saba;
- Direct link from the KNMI'23 climate scenarios to carbon emissions and in turn to climate policy;
- Improved underpinning of extreme sea levels and extreme precipitation.

The long-term projections are higher in the KNMI'23 climate scenarios than the KNMI'14 climate scenarios for the following variables:

- Heat;
- Drought;
- Heavy rainfall;
- Sea levels.

The climate has already undergone a transformation and this is visible in the higher extremes in heat, drought and precipitation. The so-called climate attribution demonstrates that there is a higher probability of extreme weather as a result of climate change caused by humans.

The four climate trends are described in more detail in the following sections. By trends in this context we mean what we have so far observed as well as what we predict for the future. The consequences of these climate trends for the economy and financial sector respectively are dealt with in sections 2.5 and 2.6.

It is becoming hotter

Average global temperatures are rising as a result of climate change. The rise in temperatures varies from region to region. According to the KNMI'23 climate scenarios, average temperatures in the Netherlands have already risen by more than two degrees since the beginning of last century. Nature is changing as a result of this increase in temperature: some plants and animals are disappearing from our country as they cannot withstand the heat. Others are in fact now appearing in our country, although this is not always positive for biodiversity as they can supplant existing varieties.

Heatwaves are increasing across the whole of Europe. The intensified summertime warming of land regions in the far north may play a role in the higher risk of prolonged heatwaves. A double jet stream is occurring more frequently as a result of this, with a second jet stream at around 70°N in addition to the usual jet stream at around 40°N. Between these jet streams, at around the latitude of the Netherlands, a high pressure area often arises that brings with it hot and sunny weather. Heatwaves are especially expected to increase in terms of frequency and temperature in the Netherlands.

Effect of clean air on solar radiation

In addition to the effect of climate change caused by greenhouse gases, the effect of cleaner air plays a significant role in the heat we are experiencing in Europe.

The huge decrease in sulphur oxides (aerosols) in the atmosphere is leading to an enormous increase in the amount of solar radiation that can reach the earth's surface. In other words, the actual warming of the planet was slowed by aerosols in the past.

The decrease in air pollution may partially explain why Europe is warming up relatively quickly compared to other regions of the globe and why the evaporation and melting of glaciers is occurring at a faster rate in Europe than elsewhere in the world. Furthermore, solar radiation has increased in Europe this century due to the more frequent occurrence of high pressure areas, which contain little cloud and therefore a large amount of sunshine.

Trend in hotter

Since the 1990s a trend has been visible in solar radiation of 3 percent growth per ten years in the summer, while in the spring it is as high as 5 percent. It is not yet clear how long this trend will continue and how big the effect could be in the event of even lower levels of sulphur oxides in the atmosphere. The KNMI'23 climate scenarios contain new projections on this effect and the expectation is that this trend will decrease because the past few years have been above-averagely sunny.

It is becoming drier

Drought is a period when less water is available than normal. A water shortage arises when the water supply (via precipitation or rivers) is low and large-scale evaporation takes place.

In the Netherlands, we are increasingly experiencing consecutive periods of drought, and the amount of annual evaporation is also growing. The important thing is when the drought occurs. A water shortage arises every year in the summer. The maximum water shortage is increasing.

Drought and desiccation

There is a difference between drought and desiccation. Drought refers to an exceptional (prolonged) dry situation that deviates from the normal situation. This drought is often temporary. In contrast, desiccation is not temporary. In the case of desiccation there is insufficient good-quality groundwater to maintain nature. This is often the result of multi-year drainage that causes groundwater levels to fall (*Droogte - Klimaatadaptatie (Drought - Climate adaptation)*).

Regional differences

The problems that arise due to drought vary greatly from region to region. Sources of water differ according to region (e.g. elevated sandy ground is fully dependent on rainwater, while river water is the source in the river area/delta and the distribution of water can be managed using barrages and dams). The consequences of drought can vary as well, such as salinisation in the IJsselmeer or excessively low water levels in rivers and canals. How drought is tackled therefore depends greatly on local inventory and initiatives.

Trend in drier

Rising temperatures and precipitation deficits combined with a decrease in water supply via waterways are leading to an increase in drought and desiccation. How desiccation will evolve in future will depend on the progress of climate change over the next few years. The KNMI has sketched four potential scenarios, and desiccation will increase in each scenario. In the worst scenario, the potential maximum precipitation deficit (once per ten years) is 30 percent higher in around 2050. A similar picture can be observed for the reference evaporation, which also increases sharply.

It is becoming wetter

It is wetter in the Netherlands than it used to be. This is especially true of winters and summers. The main reason for this: extreme precipitation is increasingly common and getting heavier.

In the KNMI scenarios, precipitation is increasing in all seasons except summer. The intensity of the precipitation is increasing in summer. As the air can absorb more moisture in a hotter climate, more extreme precipitation is occurring more frequently.

Extreme precipitation

The KNMI notes that the increase in temperature and moisture will in future lead to heavy rain more frequently evolving into more complex precipitation. This is rain with thunderstorms, hail and gusts of wind. The heaviest rain is expected to intensify most.

Storms, hail, thunderstorms and snow

The KNMI does not expect winter storms to increase. As more and higher buildings are being constructed in the Netherlands, the wind will in fact decrease somewhat. Summer storms (such as downbursts) are expected to increase, however. More downbursts could also arise around the heaviest rain. A downburst occurs when a large amount of cold air drops downwards from an intensive raincloud. This can have major local effects, such as in *Leersum in 2021*.

It is difficult to predict the increase in hail. A lack of measurements and research means there is little certainty about the predictions for hail and thunderstorms. The KNMI and Vrije Universiteit Amsterdam recently studied the spatial distribution of hail using radar images. Hail occurs throughout the Netherlands, but the highest concentration can be found in the provinces of Gelderland, North Brabant and Limburg. The KNMI expects more frequent and more extreme hail as a result of the increase in temperature and moisture. Hailstones remain in the air for longer, which makes them bigger. More evaporation leads to more condensation heat. This will cause more frequent hail and thunderstorms, with larger hailstones.

Trend in wetter

The increase in temperature and moisture will mostly lead to an increase in extreme precipitation. The extent to which extreme precipitation increases varies according to the climate scenario.

The expectation is that relative humidity will decrease in the summer, which will generate fewer (light) showers but more evaporation. This increase in evaporation will reinforce cold downbursts and rain that can evolve into heavy thunderstorms more quickly and be accompanied by hail. Future maximum hourly precipitation will rise each year. In around 2050, the increase is expected to be 4-11%, with this potentially reaching 4-31% in around 2100.

Sea levels are rising

Sea levels are rising. This is not a new phenomenon; sea levels have been rising since the last ice age, about 18,000 years ago. In recent centuries, this has been occurring at a rate of about 2 mm a year. In the last few decades, however, this has accelerated to a rate of about 4 mm a year. Compared to several centuries ago, there is now also much more to protect in terms of human lives, biodiversity in a general sense and also capital.

The rise in sea levels is caused by a combination of ocean warming (warmer water expands and occupies more space) and melting land ice. The accelerated increase of the past few decades is mainly the result of ocean expansion, accelerated melting of land ice (in Antarctica and Greenland) and melting mountain glaciers, all caused by global warming. Sea levels are not rising

at the same rate everywhere: wind patterns and the gravitational pull of large ocean ice masses (gravitational effect) can also play a role in some regions.

The effect of rising sea levels can be exacerbated (or weakened) by the subsidence (or ground heave) of the adjacent land. In the northwest Netherlands, geological movements and the compaction of clay and peat have led to land subsidence of an average of 10 cm per century. In some places, especially in peaty areas, the ground can drop by as much as 2 cm a year, however. The scenarios for rising sea levels in this document present the net rise in sea levels, i.e. including land subsidence.

Rising sea levels in the Netherlands

The *KNMI* indicates that climate scenarios for the Netherlands will mean higher sea levels and extra protection measures will therefore be required.

Moreover, saltwater intrusion in groundwater and surface water is increasing (salinisation) and the sandbanks, mudflats and salt marshes in e.g. the Waddenzee, Westerschelde and Oosterschelde could be submerged. Beach replenishment can be used to keep rising sea levels at bay for many years to come, although it may prove necessary to seek other measures in future.

As sea levels rise and the land subsides further, it will also be more difficult to discharge surplus water by means of gravity drainage into the sea and pumps will therefore be required.

Projections for rising sea levels: many uncertainties, especially after 2050

The rate at which sea levels will rise is still very uncertain. Up to 2050 the scenarios are fairly similar, but after this date they diverge considerably. The distant future scenarios for rising sea levels are certainly gloomier than before: based on the highest scenario for greenhouse gas emissions, sea levels on the coast of the Netherlands could rise by 1.2 metres in about 2100 compared to the start of this century. In the *KNMI'14 climate scenarios* this was still 1 metre. In the low emissions scenario, sea levels off the Dutch coast could rise by 26 to 73 centimetres in around 2100 compared to the start of this century.

The KNMI has also estimated uncertain processes: if parts of the Antarctic icecap become unstable, sea levels could rise by as much as 2.5 metres in 2100. Following the disappearance of floating ice sheets around Antarctica, existing ice cliffs could collapse under their own weight. This could accelerate the erosion to extreme levels, but this theory remains controversial. If it is correct though, we would first be able to observe this phenomenon in twenty to thirty years' time in the Thwaites Glacier, which is currently receding fast and empties into the Amundsen Sea.

Trend in rising sea levels

The trend is unambiguous: sea levels are rising. How much sea levels will rise in the distant future is still uncertain, however, and varies enormously according to the emissions scenario. In the worst scenario the rise is about 17 metres. This scenario also includes processes that we cannot yet quantify accurately. However, in the low emissions scenario (SSP1-2.6), which is consistent with the maximum 2°C target from the Paris Agreement, according to the KNMI the rise in sea levels could be restricted to 0.5-2 metres in around 2300.

2.2 Current policy on climate adaptation

To prepare the Netherlands for the consequences of climate change, the government has for some time now been developing policy and programmes containing adaptation strategies with the aim of reducing the negative impact of climate change.

In addition, central and local governments are developing a mix of policy instruments, such as campaigns and water coaches for residents (information), subsidies and tax incentives for farmers (financial incentives) and mandatory separation of rainwater from sewerage for businesses (regulation) in order to promote adaptation to climate change.

Below we give an overview of the main climate adaptation policies and programmes being implemented at the moment. This overview is also important to being able to identify the correlation between the individual programmes.

Figure 5: Correlation between policy programmes.
Source: The National Water Programme 2022-2027 - Water Helpdesk. Includes recent policy developments.

In describing the individual climate adaptation programmes below, the Working Group has focused on the most relevant parts of the programmes for this report.

Delta Programme

The government protects the Netherlands, now and in the future, against flooding and ensures a plentiful supply of freshwater. On top of this, the government is working on climate-proof and water-robust planning for our country. The national Delta Programme describes how the government is doing this.

The State, provinces, municipalities, water authorities, Directorate-General for Public Works and Water Management (RWS) and a variety of social organisations are working together to create and implement the Delta Programme under the direction of the Delta Commissioner (Deltacommissaris). The Delta Commissioner is the independent governmental commissioner for the Delta Programme. The programme is fundamentally a programme up to 2050.

Together with knowledge institutes, businesses and social organisations, the government is working on the long-term quality of life in our delta, with three central themes:

- New water management standards have applied since 2017. The combination of the risk of a failure of the flood defences and the scale of the repercussions define the height of the norm for dikes, which are defined in the Water Act. Flood defences are being assessed and upgraded where necessary so that all flood defences will comply with these new standards as of 2050;
- The availability of freshwater for agriculture, industry and nature is becoming more transparent. The resilience of the Netherlands to a shortage of freshwater is being improved;
- Spatial adaptation is being used to make the spatial planning of the Netherlands more climate-proof and water-robust.

The approach comprises several components:

- Delta decisions: these are national frameworks that apply to the whole of the Netherlands;
- Delta plans: these contain tangible measures for implementing policy and planning for these measures;
- An annual Delta Programme report: this describes progress on developing and implementing the Delta decisions, preferred strategies and Delta plans. Proposals for any adjustments to the Delta decisions and preferred strategies are also included in the annual Delta Programme published on Budget Day;
- Delta fund: one of the financial foundations of the Delta Programme that provides resources for protecting the Netherlands in the future against flooding and ensuring a plentiful supply of freshwater. The Minister of Infrastructure and Water Management manages the fund. Other central and local governments contribute financially and provide capacity to the Delta Programme.

Flood Protection Programme (HWBP)

The Flood Protection Programme (HWBP) is an alliance between the water authorities and Directorate-General for Public Works and Water Management (RWS) and is the biggest implementation programme of the Delta Plan for Flood Risk Management. This programme faces an enormous task: the biggest dike upgrading operation since the Delta works. To prevent flooding in the Netherlands, over the next 30 years 1,500 kilometres of dikes and 400 locks and pumping stations will be upgraded so that they meet the latest water management standards. The HWBP directors schedule and support the projects that come under the programme.

National Adaptation Strategy (NAS)

In 2016, the central government set out its path for making the Netherlands climate-proof: the *National Adaptation Strategy* (NAS) demonstrates how the Netherlands is adapting to reduce the negative effects of climate change or at least keep them manageable. In 2018, the NAS published its implementation programme aimed at placing major climate risks on the agenda and addressing them.

The Delta Programme contributes to achieving the goals of the NAS for the topics of water management, availability of freshwater and spatial adaptation. Programmes have also been initiated in recent years for climate adaptation in nature, agriculture and the built environment that contribute to achieving the NAS goals.

Climate adaptation dialogue has also been started under the NAS for the spearheads of insurability, the built environment, agriculture and nature, heat and health. The dialogue on insurability has so far led to climate adaptation becoming part of the supervision of insurers by De Nederlandsche Bank.

The NAS was evaluated in 2021-2022. More information on this can be found in the government response to the *WRR-rapport over klimaatrechtvaardigheid (Scientific Council for Government Policy report on climate justice)* and the Letter to Parliament on the evaluation of the NAS.

In November 2023, the new National Climate Adaptation Implementation Programme (NUP KA) was published in response to the evaluation of the NAS. The NUP KA aims to help accelerate implementation of the NAS via actions for the four climate themes within all the relevant policy areas. It also provides an overview of the main climate adaptation actions planned for the coming years and identifies the extra steps required to accelerate implementation of the NAS.

Water and soil in spatial planning

At the end of 2022, the Dutch cabinet decided to incorporate water and soil into its decisions on spatial planning in the Netherlands, and this generates a variety of structural options. Many of these options are preconditions that provinces can use to draw up an area-specific approach together with all the stakeholders. This involves customisation as there are huge differences between the individual areas.

Some extracts from the *'Water and soil in spatial planning' report*:

- Freshwater supplies are important at times of drought, as is the option of storing water in our 'national water tank' formed by the IJsselmeer and Markermeer;
- Take care when building in areas that will later be needed for storing and discharging water, such as the lowest parts of deep polders and the floodplains of rivers;
- Agreement is required on reducing ground cover, for example by using less paving in cities. Less ground cover means healthier ground, cooling on hot days and less flooding;
- In some areas the aim is to have a higher groundwater level. The rate at which this goal can be achieved is being examined per region. A higher groundwater level will ensure sufficient water when it does not rain for a time, slows the subsidence of peaty ground and reduces

greenhouse gas emissions. This is achieved by adjustments to water management but also by inventorying all water extraction.
- We need to be more sparing in our use of water. The aim of the Dutch cabinet is for businesses and residents to consume 20 percent less drinking water. Furthermore, it is important to preserve water quality, for example by limiting the discharge of cooling water.

National approach to climate adaptation in the built environment

In the *Nationale aanpak klimaatadaptatie gebouwde omgeving (National approach to climate adaptation in the built environment)*, the central government describes its ambitions, activities and alliances for climate adaptation and the built environment. This lays the foundations for working towards a climate-proof built environment more quickly.

In the first phase (2022 up to and including 2024), the central government formulates its ambitions for the path to green, climate-proof cities and villages, lists the actions being taken to this end and how central government wants to collaborate on these with local and regional authorities and stakeholders.

The central government's input for this first phase is divided into four lines of action: 1) working on a more binding approach; 2) including climate adaptation as standard in other assignments; 3) continuing to support regional and local implementation practices; 4) preparing phase 2 with local and regional authorities.

Then there is a *Nationale Aanpak Funderingsproblematiek (National approach to foundation problems)* with support and knowledge for central and local governments, corporations and professionals in the housing sector. Research and innovation relating to prevention, identification and repair of foundation problems form part of this approach.

Green climate-adaptive built environment benchmark

In the context of the National approach to climate adaptation in the built environment, the Ministry of the Interior and Kingdom Relations, Ministry of Infrastructure and Water Management and Ministry of Agriculture, Nature and Food Quality developed the *Maatlat groene klimaatadaptieve gebouwde omgeving (Green climate-adaptive built environment benchmark)* in 2023.

To prepare the Netherlands for climate change, green and climate-adaptive construction and planning must be included as standard in new-build projects. The national benchmark clearly defines for new builds what we mean by climate-adaptive construction and planning. This benchmark clarifies for local and regional authorities, real estate owners and the construction sector what is needed for climate-proof new-build developments.

The instrument describes the goals and performance criteria and provides guidelines for the themes of flooding, drought, heat, biodiversity, land subsidence and restricting the consequences of flooding. The benchmark does not prescribe specific measures. This provides capacity for customisation at local level and plenty of room for innovative and smart solutions. Municipalities can apply (parts of) the benchmark on the allocation of land, tenders and on subsequently granting permission for new-build projects.

Figure 6: Graphic depiction of the Green climate-adaptive built environment benchmark.

Agriculture climate adaptation action programme

On the part of the government, the Ministry of Agriculture, Nature and Food Quality has applied the *Actieprogramma klimaatadaptatie landbouw (Agriculture climate adaptation action programme*, AP KAL) since 2020. This programme was developed in collaboration with the Ministry of Infrastructure and Water Management, the Netherlands Agricultural and Horticultural Association (LTO), Association of Water Boards (UvW), Association of Provincial Authorities (IPO), Association of Netherlands Municipalities (VNG) and Dutch Association of Insurers (VvV), and has now been in progress for nearly four years. The main goal of this programme is for agricultural and horticultural businesses to be prepared for climate change in 2030 and be able to deal with this sustainably and effectively. The action programme describes how the agricultural sector can do this together with other parties and what is needed in terms of policy and measures. Climate adaptation in agriculture forms part of the National Adaptation Strategy (NAS). The action programme lists what is already being done in national programmes, what else is required within these programmes as well as additional stimuli.

The Agriculture climate adaptation action programme describes five pillars: the water system, soil system, crops and cultivation systems, livestock and supporting instruments. Below we describe the essence of the programme for each pillar and give our *response and supplementary observations in italics.*

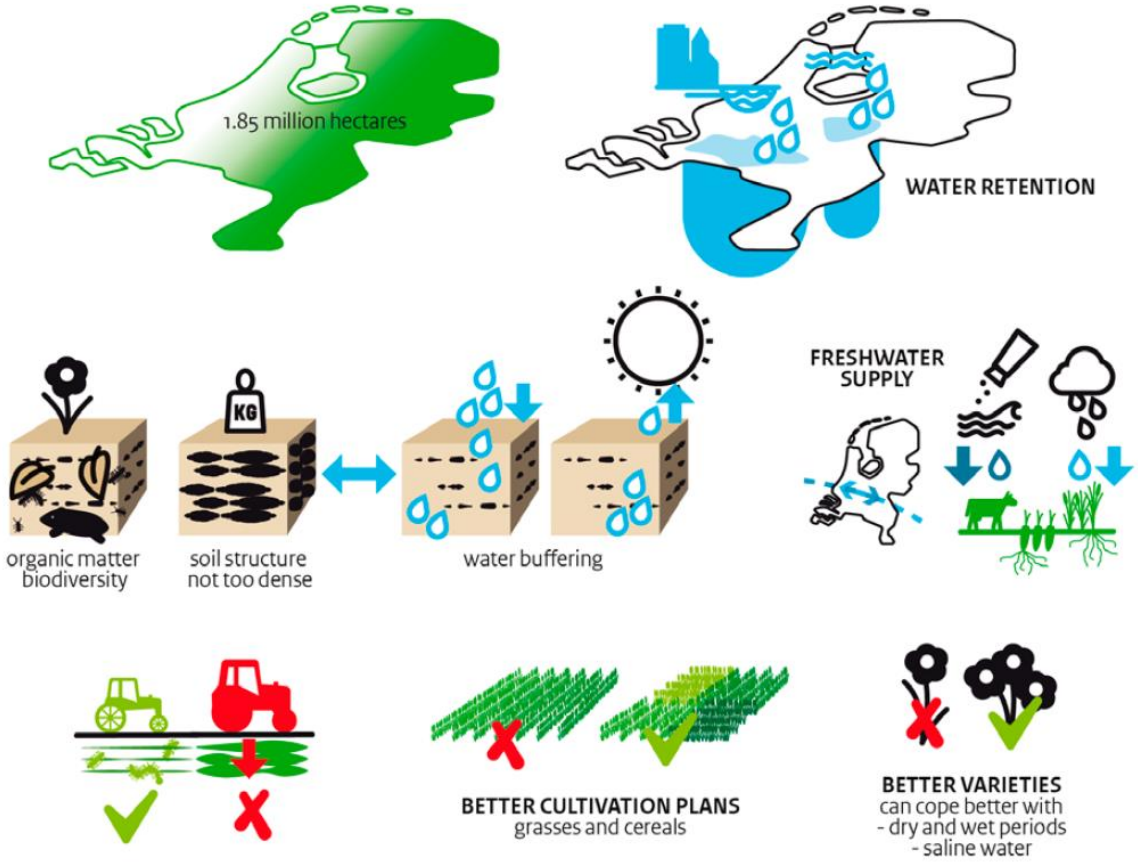


Figure 7: Graphic depiction of the Agriculture climate adaptation action programme.

(1) Water system - An efficient water system helps farmers at times of drought or flooding. Water authorities, environmental managers and farmers can together regulate how to retain water better in nature areas and on farmland. As a result, crops will be less affected by drought when it fails to rain for a prolonged period. The water system pillar contains actions for boosting national, regional and local collaboration on drought, flooding, water quality and salinisation.

(2) Soil system - It is precisely when the climate is changing that the soil must be able to absorb and retain water and nutrients properly. This *sponge function* is important to farmers because good-quality soil enables crops to continue growing well. For instance, it helps if a farmer ploughs less *(deeply) or works the soil using a different method, such as* [*no-till farming*], uses lighter machines and sows crops that take root more deeply. *'Tilling' as a form of ploughing creates a higher risk of erosion in the event of heavy rain in South Limburg in particular due to the hilly landscape. Moreover, a high level of organic matter is important to the soil acting as a sponge.* The soil system pillar contains actions aligned with the [*Nationaal Programma Landbouwbodems (National agricultural soil programme)*].

(3) Crops and cultivation systems - Extreme or hot and humid weather can damage the crops of farmers and horticultural businesses. Examples include hail, frost or new diseases that arise as a result of these. Growers can protect their harvest against this by implementing the right measures. For instance, by installing *nets* over fruit and opting for crops that are more resilient to extreme weather. *Disease and pests will also occur more frequently due to the higher*

temperatures. The crops and cultivation system pillar is aligned with the *Toekomstvisie gewasbescherming 2030, naar weerbare planten en teeltsystemen (Future vision for crop protection 2030, towards resilient plants and cultivation systems)* and its *Implementation programme*. This pillar provides an additional pre-competitive boost to developing and retaining starting materials for adaptive cultivation and improving regulations on protective measures against frost and extreme precipitation.

(4) Livestock - The livestock pillar focuses on adapting all farmed animals to climate change. One of the actions is to incorporate climate adaptation into the *maatlat duurzame veehouderij (sustainable livestock benchmark)* and policy on new indoor livestock systems. Farmed animals such as cows, pigs and chickens can be greatly affected by heat and drought. They can also become susceptible to new animal diseases. Livestock can be better protected by, for example, placing cooling systems in or *on top of* stalls with e.g. *green roofs, although this is fairly expensive for farmers*. Livestock in the fields can be provided with shade using *trees or large mobile parasols*. Agreements on how livestock is transported in extremely hot weather will similarly help to ensure good animal welfare. This is described in the *plan van aanpak voor hittestress bij landbouwhuisdieren (action plan for heat stress in farmed animals)*.

(5) Supporting instruments - This pillar names three overarching instruments for the four pillars in order to create integral support: knowledge and innovation, regional approach and risk management. Examples of this include the Ministry of Agriculture, Nature and Food Quality drawing up a knowledge agenda for climate adaptation in agriculture (from the short to long term and with options for action for agricultural businesses, central and local governments and chain and regional parties), the creation of a knowledge platform, a focus on preventive and adaptive measures to better cope with extreme weather and salinisation and, as a financial safety net, the stimulation of insurance against crop damage caused by extreme weather. The regional (area-specific) approach means that there is a focus on collaboration between farmers and local government linked to the different types of landscape and soil types, each of which bring their own challenges arising from climate change: this might include elevated sandy ground, coastal areas (salinisation), river areas and low-lying peatland.

The *Letter to Parliament* of 7 July 2022 on the Action programme for agriculture climate adaptation describes how this programme's course of action will continue.

Knowledge development via LIFE-IP project

In addition, the Ministry of Agriculture, Nature and Food Quality's *Business models and financing* project is being co-financed by the EU-funded *LIFE-IP Climate adaptation* programme. The ministry is working via its own project together with partners on knowledge development, regional strategy and exploring collaboration with financial institutions to promote developments and investments in climate adaptation. The ministry's involvement in this report is an initial step towards this. *One option is for financial institutions to be given a role in reflecting on and (further) developing preconditions, revenue models and funding constructions for climate adaptation via LIFE-IP.*

National Rural Area Programme

The National Rural Area Programme (NPLG) focuses on the future-proof development of rural areas and in doing so must comply with international obligations for nature (including national nitrogen emission targets), water and climate. The goals for nature, nitrogen emissions, water, soil and climate are being tackled jointly and consistently. These international obligations have been translated into the goals described in the NPLG Development Document and are summarised in the Memorandum on Scope and Level of Detail. The plan is to present the draft NPLG and corresponding Environmental Impact report for consultation in the autumn of 2023 and finalise the National Rural Area Programme in 2024.

2.3 Policy scenarios and strategies for spatial planning in the Netherlands

As the climate is changing more quickly than expected and extreme weather will occur (even) more frequently and more intensively, it is now generally accepted that adaptation to climate change needs to be accelerated.

A number of government advisory bodies have therefore drawn up proposals for new policy including adaptation strategies for the medium (after 2050) and longer term (after 2100). Politicians still have to approve these and at the moment it is not certain which choices will be made.

In addition to current policy including adaptation strategies, the Netherlands is therefore preparing for the future via scenarios for future policy that includes adaptation strategies. These are dealt with below.

Netherlands Environmental Assessment Agency scenarios for spatial planning in the Netherlands (2050)

The Netherlands Environmental Assessment Agency (PBL) distinguishes between *Four scenarios for spatial planning in the Netherlands in 2050* and in doing so examines appropriate – potential – climate adaptation strategies:

- Globally Enterprising;
- Fast World;
- Green Land;
- Regional Roots.

Globally Enterprising

In Globally Enterprising, large businesses take the lead in making the Netherlands more sustainable. The financial sector can potentially also play a significant role here, as private financiers of projects and corporate investments. In relation to flooding, in this strategy the Netherlands is working to upgrade dikes and use new techniques to create robust, high and narrow dikes and retention areas where water can be stored temporarily during heavy rainfall. Globally Enterprising includes greater capacity for storing and supplying freshwater for agriculture. The use of more groundwater to meet the growing demand for water often results in increased desiccation.

Fast World

Fast World places the emphasis on lifestyle groups and the digital domain. This scenario typically involves chaotic, ad hoc measures. Many measures are short term and prompted by timely alerts via early-warning systems. Water drainage and supply are regulated using emergency pumps when necessary. Areas outside the dikes may also be used temporarily. In this scenario, the quality of drinking water is under pressure.

Green Land

In Green Land, the starting point for national spatial planning is the 'Water and soil in spatial planning' report. In terms of climate adaptation there is more space for the rivers. Rural and urban areas have what are known as interlacing networks of green and blue (dry and wet respectively). These are networks of small landscape elements in rural areas. In most cases these are linear elements, such as dikes, hedges, verges and riverbanks, but they may also include small nature areas, woods and pools. Submersible dikes are also constructed. One of the most important adaptation decisions is not to build on soft or wet ground. The Netherlands is made more resilient to drought by substantially improving the retention of rainwater upriver and greatly restricting the extraction of groundwater. Adapted land use (building with nature) creates a buffer for arable land at times of drought.

Regional Roots

The fourth scenario is Regional Roots. The emphasis in this scenario is on the region, in which water authorities and regional government have a great deal of say. Light construction is permitted on soft soil in this scenario. Cities shrink and more people live in rural areas. The use of nature typically involves nature inclusivity and interlacing networks of green and blue. Increased building in 'green' areas contributes to keeping groundwater at the same level during the more frequent periods of drought. However, there are few cross-regional solutions here.

Deltares strategies

Deltares looks at the Netherlands after 2080 in its *strategieën voor adaptatie aan hoge en versnelde zeespiegelstijging (strategies for adapting to high and accelerated rising sea levels).* It describes four scenarios for what the Netherlands might look like in this year. These are lines of reasoning and are not worked out in detail. In practice, parts of the different scenarios may co-exist, for instance because one area has chosen to 'adapt to the situation', while elsewhere 'closed protection' has been selected.

Closed protection

In this scenario, more capacity is needed for dikes and rivers in the rest of this century. The current river estuaries will be closed off from the sea and pumps will be used to discharge river water into the sea. This method of flood protection uses more space along the coast, which could encounter resistance from local residents and businesses. The consequences of a (sea) dike being breached are enormous in this scenario. In this scenario, the Netherlands is not equipped to manage the consequences of flooding but instead mainly to prevent flooding using technical resources. Compared to the 'open protection' scenario, the spatial consequences in the river area are small as the dikes will not need to be raised extensively.

Open protection

This scenario involves high river dikes as well as sea dikes. In this case, the rivers remain connected to the open sea, in contrast to the closed protection scenario. Spatial use is a problem in this scenario as well, particularly in the river area where extensive dike upgrades and other measures will be required as river levels will rise in line with rising sea levels. These interventions could conflict with existing built areas and other land use. As an example, the river IJssel requires an extra 800 to 4,700 hectares. Although this scenario will also require investment in more pumping capacity in for instance the IJsselmeer area, the amount is much smaller than for the 'closed protection' scenario. More water storage capacity will also be needed than currently exists, but less than in the 'closed protection' variant.

Seawards

In Seawards, islands are constructed off the Dutch coast and linked to each other and to the mainland by barriers. These barriers are hugely important, otherwise this solution has little adaptive value. In this variant, the problem of protection against flooding and water storage is transferred to an as yet unbuilt piece of land off the coast. This means that less would need to be adapted in the existing (old) land.

Seawards offers extra options for storing water by creating freshwater lakes between the constructed islands and mainland. Extreme river discharge could temporarily be stored in these, so that dikes need to be upgraded to a lesser extent. These freshwater basins could also be used for supplying freshwater. At the same time, the existing coastline will extend further into the North Sea, where it is much deeper. Maintenance of the coastal base in this area will be more difficult than in the current location. The advantage of this solution is mainly to be found in the smaller amount of space required for adaptation measures on existing land and the options yielded by developing new land.

Adapting to the situation

In this scenario, the part of the Netherlands that lies below sea level will look like an archipelago. This will require far-reaching decisions on where and how to build. This might include locations for new builds, experiments with floating homes or raised buildings on stilts. It will not be possible to continue living everywhere in this area and people will be forced to migrate from some areas. This is an extremely long-term strategy that responds to a very large rise in sea levels. It is possible to deliberately prepare for this scenario by implementing measures but it may also be triggered by one major flood or several smaller floods.

NL 2120

In 2021, Wageningen University & Research (WUR) outlined its vision of what the Netherlands might look like in 2120. The map it drew up constitutes an integral perspective, with capacity for developments in biodiversity, water, the circular economy, sustainable energy and agriculture. The researchers show in their report what the Netherlands might look like in a hundred years' time and what future-oriented choices this involves if developments do indeed occur as described. This vision of the future also focuses on the rivers in order to deal better with peak discharge as a result of heavy precipitation. In addition, green buffer zones can be created as an alternative to dikes. In this line of reasoning the WUR places *Nature-Based Solutions* at the core as a means of shaping climate adaptation.

Rethink the Delta and combine expertise

In early 2023, a broad group of knowledge institutes and central and local governments, supported by declarations of intent from private institutions, submitted a research proposal entitled *Rethink the Delta* to the National Growth Fund to conduct long-term research into climate adaptation problems. One of the work packages in this was aimed at research into the climate resilience of the financial system and the role of financing in adaptation. Although the research proposal was not approved, it has unleashed dynamics for (even) more collaboration on this topic. The KuiperCompagnons organisation subsequently sent *a letter to the Minister for Housing, Spatial Planning and the Environment* in 2023 containing a similar plea for combining knowledge and design strengths.

Current considerations in future-oriented choices

What we decide now will fix investment for the long term and in doing so affect options in the (distant) future, potentially making it more difficult to change strategy in future. If, for example, we now opt to build in the floodplains of rivers and low-lying polders, the write-downs deriving from any reassessment will be enormous. Deltares noted back in 2019 that this can be a high-regret activity.

The choices we make now must therefore expressly take into account the direction they take us in, taking advantage of the many available scenarios. Investing in prevention now can prevent more widespread damage later. Capacity needs to be created, literally and figuratively, to avoid certain lock-in effects. The Delta Commissioner, for example, notes that from now on *each spade in the ground needs to be climate-proof*. In this respect, the Working Group believes it would also be a good idea to investigate which costs relate to which benefits, who benefits from these and the term that is involved.

A good example of a choice in which account is taken of potential future trends is keeping space free for the rivers. Another good example is when weighing up the options with equal adaptive effects to give preference to those measures that are well aligned with (future) climate mitigation measures. This might include the installation of green roofs, where a win-win situation is even possible by combining these with photovoltaic panels. The green roof keeps the panels cooler, resulting in improved energy production on hot days, and also has a cooling effect inside and outside the building. More on this type of win-win solution can be found in the *Unlocking the biodiversity nexus* guide for financial institutions. Greater synergy with climate mitigation will also lead to fewer adaptation measures being needed in future.

2.4 Impact on the economy

Climate change has an impact on the economy. Several climate trends can often have a simultaneous impact. Drought often follows periods of heat. Heat can also have consequences for extreme precipitation. Following a period of drought, water soaks into the ground less easily and as a result more drains towards the rivers, causing water levels to rise and in turn flooding. These examples show that trends do not occur in isolation but are in fact connected.

Impact of climate trends and adaptation strategies on the economy

The Working Group has investigated the (potential) impact of each climate trend - and corresponding current adaptation strategies - on a number of economic sectors. Below is a brief description of the impact of climate trends and adaptation strategies on economic sectors, presented per sector. Appendix 3 contains a more detailed description, for each climate trend and adaptation strategy, of the consequences for each sector, presented per trend.

Climate trends generally have a negative effect on a sector, and climate adaptation strategies aim to absorb or prevent this negative effect for the sector. In some cases, however, an adaptation measure is positive for one (sub-) sector but negative for another (sub-) sector. As an example, raising the groundwater level is positive for houses on wooden piles but negative for those that do not have reinforced foundations and for agriculture.

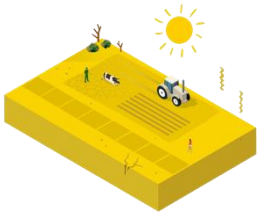
Built environment

The impact of individual climate trends on the built environment varies. Hotter weather can cause heat stress in buildings and in turn increase health risks for those who live and work in them. Drier weather, combined with human activity, can cause land subsidence. This can cause buildings to subside. Pile rot can also occur. After long periods of drought, the ground is unable to absorb water as easily. Combined with heavier hail and rainfall, this can cause a huge amount of damage to the built environment. Rising sea levels can pose a risk to coasts, increasing the risk of flooding in coastal cities in the long term. The same goes for higher river levels that can pose a threat to the built environment close to rivers.

Moreover, in general there seems to be a link between income level and vulnerability to climate change, as can be seen from the report *Verkenning naar de wisselwerking tussen sociale veerkracht en klimaatadaptie (Survey of the correlation between social resilience and climate adaptation)*, which notes in this respect that people on low incomes and with poor health mainly belong to the groups most vulnerable to climate risks. The first group cannot afford the higher climate costs (e.g. for maintenance and management, foundations, water management), resulting in them being affected more quickly/severely by the consequences of climate change, while the second group comprises people with poor health (e.g. poor immune systems, heart and lung diseases, allergies) who are affected more quickly/severely by the consequences of climate change (e.g. heat stress).

For the built environment, relevant adaptation strategies can be found in e.g. the Decree on making government buildings more climate-proof, the National approach to climate adaptation in the built environment, the Water and soil in spatial planning policy, the Green climate-adaptive built environment benchmark and the Climate-adaptive built environment assessment framework. These strategies can lead to the *modified construction and reconstruction of buildings*, namely in a climate-adaptive manner. The Water and soil in spatial planning policy could also lead to an overall *ban on building in some areas*, for instance where space is needed for water.

Agriculture



Increased drought conditions and higher temperatures are important for sectors such as agriculture. Yet rewetting and rising sea levels are also extremely relevant to the agricultural sector.

More prolonged dry periods in spring have a negative impact on crop growth. Heat leads to disease and fungus on crops, while certain crops unable to withstand heat well could even disappear altogether. Rewetting will also cause more disease in crops. These phenomena will in turn affect crop yields and quality and have an impact on both human health and animal welfare. Extreme precipitation with storms, hail, thunderstorms and heavy rainfall will result in (more) damage to greenhouses and stalls. Rising sea levels are leading to salinisation of the soil. Many crops do not thrive in such conditions. This can reduce production capacity.

Furthermore, many agricultural crops depend on pollinators such as wild bees and hoverflies. A decline in these populations as a result of a loss of biodiversity due to climate change can mean that these crops disappear and this can threaten the livelihood of agricultural businesses.

Relevant adaptation strategies for the agricultural sector can be found in e.g. the action programme for *agriculture climate adaptation* (deriving from the NAS) and the national Delta programmes *Spatial Adaptation and Freshwater*. These programmes should lead to *more agricultural businesses turning to climate-adaptive business practices but also to a decrease in the number of agricultural businesses because they are unable or unwilling to comply with the new requirements.*

Industry

Industry will increasingly have to contend with heat stress caused by more and longer periods of heat. Industrial companies can be affected directly or indirectly by flooding too. On top of damage to industrial companies in the area, this can also lead to environmental risks.

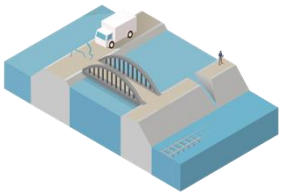
Many industrial companies depend on water and waterways for their water supply and drainage and for their commercial water consumption. The drier climate trend could potentially reduce the stability of the amount or quality of water in a region and this presents industry in the region with challenges. Climate trends can also have an impact on an industry's sales; these might be transformed: higher average temperatures, for example, mean higher or lower sales of products dependent on temperature.

Moreover, many industrial companies depend on biological resources for their raw materials. When these natural resources decline as a result of a loss of biodiversity caused by climate change, this poses a risk to industry.

Industrial companies will probably be able to absorb more moderate climate-related impacts easily by adjusting their processes. After all, industrial production typically involves the control of variables that govern production. Extreme impacts, chronic and acute, are potentially more worrying though as industrial companies can absorb these less easily.

Relevant adaptation strategies for the industrial sector can be found, for example, in the Water and soil in spatial planning policy, the Green climate-adaptive built environment benchmark and the Sea Level Rise Knowledge Programme that is part of the Delta Programme. These strategies or resulting policies can lead to the *modified construction and reconstruction of industrial premises*, namely in a climate-adaptive manner. Yet the Water and soil in spatial planning policy can also lead to an overall *ban on building in some areas*, for instance where space is needed for water, which can in turn mean that industry will no longer be able to be located in certain regions. In the event of heat and drought, industrial companies may also face restrictions on taking in and consuming freshwater, and on discharging cooling water, which could affect their production.

Transport



Flooding caused by increasingly extreme precipitation can damage transport vehicles but also damage and disrupt infrastructure, as can heat. The expansion of asphalt due to heat can lead to cracks, while rails and bridges can buckle in high temperatures, leading to transport delays or diversions via alternative routes.

Drought can lead to extremely low river discharge, which can result in transport delays or smaller consignments of goods per journey. In the worst case, it may be (temporarily) impossible to transport products by ship, and where possible an alternative method will need to be found. This can push up transport costs.

Rising sea levels and higher river discharge caused by sharply increased extreme precipitation in river basins can lead to more frequent flooding in low-lying areas of ports. This can severely damage ports, such as Noordereiland in Rotterdam, but pipelines can also be disrupted, with a potentially negative impact on the transport of goods and on the environment. On the other hand, rising sea levels could potentially make it easier for ocean-going ships to reach ports and shorten trade routes. Trade routes that could be shortened by climate change include the Northwest Passage around Canada and Northeast Passage around Siberia.

Relevant adaptation strategies for the transport sector can be found in, for example, the Decree on government infrastructure and the Integrated River Management (IRM) programme. Under the IRM, central government, provinces, water authorities and municipalities will spend the next few decades working on a future-proof river area that, if the system works properly, will be multi-purpose and sustainably managed. Choices need to be made and a new balance found in the collective use of the river area. Climate change will sometimes mean even higher water levels than are currently the case and these need to be absorbed into the rivers. This may make them (temporarily) unsuitable or less suitable for transport.

Carry out sector and business analyses for climate impact, work together on adaptation and set to work on no-regret measures.
We call on businesses and sectoral organisations to analyse the vulnerabilities at sectoral, regional and company level as well as in the chains. Vulnerabilities might include buildings, inward and outward supply lines, personnel and reputation. We call not only for the investigation of risks but also for opportunities to be studied and measures implemented.

It is up to companies to identify the opportunities and risks for their own businesses, but in doing so they can collaborate with knowledge partners and the financial sector. Although everyone is still busy familiarising themselves with this material and there are very few oven-ready answers, the process starts with analyses and actions. This also ties in with the growing reporting obligations, increased legislation and expectations of stakeholders on what businesses can (or ought) to do in terms of sustainability.

Inventory the no-regret measures and make a start. No-regret measures can in themselves have a significant impact. These are measures that can be taken if the effects of climate change are still uncertain, as they are easy to implement and have no major impact on profitability. The Kennisportaal Klimaatadaptatie (Climate Adaptation Knowledge Portal) has already published an overview of these.

Invest in collecting insights and data.
For a company to obtain insight into its vulnerabilities, it needs to know where to find climate data. A large amount of data is already available. Companies can use these data for analyses in their specific sector by linking the climate effect data to spatial planning. It is not just important to know how weather patterns are changing but also how the local area (water authorities, municipalities etc.) deals with this and how a company's premises and infrastructure are equipped to deal with the changes. Businesses can then use this information when making strategic decisions, investment and maintenance plans and in external reports. It is also important to form an idea of the impact of e.g. drought on the supply chain. Some data can be retrieved from public systems as companies and institutions must report on sustainability performance, emissions, water consumption etc. to government bodies.

2.5 Consequences for the financial sector

As described above, individual climate trends and adaptation strategies impact the economy in a variety of ways. As an important facilitator of the economy, the financial sector experiences the consequences in different ways.

Consequences of climate trends and adaptation strategies for the financial sector

The Dutch economy relies greatly on the financial sector. The built environment, agriculture, industry and the transport sector, all sectors in fact, are financed by banks and investors and insured by insurers. Furthermore, investors play a role in providing financial resources, for instance by investing in businesses, commodities and land (land holdings) and trading in investments.

It is therefore extremely relevant to the financial sector whether and to what extent specific economic sectors are exposed to the consequences of climate trends and/or climate adaptation strategies, whether they will suffer damage or loss from this and how much, and whether their valuations will potentially change as a result. This relevance to the financial sector is explained in more detail below.

Built environment

Drought, more extreme precipitation and rising sea levels will cause more damage to the built environment and in turn potentially emotional distress to residents. Heat stress can lead to health risks among residents and even death. On the other hand, the risk of cold-related excess deaths could decline.

The Dutch Association of Insurers' *Climate Damage Monitor* clearly demonstrates the effect a single extreme weather event can have on total claims. The highest claims are mostly caused by extreme weather events, which will increase under *it is becoming wetter*. The 2016 hailstorm in Someren, storms in 2018, flooding in 2021 and 2022 storms stand out immediately here. These caused not only physical damage to the built environment, but also had long-term consequences such as the drying times of buildings that meant they were inhabitable or unusable for prolonged periods and interrupted business operations. Insurers of buildings but also health and income insurers are seeing their cost of claims rise due to damage to the built environment and among residents as a result of the individual climate trends.

Hotter, drier and wetter weather, and rising sea levels also pose a threat to property values. This might include extra maintenance costs for properties owing to subsidence and pile rot. These effects can in turn impact property values.

In the case of damage to foundations, repair costs are high. As only the risk of 'sudden' and 'unexpected' damage may be insured, costs arising from foundation problems caused by land subsidence are uninsurable as they are not unexpected. The property owner, such as a real estate investor, will therefore have to bear the costs themselves. As aspects such as rental income and operating costs are significant factors when determining valuations, the high costs of foundation problems will have a negative impact on the valuations of investors in such properties. On top of this, as more information on the sensitivity of properties to the consequences of climate change becomes available, homes in risk areas may retain their (sale) value less easily in the long term.

The value of a property is important data for insurance policies. The insured amount is based on this and, for example, on the reinstatement value. Yet the value of the property is at least as

relevant to the bank that has granted the mortgage to the property owner, for instance. When the value of a property declines due to (sensitivity to) climate change, this therefore has repercussions for the insured amount, reinstatement value and mortgage.

Adaptation strategies that stimulate climate-adaptive construction, such as those found in the green benchmark, may lead to risks changing, for example because new materials or techniques are used in construction for which no quality seals exist etc. and on which insurers from an insurance perspective and investors from a financing or investment perspective still possess little data, making it more difficult to define insurance premiums and values.

The risk of damage to the building as a result of climate change is changing due to climate-adaptive construction and reconstruction. This could be in a positive sense but on the other hand it may mean an increased risk of other types of damage. This might be because nature-inclusive but extra flammable materials were used in its construction, for instance. Insurers therefore see two very different consequences of climate-adaptive construction and reconstruction in their cost of claims. These trends are still fairly recent and how the risks work out in practice will become clearer over the coming years.

Properties built using climate-adaptive techniques may well set themselves apart in a positive sense in terms of value growth versus properties built in a non-climate-adaptive manner. It is important that valuers take climate adaptation risks and solutions into account in their valuations. This is not the case at present. There is a key role here for sectoral organisations such as the NRVT (real estate valuers) and RICS (chartered surveyors). These upgrades or downgrades to valuations are relevant to the property owners and potential buyers, but also to the investors and insurers of these properties.

Finally, it may also be that adaptation strategies such as those contained in the Water and soil in spatial planning policy have the effect of increasing the risk of water flowing into the built environment, for example because it is in or becomes an overflow area. This could potentially affect the risks and value of this type of property and the options for insuring and financing these properties.

Agriculture

More prolonged periods of drought, rising temperatures, rewetting and rising sea levels have consequences for e.g. crop growth, lead to disease and fungus in crops and salinisation of the soil.

This causes damage in relation to lower crop yields, negatively impacts human health and animal welfare and results in more damage to greenhouses and stalls. If no measures are taken, insurers of agricultural businesses will face increased risks and a higher cost of claims and investors in agricultural businesses will see their returns decrease and incur higher losses on financing these businesses.

Adaptation strategies for the agricultural sector, such as those in the action programme for agriculture climate adaptation and the national Delta programmes Spatial Adaptation and Freshwater aim to reduce the impact of climate change on the sector. They may lead to more

climate-adaptive business practices, which could mitigate the current risks. New techniques may also evolve that facilitate climate-adaptive business practices but may also involve uncertainty, high costs and other risks that are still relatively unknown for insurers and investors and therefore make them difficult to assess and price.

Industry

More frequent periods of drought and more extreme drought, heat stress, more extreme precipitation and more flooding will affect industry. The declining returns and damage or loss arising from these will partly be for the account of insurers and investors.

(Exposure to) damage to industrial premises could lead to higher costs being incurred and industrial premises decreasing in value. These effects will in turn have an impact on the valuations and returns on investments in industrial premises. Investments in industrial companies could yield smaller returns if the operating activities of these businesses are harmed.

Adaptation strategies, such as those described in the Letter to Parliament Water and soil in spatial planning, will affect industry. The letter asks major consumers to use 20 percent less drinking water no later than in 2035. This could mean that industry has to apply different production methods. The risk of damage or loss from climate change could well alter in a positive sense in this respect and yield a lower cost of claims for insurers. On the other hand, changes to production processes could increase the risk of other types of (insured) damage or loss. New production methods can also lead to higher costs, which will squeeze the value of the financing.

Transport

Flooding caused by the wetter climate trend will in future lead to (more) damage to modes of transport, such as cars, vans, lorries etc.

Weather-related damage to the automotive industry is shown in the Dutch Association of Insurers' Climate Damage Monitor. This monitor clearly demonstrates the effect a single extreme weather event can have on total claims. The highest claims are mostly caused by extreme weather events, which will increase under *it is becoming wetter*. The 2016 hailstorm in Someren, storms in 2018, flooding in 2021 and 2022 storms stand out immediately here. Insurers of cars and other modes of transport will see their cost of claims rise as a result of the increase in extreme precipitation, hail and other extreme weather events, although the opposite effects of climate change will also be visible at insurers of cars and other modes of transport, such as a decrease in claims due to fewer accidents thanks to less icy conditions.

Wetter, but also hotter and drier weather will likewise lead to more damage to infrastructure, which may or may not be insured. Rising sea levels can cause flooding. Ports and pipelines can experience damage as a result of this, which can delay or make transport temporarily impossible. Transport insurers will potentially see a higher cost of claims. Damage to infrastructure can also lead to higher costs being incurred for infrastructure, causing it to decline in value. This might include extra maintenance costs for roads owing to desiccation and subsidence or for keeping bridges cool during hot periods by spraying them with water from fireboats.

If adaptation measures need to be implemented such as those within the Integrated River Management (IRM) programme to absorb even higher water levels into the rivers than is currently the case, this may have consequences for the transport of goods via the rivers in question. This could also result in a higher cost of claims at transport insurers and higher risks for investors.

Ensure clarity on climate-adaptive (new) construction and reconstruction and where (not) to build. Indicate where there is space for agriculture and other economic functions in the Netherlands.
Guidance from the government is essential to avoiding any delay. The Working Group believes a good start has been made on this via the *Kamerbrief Water en bodem sturend (Letter to Parliament on Water and soil in spatial planning),* the *Nationale aanpak klimaatadaptatie gebouwde omgeving (National approach to climate adaptation in the built environment)* and the *Tussenresultaten Kennisprogramma Zeespiegelstijging (Interim results of the Sea level Rise Knowledge Programme)*. It is important for local and regional authorities to translate this in turn into consistent policy. The Working Group proposes making the *Maatlat groene klimaatadaptieve gebouwde omgeving (Green climate-adaptive built environment benchmark)* mandatory and incorporating this into the Environmental Quality Decree (soon to be part of the Environment and Planning Act).
The Working Group proposes incorporating the climate-robust repair of flood damage into the legislation for homes and business premises. This could be done by embedding this legally into the Green climate-adaptive built environment benchmark in e.g. the Environmental Quality Decree. Enshrining this in law in this way would mean that insurers reimburse claims based on climate-adaptive repair and that this would not depend on the chosen property insurance.
Moreover, the Working Group asks that the ideas and design strengths of the public and private sectors are involved in the elaboration of the National Adaptation Strategy (NAS) and setting up a broad 'adaptation community'. There are multiple knowledge programmes at the moment and we believe it would be a good move to combine this knowledge. This is demonstrated by the *Rethink the Delta* initiative, a broad community of professionals who want to contribute to keeping the Delta region habitable for future generations. This likewise applies to the *KuiperCompagnons letter*, which with the support of other stakeholders, including those from the financial sector, calls on the government minister to combine knowledge of the future and design strengths.

In the interest of the financial sector

The above sections clearly demonstrate that the financial sector has an interest in identifying the consequences of climate trends and adaptation strategies. Furthermore, as financiers of economic activities, insurers of risk and investors, financial institutions can play a role boosting the climate resilience of society.

Financial institutions need to comply with sustainable laws and regulations, and it is important that this is done in an unambiguous manner. One recent development is the introduction of the EU Taxonomy directive, which provides a shared classification system. The EU Taxonomy

describes activities that are sustainable or promote sustainability. As part of this, criteria have also been developed for climate adaptation. The Taxonomy can therefore support a shift in capital flows towards, for example, a more climate-adaptive economy.

In addition, the *Corporate Sustainability Reporting Directive* (CSRD), which enters into effect from the 2024 financial reporting year for large financial institutions and subsequently for other, smaller (but not the smallest) businesses, will create greater transparency on sustainability topics at businesses.

There are multiple statutory sustainability initiatives that affect the financial sector directly or indirectly. Regulations governing the financial sector have been adjusted so that financial companies explicitly take into account the sustainability risks to which they are exposed and in certain circumstances the impact they have on the outside world in their activities, such as in their investment policies. Whether there is reason to adjust capital requirements when it comes to the risks associated with sustainable activities is also being studied. In doing so, an assessment is always made of whether this can be accounted for within the primary goal of the rules (such as the protection of policyholders or deposit holders) and will not lead to increased prudential risks.

In addition, new regulations, such as the SFDR and a standard for green bonds, create capacity for offering a range of products or investments that contains more sustainable financial products and financial instruments.

Investigate as a sector and institution the options for setting climate adaptation goals.
Financial institutions can play a facilitating role and support climate adaptation and potentially even accelerate it in certain respects. Institutions already report based on the EU Taxonomy on the extent to which their activities contribute to climate adaptation. The recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) and parties such as the United Nations Environment Programme Finance Initiative (UNEP FI), which support banks, insurers and investors and share knowledge with them on climate and sustainability, may provide assistance here. This collaboration with the UNEP FI is based on a commitment to sustainable banking (Principles for Responsible Banking, PRB) and there are counterparts for investors and insurers as well (Principles for Responsible Investment (PRI) and Principles for Sustainable Insurance (PSI)). Climate adaptation is aligned with the climate mitigation strategy that has already been initiated, as the Paris Agreement describes a role for the financial sector in both mitigation and adaptation.

UNEP FI is a partnership between the United Nations Environment Programme and private financial sector, with the aim of catalysing private financing to contribute to the global Sustainable Development Goals (SDGs). The initiative brings banks, insurers and collaborating institutions together to make sustainable finance mainstream and to accelerate it. Via the Principles for Responsible Banking the UNEP FI supports banks in setting specific sustainable targets in order to have a bigger real-world impact. In response to the 2015 Paris Agreement and the 2017 TCFD, the UNEP FI supports financial institutions in identifying, assessing and reporting on their risks arising from the physical consequences of climate change by providing insight into risk assessments and reporting frameworks. Given the material impact of climate change, a Working Group of 27 banks was set up to develop guidelines and pilot schemes at sector level (source: UNEP FI).

How the financial sector can play a facilitating role in boosting the climate resilience of the Netherlands is described in the next section.

3. From the inside out

In this section, we describe the contribution we believe the financial sector could make to climate adaptation from the 'inside out' perspective. We also examine what businesses and homeowners are doing themselves. Where a private solution is not feasible, we have investigated whether and how one could be found together with the government. Some suggested solutions are generic, others are specific to a sector.

3.1 Five types of instruments

We distinguish five types of instruments that financial institutions can use to facilitate climate-adaptation solutions at their customers:

- The analysis of risks as described in section 2;
- Providing customers with information on the risks, opportunities and solutions via sector analyses;
- Price incentives, such as discounts on interest rates, vouchers and purchase discounts;
- Innovative financing; and
- Enhancing the terms and conditions of products.

This format has already been used in the analysis *Nederland klimaatbestendiger maken: welke rol spelen financiële* instellingen? (Climate-proofing the Netherlands: what role do financial institutions play?) (Samen Klimaatbestendig, 2021). Here, financial institutions determine for themselves whether and how they use instruments.

In addition to financing, the fourth point also relates to insurance and investment instruments. The types of instruments are depicted graphically in Figure 8.

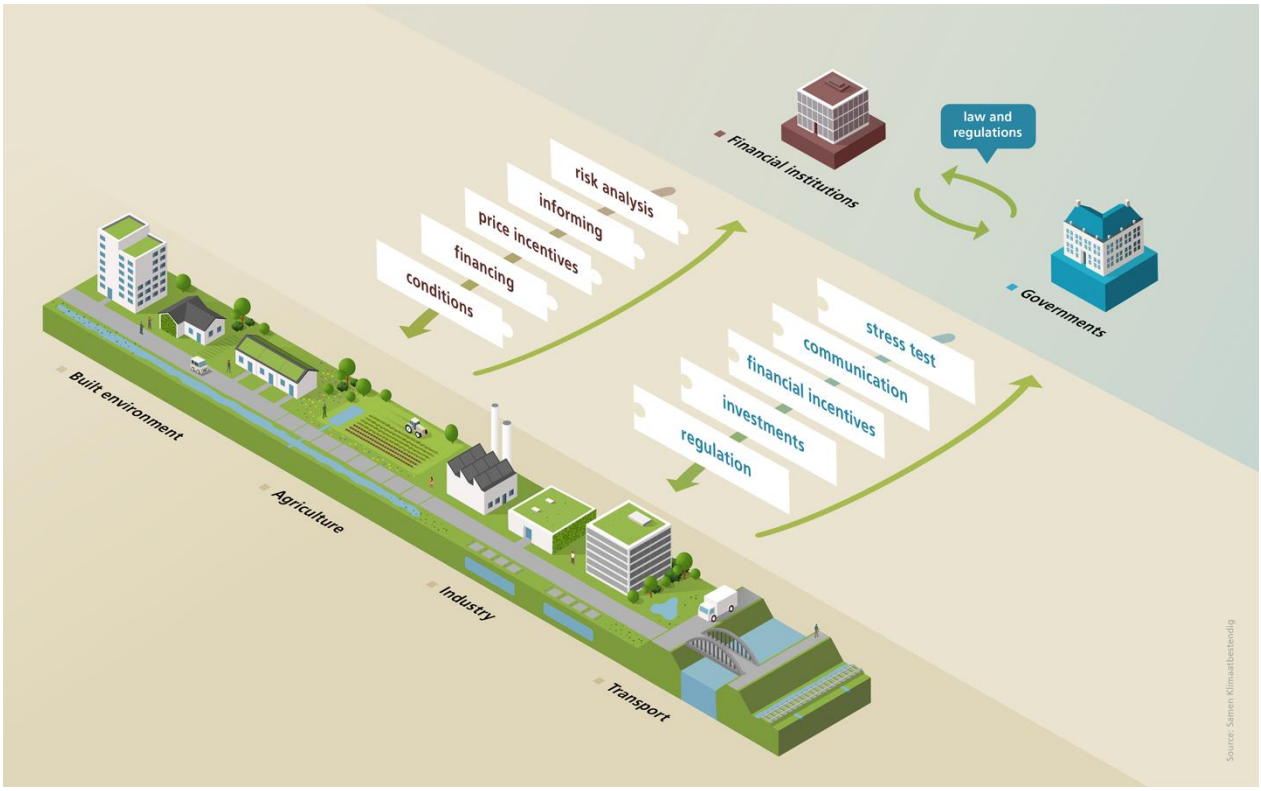


Figure 8: The instruments of financial institutions for stimulating climate adaptation among their customers within domains and sectors. Based on: Samen Klimaatbestendig, 2021, Nederland klimaatbestendiger maken: Welke rol spelen financiële instellingen? (Climate-proofing the Netherlands: what role do financial institutions play?)

(1) Risk analysis - Financial institutions conduct analyses on the impacts of climate change and options for adaptation. They do this themselves and work together at sector level. A great deal is done within the institution itself, for example based on stress testing and credit risk analysis. Some of this work takes place within partnerships, such as the Sustainable Finance Platform, risk working groups at sector organisations for banks, insurers and pension funds, asset managers, and internationally with e.g. the UN (UNEP FI), TCFD pilot schemes and the World Business Council for Sustainable Development. Further steps will be taken in this respect in the next few years.

(2) Information - Financial institutions need information to set to work on adaptation, and themselves provide information on how they view the risks of climate change and adaptation at aggregate level in sector analyses and e.g. in annual reports. This involves climate data, the vulnerabilities of businesses to climate events, adaptation policy and adaptation measures that can reduce vulnerabilities and, for example, information on government legislation with respect to adaptation: which standards/requirements, taxes and subsidies exist. Financial institutions can in turn inform customers and stakeholders of climate risks and adaptation solutions, for instance via these sector analyses.

Provide plenty of information.
The provision of information contributes to awareness of climate adaptation. For instance, banks and insurers can focus on the consequences and risks of climate change to economic sectors in sector reports. Sectoral organisations can also inform their members about this, as can consumer organisations or associations such as Eigen Huis for homeowners. We give some examples of initiatives of this in the report. A great deal more effort will be needed in this respect in the coming years and we believe the government has an important role here.

Wherever possible, unlock information on the government's adaptation policy and where to find specific climate data.
Policy on climate adaptation, water, soil, flood risks, rising sea levels and where to find data needs to be transparent. This can help businesses to make an accurate estimate of climate-related risks, what the government is doing about them and the costs and benefits of implementing their own adaptation measures. Monitor the quality and reliability of data, such as the density of maps and stress tests.

(3) Price incentives – Financial institutions incorporate climate-related risks into rates and premiums as soon as they are known and quantifiable. Raised awareness of the climate risks and adaptation options at all parties will result in more measures being implemented by businesses, residents and other stakeholders. One option here is to make business cases for adaptation financially attractive with the assistance of the government. Government guarantees/subsidies could perhaps partially eliminate 'front-end costs' on investments in climate adaptation. Multilateral banks have a role to play here too. Together with commercial and public sector banks, the EIB, for instance, makes social impact loans available at attractive rates.

(4) Innovative financing – Financing plays an important conditional role in adaptation, as after all it has to be paid for somehow. There are two aspects to this: how does money end up in innovative techniques and how to create new innovative types of financing (and investment or insurance) for adaptation (see more on these types in the products and initiatives overview in Appendix 4).

Investigate expanding the number of climate adaptation-related products, services and initiatives.
Appendix 4 of this report lists some examples. Institutions can learn from each other here. We call on each individual financial institution to examine further options for product development and activities. Competition legislation prohibits us from giving any tangible recommendations on the development and introduction of products and adjustments to product terms and conditions. Banks and funds can consult the *Regeling groenprojecten (Green Projects Scheme)* implemented by the Netherlands Enterprise Agency (RVO). Insurers can look at innovative adaptation, such as for existing buildings in areas outside the dikes other than the riverbed, such as the centre of Dordrecht or Kop van Zuid in Rotterdam or floating homes. Banks and insurers can develop financing solutions for repairing foundations. The gradual nature of foundation problems means that property & casualty insurance is not appropriate here and instead financing solutions are required. It is also important not to lose sight of other sustainability objectives, such as social sustainability.

Start joint pilot schemes to develop and test financial solutions for adaptation and learn from any dilemmas that arise.
There are already examples of pilot schemes to restrict foundation problems in certain areas or to opt for nature-based solutions in areas that are prone to flooding. The Working Group wants to start more pilot schemes or sign up to existing schemes, with social adaptation solutions and corresponding (financing) options, to learn how financial institutions can apply these elsewhere in similar situations. Any parties that wish to join us in this are welcome to do so or at any rate apprise themselves of the outcome. These are also themes that can be addressed within sectoral organisations.

(5) Enhance product terms and conditions – Price (point 3) is one of the instruments for reducing risks and stimulating adaptation measures, setting terms and conditions is another. There are several ways to do this. Whether financial institutions do this is up to them. Wherever possible we will make general observations on this in this report.

The role of a framework containing criteria and standards

One example of how residents and businesses (customers of financial institutions) can be informed about climate risks is the *Framework for climate adaptive buildings* as described by the Dutch Green Building Council (DGBC). This sets out a standard approach for assessing physical climate risks at building level (*risk analysis*). Put simply, this is a climate analysis that tells a building owner which specific climate risks apply to their building and to what extent. This type of framework has the potential to be developed further into a label. Central or local government can then inform residents and businesses on the climate risks and solutions.

Working together

We in the Working Group are proponents of private-public partnerships working together to provide building owners with clear insights (*information*). For homeowners, for example, with an initiating role for estate agents and valuers (see section 3.3).

A climate label could potentially also be used to obtain a discount on, for example, mortgage interest rates for adaptation modifications to homes (see section 3.2). The National Mortgage Guarantee Scheme (NHG) could perhaps play a role as well, for groups who are unable to implement sustainability measures but want or need to do so (*price incentives* and *financing*).
A valuable addition might also be that insurers can provide insight into the insurability of the building based on this type of climate label (*terms and conditions*). This is useful information for making a well-informed decision about a new home.
Important aspects here include the professional introduction of this type of label, interim evaluation and thorough supervision.

Introduce regulations governing a climate label for homes and buildings and make this label mandatory.
In doing so eradicate the information asymmetry on climate-related risks and increase awareness of the options for action in order to (partially) restrict the risks. The final recommendations of the *Beleidstafel wateroverlast en hoogwater (Flooding and high water consultation body)* note that it would be a good idea to explore the introduction of a water label for homes and buildings. The Working Group agrees with this but advocates expanding this into a climate label that includes other consequences of climate change, such as heat stress and damage to foundations. The *Dutch Authority for the Financial Markets (AFM)* recently argued in favour of this too. The climate label would then exist alongside the energy label and could have a similar impact. In addition, the government could include adaptation measures in the label and provide information on insurability in the information leaflet. It is important to provide clear and transparent information on risks to building foundations and other available home-related insights.

The sector approach: opportunities per sector

In this section, we look at solutions to challenges in the most important sectors and in doing so align these with the analysis from section 2 (trends/scenarios and impact). Here we examine the built environment, agriculture, industry and transport. Aside from the fact that these sectors can expect to experience a huge impact from climate change, these are the biggest sectors for the financial institutions that have collaborated on this study of climate adaptation.

3.2 Solutions for flood risks in the built environment

Challenges

About 60-70 percent of land in the built environment is in private hands. The current trend of urban flooding means it may no longer be possible to absorb this via measures implemented in public spaces, financed by municipalities. Homeowners, housing corporations, businesses and commercial property owners in risk areas will need to seek solutions collectively to prevent damage or loss caused by flooding. In this section we focus primarily on homeowners and housing corporations. In section 3.6 'Industry' we discuss the approach of and with businesses.

What property owners can do about climate adaptation themselves

Partly thanks to several actions and programmes, property owners are increasingly working actively on climate adaptation. They are removing paving slabs, installing green roofs and purchasing water butts. Some residents even have rainwater tanks and flush their toilets with water from these tanks. These initiatives are almost all voluntary at the moment and could be boosted by, for example, introducing a mandatory climate label.

National initiatives and campaigns for residents/the built environment:

- *Een groener Nederland begint in je eigen tuin (A greener Netherlands starts in your own garden)*, a national green coalition of 15 organisations that has an overview of manuals for municipalities on its portal and offers residents insight into what they can do. The coalition also organises a number of national campaigns;
- *Week van de Groene Tuin (Green garden week)* (April);
- *Plant je Mee (Plant with us)* (October);
- *(National paving slab removal championships)*, a fun competition between municipalities aimed at encouraging residents to replace their paving slabs with greenery;
- There are municipalities that stimulate residents to separate rainwater from sewerage, capture local rainwater and/or install green roofs via subsidies and tax incentives. *Beleidsmixer (Policy mixer)*, set up by a group of local and regional authorities, contains an overview of potential policy instruments and examples. Under the flag of the *Adaptatie Atelier (Adaptation workshop)* they are now working together to develop actions with and for private owners.

The role of financial institutions in adaptation solutions

Risk analysis and information

Financial institutions already analyse the physical risks associated with the buildings that they insure, finance, invest in or buy. This analysis encompasses the level of adaptation. A number of

institutions use the *Dutch Climate Impact Atlas*, while others combine this with the *Framework for Climate Adaptive Buildings* (FCAB) developed by the DGBC with about 30 partners. The FCAB provides a standard for the analysis and examines not only environmental characteristics (part 1) but also building characteristics (part 2). Part 3 (expected year-end 2023) will provide information on the measures to be implemented and their expected impact.

The extent to which banks and insurers provide their customers with information differs. Most insurers advise their customers on making their homes more sustainable via newsletters and web portals. A few banks offer a scan for checking the home for any foundation or flood risks even before the purchase takes place. We describe various examples in more detail in Appendix 4.

Price incentives

For homes the most obvious option is to offer a discount on mortgage interest rates for financing climate adaptation. However, the existing *Temporary mortgage scheme* can only be used for climate mitigation measures at the moment. The Working Group advocates expanding this scheme to include climate adaptation. A number of institutions do already offer options for discounts on advice on or the installation of green roofs.
For housing corporations and municipalities there are options for obtaining sustainability-linked loans from one of the public sector banks, NWB Bank and BNG Bank. Other non-profit organisations are also exploring ways to enable financing climate adaptation for homes (read more on this in Appendix 4).

A climate label would considerably expand options for financial institutions in both providing information to customers and developing price incentives. Growing awareness of climate vulnerability brings with it risks of lower house prices, as shown by research into the *effect of climate change on house prices*. The introduction of a climate label could help this transition to occur more gradually.

Financing via Green Projects Scheme and MIA/Vamil

Owners of business premises can obtain cheaper financing via Green banks. (Green) banks can then use the *Regeling groenprojecten (Green Projects Scheme)*. They can apply to the Netherlands Enterprise Agency (RVO) for a green declaration and in doing so finance their customers' sustainable projects at a lower rate of interest. The scheme has also included a Climate adaptation category since 2016. In addition to Sustainable Construction category 5, specific green declarations for climate adaptation can be obtained for the built environment sector for:

- Building and site-related water storage (category 7.2)
- Innovative cooling of buildings (category 7.3)
- Vegetative roofs (category 7.4)

Via the *MIA/Vamil scheme* owners of business premises can obtain an investment tax credit on purchasing climate adaptation measures.

Financing via green bonds

At project and area level, green bonds can be developed together with a public sector bank. The bonds and projects must include transparent adaptation criteria and any other sustainability

criteria that clarify how they have performed. This is worked out in more detail in section 3.7 on the role of investors.

Insurance solution for flood risks and claims settlement

The Dutch are generally well insured against storms, precipitation, wildfires, lightning and hail damage. Home insurance and usually also insurance policies for business premises and contents nearly always cover this type of damage. However, since the major flood back in 1953, there is limited cover for flood risk. In the first few decades following that flood, all types of flooding were in fact excluded. The first step towards expanding cover came with the introduction of the precipitation clause in 2001 and, following publication of the Dutch Association of Insurers' *Advies Rapport Overstromingen - 2018 (Advisory Report on Flooding)*, many insurers added flooding caused by non-primary flood defences to cover as standard. This process was accelerated after the floods in Limburg. This is a major step towards narrowing the protection gap in flood risk in the Netherlands, except with respect to flood risks relating to primary flood defences. The business market, however, still contains many customised products in which, for whatever reason, businesses have not purchased cover. Awareness of the risks and what is and is not covered is an important action point here.

Opportunities for collaboration

Climate label for homes

To enhance voluntary actions and increase the facilitating options by financial institutions, the Working Group recommends working together to create a climate label for buildings. This could be based on the DGBC's Framework for Climate Adaptive Buildings, for instance. This would match up well with the EU's Sustainable Finance Taxonomy, making it easier for financial institutions to offer price incentives to (potential) customers who perform well in this respect. The focus in this label should be on flood risk, heat, water consumption and foundations. This type of label will create clarity in the market on the direction in which best to develop.

Green Projects Scheme

Our impression is that this scheme has a great deal of potential for accelerating the financing of climate adaptation via public-private partnerships. At the same time, the Netherlands Environmental Agency (RVO) has still received very few applications for green declarations for climate adaptation. The Working Group would like to enter into dialogue with the RVO, its partners and the Green bank experts within financial institutions to develop a strategy for upscaling this together.

Improved settlement of flood claims: together with the government

Multinationals have often purchased cover against flood risk, whether via an insurance construction or other means. Yet almost no private individuals or SMEs are insured against flooding caused by the major rivers, such as the Meuse, large inland lakes, such as the IJsselmeer, or from the sea (source: *infographic verzekerbaarheid klimaatrisico's (infographic insurability of climate risks)*, Dutch Association of Insurers). There is an extremely small risk of these so-called primary flood defences being breached. And thanks to the Delta Programme the Netherlands will be well-prepared in the future as well. The consequences of this type of flooding

can be enormous, however, and costs can run into many billions. For those times when things do go wrong, it is crucial to restrict the amount of damage, set compensation in advance and make rapid repairs. Flood insurance or a similar compensation mechanism for primary flood defences could be an appropriate instrument here but given the scale and nature of the risk this cannot be done without the involvement of the government. Despite *previous attempts*, it has not yet proved possible to introduce flood insurance for primary flood defences on any significant scale.

Nevertheless, a safety net scheme has existed since the Meuse burst its banks and the river Waal threatened to do so in 1993 and 1995: the *Disasters and Serious Accidents (Compensation) Act* (Wts). If this is declared applicable, private individuals and companies can be eligible for compensation for damage and costs incurred as a result of a disaster. However, full compensation is never awarded on the basis of the Wts and the decision to activate it is a political one. A political scheme in practice means that there are no efficient claims settlement processes or one-stop shop to which people can turn for immediate advice. This creates delays, anxiety and extra consequential damage. In the wake of a disaster, above all else victims need an easily accessible one-stop shop for advice.

The lack of certainty creates an additional risk for private individuals, businesses and society that depends on them, but also for financial parties such as investors and mortgage providers. Insurance could be a (partial) solution. Consider contributing to insights, awareness and prevention in advance so that the amount of damage is restricted. In the event of a claim, insurance solutions can provide the quickest and most efficient claims settlement possible, restricting consequential damage and social upheaval wherever possible.
The European Commission and EIOPA, the European regulator of insurance and occupational pensions, are monitoring the insurance aspects of floods in various member states. (Foreign) investors and rating agencies are also increasingly examining water risks in the Netherlands more closely. In the past two years, the *Dutch Authority for the Financial Markets (AFM)*, *De Nederlandsche Bank (DNB)*, *Scientific Council for Government Policy (WRR)* and *Research and Data Centre (WODC)* have called on insurers and the government to review additional insurance options together. In 2023, insurers explored how they could create a decisive and future-proof one-stop shop and entered into talks on this with an interdepartmental working group from the ministries of Finance, Infrastructure & Water Management and Justice & Security. The Dutch Association of Insurers sees two possible directions:

- A modified, more specific Wts with claims settlement by insurers;
- An insurance construction with a role for the government as reinsurer.

A public-private system with the government as backstop or reinsurer (in addition to private reinsurers) offers the following advantages:

- In the event of flooding, claims can be settled quickly via a one-stop shop, namely the insurer, based on pre-agreed terms and conditions and with use of the insurers' claims centres. They could also potentially advise on emergency measures appropriate to the customer's situation;
- Claims settlement would be calculated by the insurer (in the back office);
- Insurers cannot bear the financial cost of a major flood alone, not even with reinsurance. The government is needed for this. The greater the involvement of the government, the less reinsurance will be required on the international market;

- The government's financial participation guarantees that the government has an interest in keeping water management under control;
- It will also encourage residents and SMEs to consider implementing measures against flooding. Insurers can further stimulate prevention among their (potential) customers, for example via policy terms and conditions, awareness and advice.

Investigate in greater depth the options for a public-private compensation solution for customers behind primary flood defences.
Without the collaboration of the government it is not feasible for insurers to insure damage or loss caused by the failure of primary flood defences. In extreme scenarios, the claims are too high for the insurance and reinsurance markets to bear. However, insurers could process claims for flood damage caused by the failure of primary flood defences and bear a portion of the risk. To this end the Dutch Association of Insurers has already reviewed several scenarios and presented these to various government ministries, which are now studying the proposals in more detail. The aim is to find a solution in which there is as much advance transparency as possible on which claims will be reimbursed. The safety net scheme that regulates the Disasters and Serious Accidents (Compensation) Act (Wts) will then need to be modified. One option is a new public-private insurance construction. The idea of a public-private partnership here is to shorten the period of uncertainty for residents and businesses with respect to compensation following flooding and to ensure that damage can be repaired more quickly. This will also safeguard investments and mortgage collateral and in doing so serve the broader public interest.

3.3 Solutions for the consequences of land subsidence in the built environment

Foundation problems for which a solution is being sought

Climate change will lead to the Netherlands becoming drier in coming years. For the built environment, increased drought conditions will mean a higher risk of foundation problems and wildfires. We zoom in on this theme of foundation problems because we anticipate a huge impact here and because mortgages constitute a significant portion of the portfolios of financial institutions.

Soft ground and foundations

Homes have been built on soft ground for centuries (mainly peat and clay) in many parts of the Netherlands. A variety of different foundations have been used to do this:

- Properties that predate 1970 are built on shallow foundations (natural foundations) and prone to subsidence, which can be exacerbated by drought caused by climate change;
- Properties with wooden pile foundations are susceptible to pile rot, which is exacerbated by drought or lower groundwater levels;
- Properties built after 1970 usually have concrete piles as foundations and are therefore less prone to foundation damage.

In addition to the impact on homes, drought and land subsidence also affect public infrastructure, major public works, industry and industrial sites.

Cost of repairing homes

About 250,000 homes currently require urgent repairs to their foundations. It is estimated that if groundwater levels fall further in future (in the scenario: it is becoming drier), about one million homes will experience foundation problems.

Repair costs are low in 80 percent of cases (less than €10,000 per home) but can also rise substantially (€30,000 - €120,000) if the foundations need to be upgraded. The total costs for damage to foundations in the Netherlands, in the event of a climate that theoretically does not change further, are estimated by Deltares in its report *Impact droogte op funderingen (Impact of drought on foundations)* to be between €5 billion and €39 billion. Increased drought conditions could push up this amount by between €3 billion and €15 billion. These estimates date from 2020 and have since risen (due to a lack of construction materials and manpower). The Kennis Centrum Aanpak Funderingsproblematiek (KCAF, knowledge centre for foundation problems) estimates that total damage to foundations in the Netherlands could rise to €60 billion (*Funderingsschade door droogte (Damage to foundations caused by drought)*) and Deltares estimates this to be €20-30 billion (*Naar een kennisagenda funderingsproblematiek (Towards a knowledge agenda for foundation problems)*). Early identification of damage to foundations and repair can reduce costs as this can potentially prevent more severe damage.

The role of financial institutions in foundation solutions

Before making recommendations on how the government and financial service providers can contribute jointly to solving these foundation problems, in the next few sections we first examine the provision of information, pricing and financing by financial institutions.

Risk analysis and information - Insight into the risk of damage to foundations

The lack of accessible information on foundation risks creates both information and knowledge asymmetry. This applies to house sales and homeowners, for instance. It is important that homeowners and buyers are aware of the foundation risks at an early stage so that they can take appropriate measures. ING, for example, responds to this by offering its (potential) customers a *home check*. The report on the home, which can be arranged online, specifies the flood and foundation risks, among other things.

There are several challenges when it comes to determining the risk of damage to foundations at individual property level. Factors such as ignorance about the type of foundations, uncertainty about the state of the wooden piles and lack of information on the groundwater level and soil conditions make it difficult to make accurate predictions.

The goal of the *KCAF* is to collect knowledge and make it available. It provides public information at neighbourhood level via the *Funderingsviewer aandachtsgebieden (Foundations viewer focus areas)*. At individual property level, it has developed the *Fundermaps* application, which can visualise and analyse damage to foundations. Use of this information is subject to a fee.

The KCAF has developed a foundations risk report that it is currently mandatory to add to valuation reports. A variety of modifications have improved the quality of the data, although we note that the data continue to evolve. In addition to the KCAF, the Kenniscentrum Bodemdaling en Funderingen (*KBF, Land subsidence and foundations knowledge centre*) also actively shares knowledge on this topic with central and local governments, businesses and private individuals.

Price incentives - Pricing

It is important for customers and financiers that climate risks (such as damage to foundations) are properly incorporated into the valuations of properties as, when these need to be addressed, this involves costs for prevention or repair. If damage to foundations is detected, the market price will fall (ceteris paribus).

The study *Gemelde funderingsschade leidt tot forse prijskorting bij woningverkoop (Reported foundation damage leads to sharp discount on sale of property)* illustrates that climate risks are not explicitly incorporated into market prices at the moment, unless there are specific disclosures of poor or repaired foundations on real estate website Funda. This was the case for 2.2% of homes in the period January 2019 - June 2022. These disclosures have a significant impact on prices, according to this study pushing them down by an average of 12% for poor foundations and up by 2% for repaired foundations. It is possible that this average decrease in value of 12% mainly relates to houses with extremely poor foundations, so poor that disclosure is unavoidable. The actual average decrease in value over all homes with some to severe damage to foundations is likely to be smaller. This is underlined by the finding that repair costs are less than €10,000 in 80% of cases. We believe it is important to conduct more research and improve insight into this topic.

The risk of damage should ultimately be part of price negotiations (know what you are buying). Yet in our view this information requires greater nuance than is currently the case in the Fundermaps appendix to valuation reports, as these are 'merely' estimates. They are often good estimates but if the situation is potentially different in practice, then they cannot be used properly in price negotiations. As a start to improving this, when selling a property it could be made mandatory to disclose relevant facts, such as the type of soil and foundations. And then in future this obligation can be expanded as soon as more facts are known. A kind of growth process, with the advantage of more gradual incorporation of these aspects into property valuations.

Once information on foundation risks is verifiable and leads to more widespread changes to the way we need to view risks, this will in turn be adopted by the market. The speed at which damage to foundations is reflected in house values (step-by-step versus a shock) ultimately touches upon a distribution problem. Major banks ABN AMRO, ING and Rabobank are currently researching the impact of physical risks (including foundation risks) and of climate-mitigating and climate-adaptive measures on the housing market as follow-up to the study *Een economisch perspectief voor een grondige renovatie van de huizenmarkt (An economic perspective for a thorough renovation of the housing market)*. This research should generate policy insights that contribute to a gradual, fair and cost-efficient transition to climate-neutral and climate-proof housing stock (due to be published in early 2024).

Insurability and financing

Damage caused by subsidence is not insured in the Netherlands. It is only possible to insure against the risk of 'sudden' and 'unexpected' damage. The risk of foundation problems caused by land subsidence cannot be insured as they are not unexpected. The building owner pays the repair costs for damage caused by subsidence. When problems are demonstrably caused by an intervention by third parties in the immediate surroundings, the costs can be claimed from these third parties.

It is important that customers affected by this have options for action. There are generally two options for financing foundation repairs by homeowners: an additional mortgage for those who meet the credit terms and conditions (see above) and a safety net construction for those who do not. In particular for those consumers who cannot afford specific measures, there is the safety net construction of the *Fonds Duurzaam Funderingsherstel (Sustainable foundation repair fund)*. Unfortunately, this fund is not yet nationwide (see our recommendation under Opportunities for collaboration).

Municipalities and housing corporations have the option of arranging long-term loans from BNG Bank or NWB Bank. The municipality of Woerden did this for the village of Kanis in order to repair public spaces. Calculations showed that over a period of 75 years it was ultimately cheaper for the municipality to do this than allowing the problems to take their course (source: SWECO).

Terms and conditions - Financing homes and total ownership costs

Several climate change-related factors are relevant to residential mortgages. The property's role as collateral acts as security for the mortgage provider. We believe it is important to work with information that is as specific as possible, and information on foundations should be a part of that.

Opportunities for collaboration

Foundation problems will become an increasingly major issue in the Netherlands as a result of climate change. The Working Group is a proponent of centralised policy for foundation repairs. Collaboration between the government and financial service providers could then enhance the approach to tackling this issue. Based on the described foundation problems, playing field and potential role for the financial sector, we see three important opportunities for elaborating on this further together:

- Improved information provision on foundation risks;
- Public and private financing options for foundation problems;
- Area-based approach to foundation problems.

1. Conduct research, share information and develop a standard

With respect to foundation damage risk (and other climate risks) for homes, we believe it is desirable for all the parties involved to have access to high-quality information. This prevents unwelcome financial surprises for both buyers and vendors and ensures that everyone can make a well-informed decision. We therefore recommend that municipalities in collaboration with the central government and provinces invest more in research into soil conditions and foundation risks in the Netherlands and that parties such as the KBF ensure that this information is shared properly. Existing homeowners will also benefit from early access to this information. This

information is mostly aimed at buyers at the moment. Start with facts such as the type of soil and foundations and then expand this once more information becomes available.

From the perspective of the financial sector, as a Working Group we will be happy to actively consider the shape this improved information could take. Specifically for foundation risk, our idea is to ensure the improved unlocking of foundation data for (potential) homeowners and include the type of foundations in the National Register of Addresses and Buildings (BAG). Deltares endorses this in its *Position paper* for the *Rondetafelgesprek funderingsproblematiek (Foundation problems roundtable discussion)* (May 2023) held by the Lower House of the Dutch Parliament. In a broader sense, there are now a variety of initiatives that aim to create insight into climate risks. We recommend developing a joint standard within these (see also this *rationale* by ING for a standard method of estimating physical climate risks).
For the individual parties involved in the purchase of a residential property, improved information will in our view result in the following responsibilities and recommended measures:

- The **homeowner/vendor** must be aware of the risk of damage to foundations and its potential financial impact;
- In our opinion, the **KCAF** is well-positioned for providing information on foundation risk. We advocate the low-threshold unlocking of this information at individual property level;
- As representative of the vendor, the **estate agent/Funda** provides potential buyers with information on the property.
  We advocate that in the event of an increased risk of damage to foundations, the estate agent states this in the sales brochure on behalf of the vendor;
- The **valuer** is responsible for providing potential buyers with more detailed information on the property's foundation risk. It is important that the valuer incorporates their local knowledge of foundation risks into the valuation report;
- The **mortgage broker** is responsible for advice on responsible financing of the purchase of a new home;
- The role of the **mortgage provider** is to provide the funds for the mortgage.
  Measure: Foundation risk should form part of the acceptance process of mortgages. We think this can happen at several levels:
  - By the government making a foundation survey mandatory if there is a high risk of (signs of potential) foundation problems;
  - Foundation problems can lead to higher repair costs. This could be taken into account in the mortgage. Banks can include this in their own acceptance criteria. One condition is, for example, that enough reliable and specific information is available on this and that there is concrete information on when this could arise. This is not that easy in practice;
- The **notary** ensures that property transactions run smoothly;
- The **government** can enforce the abovementioned measures via legislation.

These recommended measures have (mostly) not yet been agreed with the parties involved and form a starting point for further consultation.

2. Financing
Homeowners can currently only borrow funds from the *Fonds Duurzaam Funderingsherstel (Sustainable Foundation Repair Fund)* if their municipality signs up to this via a cooperation agreement. Talks are currently ongoing that should lead to this fund becoming nationwide and to

amended fund terms and conditions, with the aim of this revised fund starting as of 1 January 2024. The new Sustainable Foundation Repair Fund must be able to provide sufficient funds to enable an effective national approach to tackling foundation damage for those who cannot fund it themselves.

We recommend the following in relation to this fund:

- Make the fund more accessible for the repair of foundations and ensure that it is truly nationwide;
- Structure the fund as a sound alternative when financing via the mortgage provider is not an option (aimed at everyone who cannot fund it themselves). The number of people unable to borrow funds to pay repair costs and applications to the scheme could rise sharply in coming years and this needs to be taken into account as well;
- Have the fund apply market rates.

3. Area-based approach

One of the biggest challenges in foundation repairs is to get all the homeowners in a block of flats in which at least one home requires essential repairs on board for simultaneous and adequate repairs. The municipality has an active role in informing and assisting residents throughout the process. Rotterdam and Dordrecht, for example, have foundation repair programmes in which this approach is structured per building block and addressed effectively. If a homeowner refuses to participate, a municipality can opt to send them a formal notice. This means that the owner is forced to participate. However, it is a lengthy and difficult process. Municipalities with urgent foundation problems are in our view well-positioned to direct an area-based approach to this problem. For smaller municipalities with foundation problems, a lack of resources (money and manpower) is often the restricting factor. Direction and assistance from central government is required to address this.

The municipality can play a key role in communications with homeowners and in directing this issue at area level. Valuable lessons could potentially be learned from the experience acquired in the Natural gas-free area-based approach (*Voortgangsrapportage Programma Aardgasvrije Wijken (Progress report on natural gas-free areas programme), Monitor 2021*).

3.4 Climate solutions in agriculture and horticulture

Challenges

The climate change challenges for agriculture that we identified in section 2 are: increased heat stress, hail damage, increased flooding, more prolonged periods of drought, more crop diseases and salinisation. These have consequences for crop yields and their quality and for animal

welfare, as well as causing more damage to greenhouses and stalls. In this section we discuss solutions and actions for these challenges.

What are farmers and horticultural businesses themselves doing about climate adaptation?

Organisations operating in Dutch arable farming chains are collaborating via their *sectoral organisation (BO Akkerbouw)* on creating a climate-proof environment. The goal is to identify new breeding methods for robust varieties, sustainable soil management, water-saving techniques and increase water storage capacity (*Ruimte voor de Nieuwe Akker (Capacity for new fields)*, 2023).
The measures found on government portal *Klimaatadaptatie Nederland (Climate adaptation Netherlands)* are: resting crop cultivation, increasing organic matter in soil for improved sponge effect, use of lighter machines, placing dams and enabling water storage, adjustments to groundwater levels and different irrigation methods to combat drought. Or placing nets to protect against hail damage, or taking out insurance against damage caused by storms, hail, drought and intense precipitation.
The vulnerability of greenhouse cultivation to hail and storms is reduced by the use of tempered glass and improved constructions.

Business model

Agricultural and horticultural businesses find themselves in a transition phase towards (more) sustainable business models. The soil requires a recovery period in this transition phase, which can mean a decrease in crop yields. This has an impact on the business model in the short term. Funds are needed for this that can be paid for out of the businesses' capital or loan capital. A bank, chain and/or government can provide these funds and a public-private partnership is needed here. The government has already initiated policy in this respect, such as via the 'Water and soil in spatial planning' policy agenda and Investeringsfonds Duurzame Landbouw (Sustainable Agriculture Investment Fund). Here we focus first on what financial institutions themselves can do.

The role of financial institutions in adaptation solutions

Alignment with agricultural policy - For the pillars of water system, crops and cultivation systems and soil system in the *Actieprogramma klimaatadaptatie landbouw (Agriculture climate adaptation action programme)*, financial institutions play a role as co-financiers of the required changes, as insurers of risk and as investors in agricultural land, for example. And they face transition opportunities and risks for their customers as a result of changes. Furthermore, they can contribute by sharing knowledge and via networks (pillar 5, support). This also overlaps with the move towards sustainable agriculture. In terms of sustainability, Dutch financial institutions have committed to the Dutch National Climate Agreement, while a number of financial institutions have likewise signed the international *Finance for Biodiversity Pledge*. If we examine the role and initiatives of financial institutions in practice, this starts with the fact that they can help farmers to finance making their businesses more sustainable.

Risk analysis and information - The transition to sustainable agriculture depends on in-depth discussions with customers on the outlook for the future. Banks have conducted studies for each sub-sector in agriculture and horticulture to examine what the future could look like (impact, risk and scenario analyses). As an example, see these two studies from Rabobank: *Akkerbouwer wordt zoetwatermanager: de invloed van toenemende droogte op de Nederlandse akkerbouw (Farmers become freshwater managers: the impact of increasing drought conditions on Dutch farming*, October 2023) and *Agrariërs: houdt controle over milieugebruiksruimte (Farmers: retain control of the environment*, September 2020). Banks here assess several aspects associated with sustainability, such as in addition to nitrogen emissions also soil, animal welfare, greenhouse gases and water quality. Account managers at banks use this information and information from individual businesses to talk to their agriculture and horticulture customers and discuss options for innovation, extensification, transition, relocation or closure (*information*).

Soil containing more organic matter can retain more water. This improved sponge effect is positive in the event of heavy rain (water that is absorbed does not need to be discharged) and drought (less crop damage due to increased availability of water). The government has a steering role here and financial institutions are also taking the initiative. They are doing so by means of the *Open Bodem Index (method for evaluating soil quality)* (OBI). This enables them to inventory the quality of the soil. The OBI can become (and already is for some parties) part of the sustainability score used by institutions to assess businesses.

The Dutch government has formulated the ambition of *achieving 10 percent interlacing soil networks of green and blue in 2050*. Interlacing networks of green and blue can contribute to sequestering CO_2 when it involves hedgerows and similar. And if you add nature-friendly riverbanks, you can absorb and retain more water in the event of heavy precipitation. Moreover, this enhances nature and landscape and in turn biodiversity.

Financing and price incentives - Banks provide loans for these transitions. They offer discounts on interest rates to stimulate sustainability (*price incentive*) as well as grace periods and can, for instance, offer temporarily more flexible financing to enable businesses to make the step towards more sustainable business operations. This is because the transition may involve a temporary drop in income and it is precisely at this time that new investments will need to be made. A bank can offer a bridging loan and/or temporarily accept a lower interest rate on loans. The business plan does need to be aligned with the province's area-based approach, however, and there must be the prospect of an economically-viable business model. Based on sources relating to the agricultural agreement, national newspaper Het Financieel Dagblad announced that *Dutch banks will make a total of €4 billion* available for making agriculture more sustainable. Of this amount, a large portion will be provided via Rabobank, which *indicated* that it would furnish €3 billion in loans with amended terms and conditions for financing the transition to sustainable agriculture.

Terms and conditions - The terms and conditions for loans take into account performance on several sustainability criteria: including nitrogen emissions, soil, animal welfare, greenhouse gases and water quality. It is up to each individual financial institution to define their own terms and conditions and in doing so set themselves apart from each other.

For crops and cultivation systems, there could be a further role for insurers in which they can set sustainability performance criteria for soil, water and crop cultivation. It may well be possible to restrict risks via more sustainable business operations that also embrace climate adaptation. The insurer could cover the risks of potential damage to crops caused by the rest period for soil. However, this is not easy without clear-cut standards. In addition, monitoring of this is complex and makes it a challenge for insurers.

Opportunities for collaboration

The Working Group on Climate Adaptation has identified a number of opportunities for collaboration in its discussions on climate adaptation in agriculture and horticulture.

(1) Clear-cut standards, quality seals and agreements on measuring climate adaptation in agriculture - Farmers, financiers, insurers and investors need clarity in the shape of transparent standards. This would define the required direction (goal/performance) and/or interpretation (measures) of business operations. In doing so it would become clear what is to be measured and how in relation to climate adaptation and soil use. In broader terms, this also applies to other developments in agricultural sustainability but we focus on adaptation in this report.
Collaboration and consultation between the market and government are required here. It is also important to prevent the proliferation of quality seals, initiatives and projects that all aim to reinvent the wheel. We advocate adopting e.g. measurement instruments such as the Open Bodem Index and Biodiversity Monitor and that these form part of public and private working methods and funding policy (see also the study *De BiodiversiteitsMonitor Akkerbouw in de praktijk (The Biodiversity Monitor Farming in practice)*, 2023). The standards could also include (participating on) rainwater storage for re-use.
With respect to crops and cultivation systems we also see a potential role for insurers, which can define criteria/terms and conditions within insurance cover or talk to customers about introducing improvements to locations and sustainability performance on soil, water and crop cultivation and implementing preventive measures.

Within the framework of the Ministry of Agriculture, Nature and Food Quality's recycling vision, WUR researchers in collaboration with industry (including via pilot projects) are working on a set of Key Performance Indicators (KPIs). The preference is for this planned broad set of KPIs to include KPIs that indicate how climate-adaptive agricultural production is as well.
Clear-cut standards, quality seals and agreements serve to enhance risk analysis and information for customers, while they can form a framework for price incentives and with transparent lower thresholds be used in terms and conditions.

(2a) Upscale public-private funding, joint instrument: the Sustainable Agriculture Investment Fund - In the *Sustainable Agriculture Investment Fund* (IDL) subordinated capital is offered at attractive lending conditions via the National Green Fund. Loans are made to businesses with an 'integrated sustainable transition plan', i.e. the fund will make meaningful modifications to business operations for several sustainability goals. The fund assets provided by the Ministry of Agriculture, Nature and Food Quality for the pilot period up to and including 31 December 2023 amount to €31 million. In this pilot phase, a maximum of €400,000 is available for each business. A long-term IDL is currently being worked on to follow on from the pilot

scheme. Businesses pay a low rate of interest (1%) and do not need to make any repayments in the first few years. Within this multi-year fund there will also be a minimum of 40-60% co-financing on top of this loan, such as a loan from the company's (main) bank, capital, crowdfunding etc. This fund will provide support for farmers and provides direction for making the transition under transparent criteria/terms and conditions.

(2b) Upscale public-private funding, line up financing and financing -
On the basis of uniform sustainability standards (see previous point), it is also important to work with chain parties from a variety of sectors on specifying the 'accumulated rewards' for services that farmers provide to maintain or restore nature and landscape and promote biodiversity above and below ground. These services can contribute to resilient soil, water and crop/cultivation systems within the context of climate adaptation. Collective rewards for services will help accelerate the transition to sustainable agriculture.

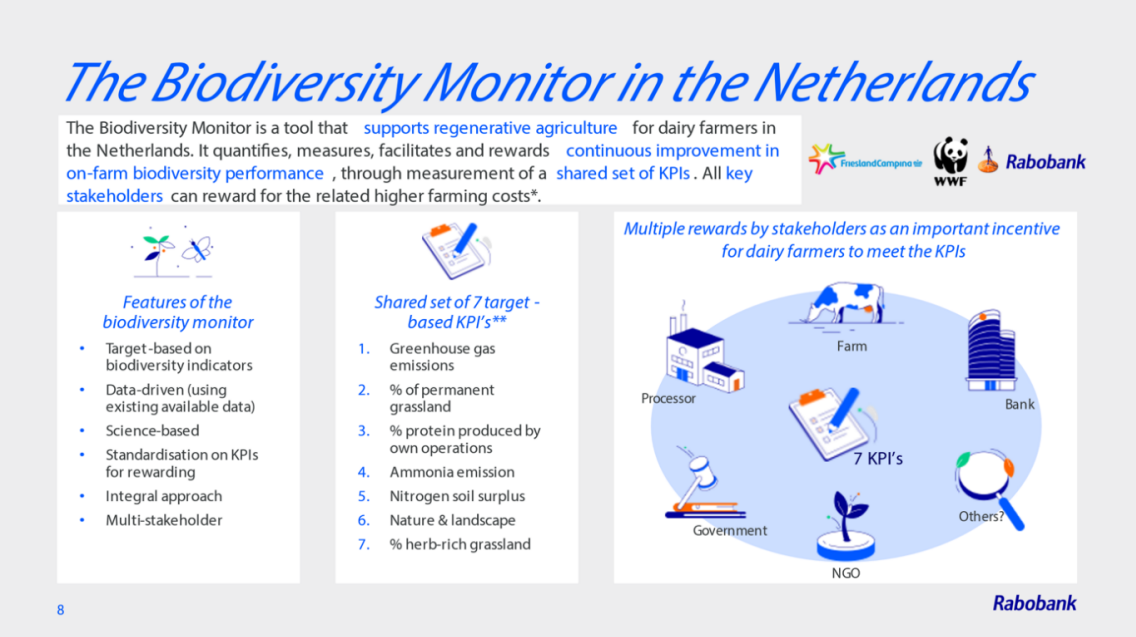


Figure 9: Example from Rabobank for 'accumulated' financing by means of proven performance, such as via the Biodiversity monitor.

(3) Stimulating innovation: precision agriculture, drip irrigation and irrigation using effluent - Further development of climate-smart agriculture via innovations such as precision agriculture, drip irrigation and irrigation using effluent can help to increase the resilience of agriculture.

- In addition to the customised use of fertilisation and crop protection using GPS, sensors on the ground or from the air, and computers in agricultural machinery or vehicles, precision agriculture can enable improved strip cropping or restrict soil compaction as well;
- **Drip irrigation** is being investigated with a financial contribution of 50 percent of the costs via the Hagelunie innovation fund. One of the preliminary findings for onion cultivation is that this reduces the consumption of water by two-thirds. The next innovation being investigated in this pilot scheme is fertigation, in which plant nutrients are also added to the drip irrigation

process. The knowledge acquired via the innovation fund is actively shared with, among others, employees of insurer Achmea;
- The safety of **irrigation using effluent** from sewage treatment (RWI) is being investigated by a consortium headed by the WUR. The study is focusing on inventorying the risks of spreading contaminants on fruit and vegetables, the health risks involved and what water treatment and monitoring are required to prevent this. The use of RWI will mean that less groundwater will be required and could potentially ensure that crop irrigation remains possible in coastal regions (with salinisation).

In the opinion of the Working Group it is important to further investigate and fund this type of innovation. Standards and policy must contain capacity for and stimulation of this, as well as safeguards for the legal soundness of the innovation. For example when an agricultural business applies to a municipality for a permit to construct a water basin or on admission of an innovation to the Dutch market. In addition, we need to remain alert to whether an innovation can form part of positive terms and conditions for implementation, such as the tax incentive via the *MIA/Vamil scheme* and *Green Projects Scheme*.

(4) Broader terms and conditions in weather insurance – Via *broad weather insurance* businesses can insure themselves against damage to crops caused by extreme weather. This involves damage caused by hail, rainfall, (night) frost, storms, drought, snow, ice and fire caused by lightning strikes. Businesses can obtain subsidies for the cost of premiums via the Netherlands Environmental Agency. Interest in broad weather insurance grew by about 16% a year on average in the years up to and including 2022 but stagnated in 2023. It is nevertheless a challenge to ensure cost price premiums. The dry summers of the past few years have led to relatively high payments. Extreme weather is expected to occur more frequently because of climate change, so without climate adaptation the risks will increase and premiums will have to rise. We recommend investigating how other countries deal with this. Significant premium differentiation by insurers based on implemented climate adaptation measures could promote the rapid implementation of such measures, for example, and contribute to keeping total premium costs affordable. The premium subsidy scheme and tax-exemption for premium tax are being evaluated in 2023. Following submission of the evaluation report, this is the right time for the sector, insurers and the government to review the adjustments that can and/or need to be made by which party or parties to further develop climate-proof insurance as the final element in the risk management of weather-related damage or loss. More prolonged and more extreme periods of drought are predicted for the coming decades. A potential next step might be to investigate how other countries deal with this. Premium differentiation by insurers based on a clear measurement system could be another next step.

(5) Research into crop protection on increase in diseases – Further research is needed into how to deal with more crop diseases caused by higher temperatures, while at the same time fewer pesticides may be used. The reduction of chemical pesticides is occurring at a faster rate than the development of alternatives. As a result of this, Dutch growers lack a familiar set of tools for combating disease and pests. Preventive spraying against diseases and pests is carried out as a sort of insurance against damage. Can an insurance policy really be a substitute for that? And what role do organic cultivation methods play here? How can innovation and admission of

(nature-based) innovations in crop protection be accelerated? We believe that dialogue on this is essential.

We will continue to discuss these topics in our Working Group in the coming months.

3.5 Solutions for industry

Challenges

In section 2 we saw that more frequent periods of drought and more extreme drought, heat stress, more extreme precipitation and more flooding can affect industry just as they can every other sector. Industry needs to take account of reduced water supplies at times of drought, restrictions on discharging process water into rivers, more frequent disruption to international supply chains, heat stress that can adversely affect employees and in general more climate-related damage or loss and environmental risks. In this section we discuss solutions for climate adaptation in industry and corresponding actions for the government, industry and financial sector.

At the end of this section we look specifically at industrial sites as we believe significant results can be achieved here. A number of challenges and opportunities come together here, as these sites are currently mainly structured based on efficiency and accessibility and take the climate and quality of life into account to a lesser extent or not at all. These are often paved areas containing a large amount of asphalt and few green spaces.

Developments aimed at industry

The Dutch government[2] wants the Netherlands to lead the way in making industry more sustainable and in realising the solutions required to do so, such as technological innovation and a circular economy. A *National Programme for Sustainable Industry* and Roadmap have been created to this end (see Letters to Parliament by Adriaansens, *2022* and *2023*; these publications are leading for this section on policy).[3] Although this approach is much broader than adaptation alone and consequently yields less focus on solely that aspect, in our view this approach makes sense. Climate and other environmental challenges are closely correlated with each other and mitigation and adaptation are two sides of the same coin. Both require action now to prevent the situation from worsening. Moreover, businesses address these issues collectively.

[2] At the time of this report's publication the Netherlands had a caretaker government. Decisions on the use of instruments such as taxes, subsidies and standards are political and therefore depend on the outcome of the elections.

[3] The national programme and roadmap are geared towards implementation. Together the two documents form a decision-making agenda and also set out the preconditions, such as capacity for the energy transition.

Industry provides many basic necessities and closing or relocating polluting industries is not a long-term solution in the eyes of the Dutch government (to be viewed as a form of regulation, in line with the types of instruments). Making industry more sustainable is a long-term solution, however, and provides opportunities for the Netherlands' future earning potential. Adaptation is also needed to continue competing internationally. The Netherlands views adaptation and sustainability as an opportunity to set itself apart from other countries.

The drive to make industry more sustainable will require new production facilities to be built, existing facilities to be modified and some products to be reduced (such as fossil fuels). The government stimulates businesses that want to make this transition, formulates standards for circularity and prices carbon emissions (= use of incentives and regulation instrument). Nitrogen emissions will also need to be cut. The economic process will ensure that businesses that either do not want or are unable to make the sustainability transition will disappear in the long term.

In its industrial policy, the government will use the steering instruments of *stimulating, standardising and pricing* to encourage industry to make the required modifications. The government has released additional billions to stimulate innovation and upscaling of (green) technology within industry, especially for customised agreements on carbon emission reductions and innovation in SMEs (€3 billion) and the National Growth Fund (€20 billion in total). In the National Growth Fund, choices are made in favour of investments in value chains and technologies that the Netherlands believes are promising, such as *quantum technology, photonics and green plastics*. Initiatives by knowledge institutions and businesses are selected on the basis of a specific process, at the recommendation of an independent committee. Customised agreements on carbon emission reductions form part of this as well.

There are a number of initiatives in which central and/or local government fulfil a supporting role towards industrial sites and seek collaboration with financial institutions, for example to align flanking policy and financial instruments with one another in order to facilitate sites and their businesses in becoming climate-adaptive industrial sites:
Samen Klimaatbestendig has set up a broad network around blue and green industrial sites and written a publication on how the parties involved join forces. The portal contains several examples and a knowledge dossier too.
Within the *Adaptatie Atelier (Adaptation workshop)* foundation, municipalities, water authorities and provinces collaborate together with others in various working groups on making private assets greener. Here they examine both policy and financial instruments and develop and test these in practice. The industrial sites working group was set up in mid-2022 and financial institutions are welcome to take advantage of the opportunities for collaboration.
Werklandschappen van de Toekomst (Work landscapes of the future) is a coalition of over 30 partners that works in a joint innovation and research programme to make Dutch industrial sites greener. With a contribution from the Growth Funds of €26 million there is a focus on flanking policy, underpinning the green business case, a knowledge agenda and financing instruments. As soon as the stage of developing financing instruments has been reached, members of the Working Group on Climate Adaptation will be involved.
Some provinces have a specific approach and/or subsidy scheme for future-proof industrial sites, including the provinces of *Gelderland*, *South Holland* and *North Brabant*.

What can industry do about climate adaptation?

Risks within the value chain

Businesses (industry) can prepare themselves for climate impact by working according to scenarios (large companies) and assessing the physical risks for the company and sector. What is the extent of their exposure and what are the options for restricting the risk? This applies within the company itself but also to its suppliers and customers. Businesses can also analyse the expected applicable developments in environment-related legislation and climate-adaptation requirements. The collection and interpretation of climate data is a priority for all parties as well.

Raw materials and transport

More specifically, there are risks and adaptation opportunities when it comes to access to/availability of raw materials for industry. These materials will perhaps become more expensive or supplies become less reliable as a result of climate change due to, for example, extraction difficulties and disruption to transport. Businesses can restrict the consequences by attempting to be less dependent on specific raw materials or certain suppliers. Or by trying to arrange insurance.

Opportunities

Several opportunities emerged from discussions in the Working Group, and although the time available in the context of this report was too short to do so we believe they merit further investigation:

- Increasing demand for energy-efficient cooling;
- Increasing demand for water technology in the broadest sense, such as pumps and drainage systems;
- Stimulate circular (and local) products, reducing the dependence on long supply chains. These chains may be disrupted by a changing climate;
- In line with the industrial site approach: green and climate-proof planning of the site and building.

The role of financial institutions in adaptation solutions in industry

Financial institutions firstly play a role towards industry - whether it involves energy, chemicals, construction or any other industrial sector - in providing financing, arranging funding, project financing, insurance and so on. Investors provide funds and use their voting rights to exert influence. Financial institutions are a link in the economic system.

Industrial sites

One example of where a challenge lies for industry is industrial sites. These occupy 100,000 hectares in the Netherlands and only one percent constitutes natural elements. As a result, 87 percent of the 3,500 industrial sites are prone to flooding caused by heavy precipitation (source: *Werklandschappen van de toekomst*, IVN). This must and can be addressed with urgency. Furthermore the expectation is that, if nothing changes, in 30 years' time the 'feels like' temperature on summer days on industrial sites will rise to 40.8 °C. These problems could be

eliminated by making industrial sites greener and in turn making them more attractive workplaces for employees.

No-regret measures

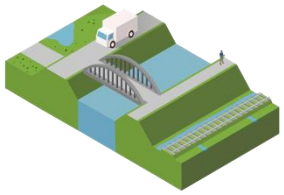
The Adaptatie Atelier defined a number of no-regret measures for businesses and industrial sites during its *meeting* in September 2023: removing impervious surfaces (for sponge effect of the soil and cooling), planting trees (water absorption and cooling) and hedges rather than fences. These measures are also good for biodiversity, as long as they are selected and installed with care.

Opportunities for collaboration

There is a need mostly, but not exhaustively, for the following in the next steps:

- More precise quantification of the risks for businesses and sectors, for certain locations, scenarios etc.: impact analysis in relation to the real economy and society;
- Translate the risks for businesses into potential risks for financial institutions as well;
- Identify potential (adaptation) strategies for restricting the risks - primarily by the businesses themselves and with government policy to safeguard and preserve the resilience of the physical economic structure. In addition, financial institutions can restrict certain risks via their acceptance policy, by pricing risks (or offering lower interest rates when measures are implemented), by setting terms and conditions relating to implementing measures or requiring insurance;
- Identify opportunities for public-private partnerships: translate potential solutions into the required contributions of financial institutions and identify opportunities and the need for collaboration with central and local governments.

3.6 Climate solutions in transport



Challenges

In section 2 we discussed the fact that climate change has an impact on the transport sector as it causes physical damage to infrastructure and because the conditions for using the infrastructure become more challenging. More damage is expected to roads, railways, bridges and ports, electricity and telecommunications networks, while maintenance costs for infrastructure will rise and there will be greater disruption to road, water and air transport. The safety and reliability of infrastructure is a task for governments as they possess the resources and knowledge to do this.

Via the *Delta Programme* and protection of *Vital and Vulnerable functions*, central and local governments are restricting the growing risks associated with infrastructure and transport. They do this via flood defences, water storage strategies, designating floodplains, constructing

infrastructure in different locations, adjusting building regulations etc. There are plenty of ways to protect the Netherlands, as long as the rising sea levels and other types of climate impact remain within manageable limits.

The same applies to the transport sector and shipping companies. Transport and shipping companies can prepare themselves thoroughly by obtaining insight into their own vulnerabilities and the risks in the supply chain or at their customers. But also by drawing up contingency plans, such as the use of alternative routes.

What are transport and shipping companies themselves doing about climate adaptation?

Business operations and reporting

It is our impression that transport companies already take disruption to routes caused by weather conditions into account and adjust their business operations accordingly, insofar as they are able and mostly in the short term. For instance, they often opt to insure themselves against specific risks. Listed companies also report on climate risks and issues such as carbon emissions (see e.g. *the Carbon Disclosure Project* (CDP), which analyses these reports), as discussed *in this memo* containing international examples and steering in relation to climate adaptation for the transport sector. The challenge of climate change is that disruption will occur increasingly frequently and on a larger scale. On top of this, in terms of impact it is important to note that different parts of the world are increasingly connected thanks to globalisation. Disruption in one location can quickly have repercussions elsewhere.

Acquisition of knowledge

Transport companies can also restrict risk by acting decisively and in a timely manner, acquiring knowledge of climate change, identifying potential bottlenecks in transport routes and considering alternative routes. At an *international level*, for example, the International Union of Railways (UIC) is working on predicting and preventing damage and improving the resilience of the rail system of infrastructure, operations and transport companies.

Innovation in hardware

Investment in hardware can also help, such as the use of smaller and lighter ships that can more easily navigate rivers if water levels are low due to a prolonged drought. This type of ship, with a draught that is about 20 cm shallower, mainly makes sense if supply security is important in extreme conditions. Or, as just one of many examples, improving cooling systems in lorries to be better prepared for higher temperatures and heat stress.

The role of financial institutions in adaptation solutions in transport

Risk analysis and information – Financial institutions can hold periodic meetings with customers from the transport sector on climate and sustainability. They also make sector analyses in which climate impact can be included as a major risk. This involves not only the risks

but also the opportunities for businesses, for instance by responding to changes more quickly and effectively than their competitors.

Financing and price incentives – Banks and investors offer loans and impact investments for making economic sectors more sustainable, including the transport sector. At the moment, this mainly applies to the sustainability of ships or road transport. Similarly, they can develop new financial services for measures that businesses *need* (legislation) or *want* (own ambitions, to keep costs manageable or for competitive reasons) to implement in relation to climate adaptation. In this respect it is important for the financial institution that the measures can be viewed objectively and monitored. This is essential to being able to make a sound risk assessment and report on the financing properly as transition loans or impact investments, for example. Loans (and investments) can then qualify for the EU Taxonomy or for a Green Asset Ratio.

Terms and conditions – The overview of examples of products and services (Appendix 4) contains examples for individual sectors that we are aware of and are publicly available.

Opportunities for collaboration

The Working Group on Climate Adaptation has identified a number of opportunities for collaboration in discussions on climate adaptation in transport, for potential further follow-up at sector level by the sectoral organisations:

- Share knowledge of measures in the context of the critical infrastructure programme and availability of expertise for businesses and financial institutions;
- Collaboration of the sector and financial industry with knowledge and data partners, and (further) unlocking of data at sector level, monitoring and reports on trends in claims;
- Clear standardisation by the government, for example for the navigability of the rivers: then inland shipping companies can examine together with financial institutions what long-term modifications are needed to the fleet and, for example, ensure that this is aligned with the broader sustainability process/engines with lower carbon emissions.

We will continue to discuss these topics in our Working Group in the coming months.

3.7 Solutions by institutional investors

In this report we discuss the role of banks, insurers, asset managers and pension funds combined. As most examples come from banks and insurers, it seems a good idea to explain the role of institutional investors separately.

The role of institutional investors in adaptation solutions

Investing in economic activities

Institutional investors occupy a role in the economic system as investors in economic activities and in doing so they assess the expected risks and returns. The main task of institutional investors here is to invest the capital entrusted to them properly. In the case of pension funds,

this involves pension contributions from employees, at insurers this derives from paid premiums, at asset managers this is money from both private and institutional investors such as pension funds and insurers. The principle is always the same. Based on a risk/return assessment and test against the fund's mandate and then the asset owner's instructions to the investor, a certain portion is invested in say company shares and (government) bonds. Investors also take sustainability into account as an investment criterion here. After all, sustainability/ESG risks affect the current and future value of investments, either positively or negatively, and generate social risks. Climate adaptation is one of the aspects to be assessed as part of this process, as a potentially risk-mitigating factor for absorbing physical risks and transition risks. Regulator DNB therefore stresses the importance of ESG risks and increasingly incorporates these into its regulatory framework.

Impact investment

Investors can make use of impact investments as well. Impact investments are investments that in addition to a financial return also intend to make a positive contribution to sustainability goals, such as climate adaptation and mitigation. Some investors apply the definition here that this involves a 'supplementary' sustainable impact. Examples of this include investments in making homes more sustainable, boosting biodiversity at farms and constructing wind and solar farms. Impact investments can be made in a variety of asset classes. Examples include project financing, investment in private equity in businesses that are working on solutions or investment in bonds of which the proceeds must be used for sustainability projects (hereafter green bonds).

Influence via engagement and voting

Furthermore, institutional investors can exert influence on the businesses in which they invest. This might be via dialogue, known as engagement, and by exercising their voting rights on the shares they own. Only investors can do the latter, but engagement can also be done via alliances. One example of a collective engagement process relating to water risks is the *Valuing Water Finance Initiative*. In addition, Dutch pension funds collaborate within the *Dutch Engagement Network* (DEN), including by conducting engagement on water consumption in the food industry in relation to climate adaptation.

Institutional investors also vote at shareholder meetings. The motions that are put to a vote often involve the appointment of board members or profit distributions. Sustainability themes are increasingly being placed on the agenda though. This might include climate goals being incorporated into the remuneration policy for board members. Investors can themselves also submit motions on sustainability themes. However, drawing up and submitting motions takes up a great deal of time and capacity.

Terms and conditions and exclusion

Finally, investors can also decide to scale back the investment position and exclude specific sectors or businesses. Depending on the stance you adopt on this topic, the glass is either half full or half empty when it comes to the question of whether enough is being done. The trend is mainly towards conducting more engagement, alliances between investors, all complemented where necessary by the threat of withdrawing the investment altogether.

Opportunities for collaboration

Financing via green bonds

Institutional investors currently already invest in green bonds and green loans and this needs to be expanded. If these instruments are specifically linked to financing climate adaptation, it makes it easier for investors to steer their funds towards climate adaptation. This could be an instrument for financing infrastructure. It is essential here to guarantee the verifiable designation of climate-adaptation projects as adaptive. Green bond issuers are obliged to report on the allocation and impact until all the funds have been allocated or in target years, as this is a precondition for institutional investors investing in the bonds. Central and local governments and banks could issue more of these bonds in coming years, taking into account that climate-related damage and prevention will increase and more adaptation projects will be set up.

At the moment two types of green bond have been issued in the Netherlands that are directly linked to financing climate adaptation: by the State of the Netherlands for projects such as the Delta Plan (since *2019 and extension in 2021*, a total of approx. €3 billion, *2022 report*) and by NWB Bank for water authorities (since 2014, a total of approx. €8 billion). The bonds are restricted by the funding needs of the Delta Plan and water authorities, as well as by the investment options for investors in climate adaptation. When setting interest rates, issuers are dependent on demand for this type of bond among investors, sectors and other market conditions. For now, most investors do not distinguish between where the green proceeds from green bonds are spent, as long as the relevant standards (e.g. ICMA Green Bond Principles) and benchmarks (e.g. SBTi, EU Taxonomy) are applied. Investors could enter into dialogue on this with the government and NWB Bank.

New bonds for climate adaptation

New (types of) bonds are needed to facilitate more climate-adaptation financing via bonds. Climate-adaptation financing of housing corporations or municipalities could for instance be combined and issued as a bond by a public sector bank, such as BNG Bank or NWB Bank. Expenditure on climate adaptation must then be identified properly in order to be included in a bond. This could be done by setting goals in bond documentation or project-specific financing, where this is now normally unspecified balance sheet financing. Investors could perhaps negotiate with bond issuers to agree terms and conditions that are acceptable to both. An alternative is that investors themselves draw up frameworks to assess whether investments contribute to climate adaptation and are transparent about this. The issuing governments and/or businesses can then adjust their products accordingly. This will mean that they are not dependent on the bonds that are issued and enable investors themselves to actively contribute to financing climate adaptation.

Investigate how to improve insight into the benefits of climate adaptation for individual parties.
Investments in climate adaptation can have positive secondary effects, such as on insurance liabilities or the value of real estate investments. After all, climate adaptation can reduce damage or loss caused by extreme weather or lead to lower medical expenses as a result of the effect on health. This integral approach is not yet frequently applied to portfolio management or asset liability management but could improve the risk/return assessment. The starting point for this type of assessment is clarification of the benefits of sizeable climate adaptation investments and how these work out for the individual stakeholders (including financiers). This will facilitate an informed debate on financing and make it clearer which projects will not get off the ground based purely on economic grounds.

Ensure that the technical screening criteria for the EU Taxonomy for sustainable activities and related reports are workable in practice. Only then can investors, financial institutions and companies measure, steer and report on climate adaptation properly. Help with questions and answers and be understanding about the fact that it takes businesses time to comprehend and apply these requirements.
The Taxonomy is directly linked to reporting requirements on green investments for institutional investors and other financial institutions. The Taxonomy and other EU sustainability legislation, such as the Corporate Sustainability Reporting Directive (CSRD), provide a detailed framework for this. This framework has only recently been created. The reports of our customers will become available in the next few years. We therefore believe it is important to have adequate scope for structured feedback and that adjustments can be made where necessary. We note that this already forms part of the EU approach but especially wish to underline the importance of this.

Joint research

Various asset managers conduct joint research into water risks in their portfolio in collaboration with Deltares and the World Wildlife Fund (WWF). This research is a follow-up to a *discussion paper* on ESG water data and zooms in on the water risks in two river basins with a link to investment portfolios. The research aims to clarify the risks that are not yet being reported by businesses and how these gaps can be addressed, for example via engagement.

Catastrophe bonds

There may also be opportunities for developing *catastrophe bonds*. The bond issuer does not need to redeem these bonds in the event of a pre-defined catastrophic situation. In exchange for this, investors in these bonds receive additional return. For investors this is therefore a method of earning additional return, although the high risk means it can only constitute a small part of the portfolio. For the issuer it is a way of raising money if there is a tail risk that makes it more difficult to do so on the financial markets.

What are the obstacles here?

Limited capacity (and supply) for impact investment

First of all, there is limited capacity for impact investments at pension funds and insurers at the moment. The majority of the portfolio is invested in 'normal' government and corporate bonds, mortgages, private investment funds and equities that are assessed against standardised benchmarks that do not include this positive impact. A second major restriction is that - at least at the moment - there are a limited number of easily investable projects and businesses that match the mandate and risk/return sustainability ratio. Furthermore, it is important to monitor which infrastructure projects are being created for adaptation and how economic sectors are setting to work on this.

Transparent sustainability aspects

Another obstacle to impact investment is that it is relatively time-consuming, complex and expensive to analyse the sustainability aspects of propositions and verify information or monitor performance. Available analysis capacity and being able to calculate the costs are relevant factors here. This may well be possible for major transactions but is trickier for smaller transactions. Nevertheless, when viewed from a different perspective: as climate adaptation is prioritised more in the economy - out of necessity, because the climate impact and amount of damage are growing - and taking advantage of frameworks and definitions for adaptation - such as the EU Taxonomy, DGBC Framework, Green climate-adaptive built environment benchmark - more options will become available to investors. There is also currently a lack of sound and reliable ESG data on businesses. This will probably improve significantly in coming years, aided by the various EU legislative processes.

What else is needed?

Businesses need to inventory their water risks better, including in their supply chains. Institutional investors will then be able to collect more and better data, develop and standardise analysis methods and price ESG risks. Investors will also be able to use this information to conduct more effective engagement and/or submit motions to those companies that are lagging behind. We see a role here for data providers in standardising and unlocking these data. Investors will subsequently be able to participate more emphatically in businesses and bonds that contribute positively to climate adaptation.

For institutional investors it is likewise important that Dutch climate policy is effective and predictable. Institutional investors can best fulfil their role as investors, shareholders and risk assessors if there is clear government policy in which industry, residents and also investors know what is expected of them in terms of sustainability and reporting obligations. Roadmaps, support from the government, 'lined-up' subsidies and taxes, proper pricing of environmental risks (trying to internalise so-called external effects - as carbon emissions pricing aims to do) and approved measurement methods and wide availability of data. A large amount of climate policy demanding decisions will be on the table in the next government's term of office. Institutional investors apply a long-term investment horizon and can align themselves with this new policy in their investments.

4. In conclusion

This Working Group has initiated a great deal of debate between the parties in the financial sector and government and at other stakeholders. This has yielded ideas that we wish to explore further. It is for this reason that we are initiating pilot schemes. The importance of climate adaptation is obvious; what matters now is to identify the most effective methods and define the financial sector's role in this. We believe that the effectiveness of this role could be increased by adding incentives to financial products, such as insurance or loans, with premiums or discounts based on physical risks and adaptation measures that can restrict these risks.

Widespread communication is important here as well: we need greater awareness of climate risks and what you can do to restrict them (options for action), including at customers. In this report, we have made recommendations for amendments to laws and regulations with the aim of stimulating adaptation even more. This includes making the climate-adaptive benchmark mandatory for new builds; adjusting the temporary mortgage scheme; introducing a climate label and making it mandatory for buildings, and later possibly also for other sectors such as agriculture.

Finally, we have presented recommendations to industry for setting to work on analyses and *no-regret* measures and reporting on these. This applies mainly to large companies, but we are seeing an increase in reporting requirements for smaller businesses as well. It is best to anticipate this now. Furthermore, financial institutions need this information to define sustainability performance and risks and to be able to report on their client portfolios to regulators.

This report examines how financial institutions can also contribute to adaptation as investors, via impact investment and their engagement processes with listed companies. A large portion of land in the Netherlands is in private hands and adaptation is required in these areas too. We nevertheless note that the government has a primary responsibility and possesses appropriate instruments for implementing adaptive measures in the public domain. In our role as financial sector we wish to collaborate with the government on accelerating climate adaptation in both the public and private domains.

Appendix 1: Definitions

- *Climate trend*: The expected change of the climate, with all the uncertainties surrounding it.
- *(Climate) scenario* – The expected change in the climate and the expected consequences of this change are elaborated in a number of variants (scenarios). Think of changes in higher temperatures, increasing peak rainfall and longer periods of drought.
- *Adaptation* strategy - A (national) strategy, usually as a form of government policy) to make the Netherlands more climate-resilient. This concerns a time horizon of 20 or more years, and (national) design issues.
- *(Climate adaptation)* measure – A physical measure that an individual or organisation can implement to make its asset more climate-proof. Such as constructing a water basin, building a dike or constructing a green roof.
- *Scale levels* – The level at which a strategy, measure or instrument can be applied. We distinguish: parcel/asset (micro), local/region (municipal-province / meso) and rural (macro).
- *Products* – The products that a financial institution offers to its customers. Such as loans and mortgages (financing), investments (investing), and insurance (insurance). When a financial institution adapts or customises a product to facilitate climate adaptation at a particular level, we refer to this as an 'instrument' in the context of this report.
- *Instrument* – A way to act as a financial institution (or government) that, for example, facilitates a customer / private individual to take climate adaptation measures. We distinguish five instruments: analysis, information, price incentives, financing and adjusting conditions.

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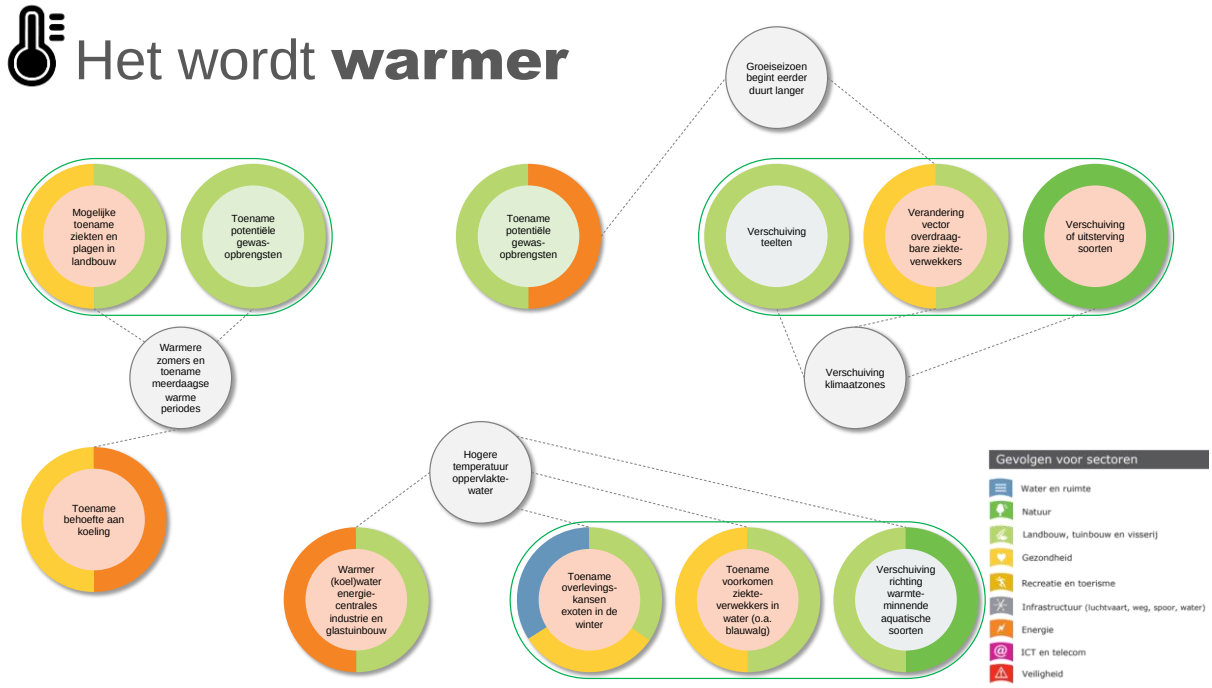
Appendix 3: Impact of climate change trends on the economy

It is getting warmer

The bulb diagram of the National Adaptation Strategy (NAS) shows the various consequences of the trend: *it is getting warmer*. An explanation of the main consequences for the built environment, transport, agriculture and industry sectors follows below.



It is getting warmer – Effect on the built environment

Many homes in the Netherlands are built in such a way that they let in as much sun as possible, such as the post-war sun-drenched house. But due to the increasing heat, such a sunny home is no longer ideal and even problematic: in the summer, homes can get too hot. It is therefore not surprising that more than half a million extra air conditioners have been sold since 2016. Because heat has only recently become a point of attention in the housing sector, there are still few heat-resistant homes in the Netherlands.

Heat stress can cause health problems, especially for vulnerable groups in densely populated cities and boroughs. On average, it is warmer there than in rural areas, due to the 'heat island effect'. This means that the heat in urban areas lingers longer, partly because it is more petrified.

Heat waves can lead to overheating of buildings and reduced productivity. The heat island effect causes urban areas to be warmer than their surroundings, leading to health problems, technical problems with buildings and depreciation of real estate.

Higher temperatures can cause health problems such as heat exhaustion and dehydration. Buildings can experience thermal stress, resulting in damage to roofing, façade materials, and infrastructure. The heat island effect can also lead to reduced attractiveness of urban areas and lower property values.

Higher temperatures result in increased demand for air conditioning, leading to higher energy costs and potentially increased tenant turnover. The demand for energy also increases with higher consumption. The use of air conditioning during hot periods results in higher energy bills for building owners and occupants. Uncomfortable living conditions can make tenants decide to move to cooler homes. The heat island effect can shorten the lifespan of roofing and façade materials, resulting in increased property maintenance costs and reduced demand for real estate in urban areas.

Heat stress causes problems in inner-city areas and sparsely populated areas, especially when combined with prolonged drought. This exacerbates flooding and drought problems, as the soil can absorb less rainwater and drainage systems become overloaded. High temperatures have an impact on people's health and well-being, reducing the attractiveness of the environment and reducing demand for real estate. Health problems such as fatigue, difficulty concentrating, headaches and dehydration can occur.

Cities become less attractive during warm periods, with consequences for homes and shopping areas. Uncomfortable living conditions can reduce demand for housing, while lower sales for retail and hospitality venues can occur due to people avoiding shopping areas during heatwaves.

It is getting warmer – Effect on transport

The climate risk of heat has a significant impact on the transport sector. The increasing heat caused by climate change has a direct impact on both the infrastructure and the operation of the transport network. Extreme heat can lead to disruptions to roads and bridges, restrictions on aviation transport, risk of vehicle overheating, impact on logistics operations, and disruptions to public transport.

Specifically for road infrastructure and waterways, there are also risks such as thermal expansion of the road surface and the inability to open movable bridges. In the rail sector, failures can occur in installations due to heat, such as relay boxes and substations. In addition, the risk of track spatter increases and railway bridges can expand too much.

The additional power demand from air conditioning in trains and the lack of shade at stations and waiting areas are also important consequences of heat in the transport sector. The effect of heat on the transport sector (both transport and physical infrastructure) manifests itself in several ways. Disruption of roads and bridges can also occur. Expansion of asphalt can lead to cracks and subsidence, which can cause delays, diversions, or closure of roads and bridges, hindering mobility.

High temperatures can affect the performance of aircraft, with restrictions on heavy loads and the number of passengers and cargo, which can impact the aviation industry. This can lead to restrictions in air supply. High temperatures can lead to technical issues such as overheating

engines, air conditioning failure, and electrical failures, which can reduce vehicle reliability and availability.

Further, high temperatures can slow down or limit logistics operations, with heat-related health issues for workers that can reduce productivity. Heat can affect trains, buses, and trams, with speed limits, cancellations, and reliability issues due to overheating rail lines and driver health issues. Heat can also lead to increased refrigeration requirements for perishable items, restrictions on the transportation of sensitive items, and delays or cancellations of transportation services, increasing costs and impacting the efficiency and supply of items.

Increase in summer and tropical days can lead to heat stress on main roads and waterways, which can cause problems such as thermal expansion of road surfaces, inability to close movable bridges, and restrictions on shipping. High temperatures can cause faults in electrical systems of relay boxes, relay houses, substations and switching stations, which can affect the power supply and reliability of the railway network.

On hot days, the chance of track spatter increases, which can cause lateral or upward deviation of rails, especially depending on the connections between the rails and the type of sleepers. Heat can lead to excessive expansion of movable bridges, which may prevent them from being operated. The use of air conditioning in trains can lead to increased power demand, which can increase the load on the energy network. In extreme heat, the water level in rivers and canals can drop, which can limit shipping due to insufficient draught or obstructions in the fairway. Heat can lead to an increased risk of traffic jams due to a combination of factors, such as road subsidence, technical problems with vehicles, and increased demand for road transport due to holidays or recreational activities.

High temperatures can lead to changes in people's behavior, such as avoiding travel during the hottest part of the day, which can affect the demand for and use of different modes of transportation. Heat can lead to health problems and an increased risk of heat-related illness among workers in the transportation industry, such as truck drivers, bus drivers, and train crews, which can affect safety and productivity.

At high temperatures, vehicles may have higher fuel consumption due to the need for air conditioning and the impact of heat on engine efficiency, which can lead to increased costs for transportation companies and increased greenhouse gas emissions. Heat can cause wear and tear and damage to vehicles, infrastructure, and equipment in the transportation industry, resulting in an increased need for maintenance and repairs, incurring costs and potential delays.

Heat can affect cross-border transport, such as delays at border crossings, requirements for additional checks, or restrictions based on temperature-sensitive goods. High temperatures can increase the risk of wildfires, which can lead to road closures, diversions, and reduced visibility due to smoke generation, which can affect the safety and efficiency of road transportation.

It is getting warmer – Effect on agriculture

Climate change is having a significant impact on the agricultural sector, with both positive and negative effects occurring. For example, the increasing concentration of CO2 in the atmosphere

and rising temperatures have a beneficial effect on crop growth, but at the same time they cause heat stress in livestock.

Important effects of heat and changing climate zones are the following points. Crop growth is negatively affected by longer dry periods in the spring. The lack of water leads to reduced yields and loss of quality of crops. While higher temperatures and CO2 concentrations can promote crop growth, prolonged heat can lead to lower crop yields.

High temperatures can disrupt photosynthesis, increase the water requirements of crops, and negatively affect fruit set. Warmer, wetter summers, on the other hand, carry a higher risk of pests and diseases, which can be detrimental to crop yields and quality.

Arable farming in the Netherlands is particularly vulnerable to the increasing volatility of the weather, including long periods of drought, abundant precipitation and extreme temperatures. These factors also increase the risk of salinization and the spread of pests and diseases, further jeopardizing agricultural production. Salinisation due to high temperatures and drought are a growing problem because the supply of fresh water to vulnerable polders via the main water system may be insufficient. Areas with intensive horticulture can suffer significant financial damage. The effects of climate change on pests and diseases are difficult to predict, but past observations confirm the expectation that pressure on crops will increase. Higher temperatures can lead to increased pressure from pests and diseases, as observed during the relatively warm period of 1989-2004.

Changes in the climate influence each other in complex ways. For example, increased CO2 concentrations reduce crop transpiration, which can have a dampening effect on moisture deficiencies during drought, but at the same time increase the risk of damage from excessive moisture. Higher temperatures can lead to heat stress in livestock, both in the pasture and in the stables. This has negative consequences for the health, welfare and productivity of livestock.

On the other hand, the warming of the Netherlands may also provide opportunities. For example, opportunities to grow crops from originally warmer countries.

It is getting warmer – Effect on industry

The industry has to deal with the increasing heat/heat in various ways. Due to heat, working conditions may be subject to heat protocols in the summer. This has a negative impact on productivity.

On the other hand, there is less chance of harsh winters, which can increase productivity. Furthermore, the temperature of the surface water also increases, which can lead to the cooling water being less effective.
It is important to note that the industry sector encompasses a wide range of subsectors, each with its own specific challenges and risks. Thus, the impact of heat and climate change can vary depending on the subsector.

Heat can lead to disruptions in industry supply chains. For example, extreme heat can lead to lower crop yields and shortages of raw materials such as water. This can affect the availability of

essential inputs for industrial processes and increase the cost of raw materials. Certain industrial processes and products require specific temperature and cooling conditions. Higher temperatures can lead to increased cooling needs and higher energy costs for industrial refrigeration systems. This can increase the operational costs of companies in the industry.

Industrial facilities can be vulnerable to heat damage, such as building expansion and structural changes. This can lead to structural damage to buildings, pipelines, and storage tanks. Repairing such damage may require significant financial investment. Robust building design can help counteract this.

High temperatures can affect the health and safety of workers in the industry. Workers may face heat-related health issues, reduced productivity, and increased occupational hazards. This can lead to lower productivity and higher health costs and absenteeism, which has financial implications for industrial companies.

It is Getting Warmer – Adaptation Strategies

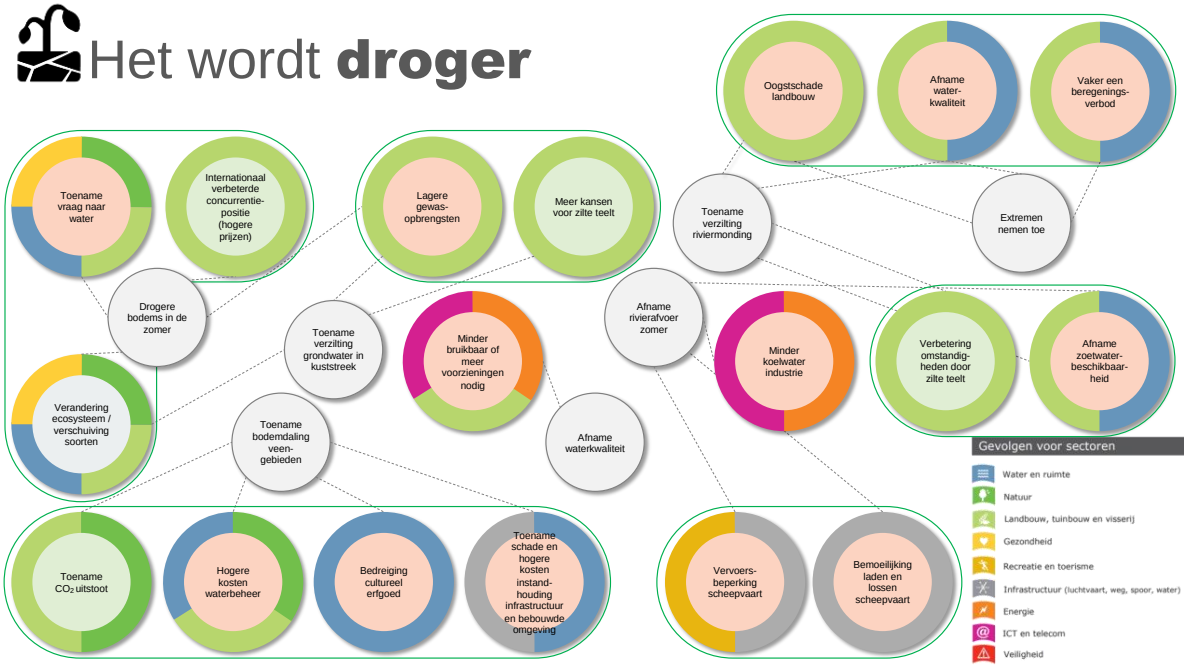
It is getting warmer has led to adaptation strategies that are important for the economy, such as the heat plans manual resulting from the NAS, the Solar Power Action Plan and the approach to climate climate adaptation in the built environment.

Table risks: it's getting warmer

Risks It is getting warmer	Chance	Impact			
	Adaptation Scenario	Agriculture	Industry	Transport	Built environment
Heat and shift climate zones		■ Higher temperatures and drought reduce crop yields and quality. ■ Wetter summers increase the risk of pests and diseases for crops. ■ Changeable weather, drought and extreme temperatures exacerbate salinisation and diseases in arable farming. ■ Salinisation due to heat and drought leads to water shortages and damage in horticultural areas. ■ Higher temperatures increase the pressure of pests and diseases. ■ Increased CO2 concentrations reduce perspiration, but increase moisture damage. ■ Heat stress in livestock has negative consequences for health and productivity.	■ Disruption of production processes ■ Increased Cooling Requirements ■ Risk of damage to industry-specific infrastructure ■ Impact on supply chains ■ Impact on employees ■ Water management and water shortages for industrial processes.	■ Disruption of roads and (railway) bridges, thermal expansion. ■ Air Transportation Restrictions ■ Risk of vehicle overheating ■ Impact on logistics activities ■ Disruption of public transport ■ Impact on freight transport ■ Heat stress and heat nuisance ■ Risk of malfunctions in electrical systems ■ Spur spatter	■ Significant consequences of heat waves and the heat island effect. ■ Health problems, technical problems and depreciation of real estate due to the heat island effect. ■ Higher energy costs and potential tenant turnover due to the demand for air conditioning. ■ Shortened lifespan of roofing and façade materials, higher maintenance costs and reduced demand for real estate. ■ Problems with flooding and drought in urban and sparsely populated areas. ■ Health problems and reduced attractiveness of the environment. ■ Less attractive cities with an impact on housing and shopping areas. ■ Complaints such as fatigue, concentration problems, headaches and dehydration. ■ Impact on the value and rentability of homes. ■ Lower sales in shopping areas during heat waves.

It is getting drier

The bulb scheme of the National Adaptation Strategy (NAS) shows the various consequences of the trend: *it is getting drier*. An explanation of the main consequences for the built environment, transport, agriculture and industry sectors follows below.



It is getting drier – Effect on the built environment

In the short term, drought can lead to increasing damage and higher costs for maintaining infrastructure. This is partly due to the fact that the soil can absorb less water during heavy rainfall. Low groundwater levels lead to higher costs for water management and damage to the built environment. This includes damage to foundations due to differential settlement and pile rot, which could amount to 60 billion euros in 2050 (KCAF, 2022).

Drought also increases the risk of damage from wildfires, which are increasing in intensity and frequency. In the long term, infrastructure costs will increase in water management and water shortages may lead to rationing for gardens and green roofs.

Increasing drought also has an impact on health and well-being. In the short term, drought leads to an increase in particulate matter, pollen and higher exposure to UV light. There has also been an increase in exposure to waterborne diseases. We are seeing respiratory symptoms due to smog and pollen earlier and longer. In the long term, salinisation reduces the supply of fresh water.

It is getting drier – Effect on transport

Within the transport sector, increasing drought mainly affects shipping. Low water levels may result in transport restrictions where it is not possible to sail with a full load due to a narrow and/or shallow channel. Low water levels also make it difficult for inland shipping to load, unload

and moor and there is a sharp increase in waiting times at locks. These are consequences that occur (or have already occurred) in the short term.

It is getting drier – Effect on agriculture

In the agricultural sector, increasing drought can lead to lower crop yields in the short term. On the one hand, this may be because drought causes inefficient agriculture. On the other hand, the increase in the risk of (natural) fires can lead to damage to the crops. In the long term, drought can also create opportunities for agriculture. Think of saline cultivation.

It is getting drier – Effect on industry

Within industry, water is used extensively in both the generation of energy and within production processes. Think of the use of water for cooling, the generation of electricity with hydroelectric power plants (relevant for the foreign power supply). A lack of water due to drought can therefore have implications for production capacity. In addition to this, the above-mentioned restrictions on the transport sector have a direct impact on the supply chains of the industry. It is therefore predicted that transport costs will increase significantly over time (see Figure X). Increasing drought also increases the risk of wildfires, which can lead to physical damage.

It is getting drier - adaptation strategies

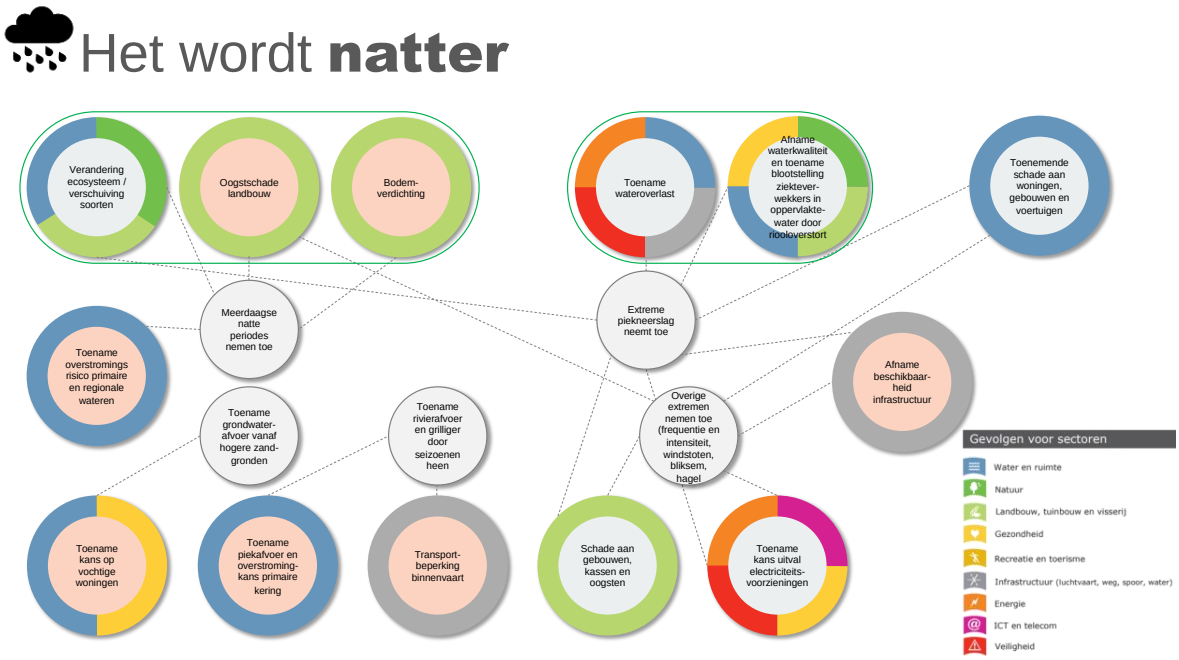
It is getting drier has led to adaptation strategies that are important for the economy, such as the Water and Soil Steering Decree and the *Delta Plan on Freshwater Supply*.

Table risks: it is getting drier

Risks It is getting drier	Chance Adaptation Scenario	Impact Agriculture	Industry	Transport	Built environment (+health)
Low groundwater levels		■ Crop damage ■ More opportunities for saline cultivation ■ Lower crop yields			■ Increase in damage to foundations due to differential settlement and rotting ■ Increase in costs of water management (dike management)
Low settings surface water			■ Lack of water for hydroelectric power plants (foreign power supply) ■ Lack of cooling water (industry and power generation) ■ Logistical problems with the supply chain ■ Lack of water to carry out production processes (production limitations)	■ Shallow/narrow fairway leads to transport restrictions ■ Difficulty loading, unloading and mooring inland shipping	■ Water shortages due to rationing for gardens and green roofs ■ Increase in costs of water management (dike management)
Increase in (natural) fires		■ Crop damage	■ Damage to facilities		■ Damage to the built environment
Desiccation		■ Lower crop yields ■ Crop damage		■ Increase in the amount of particulate matter	■ Increase in the amount of particulate matter ■ Increase in pollen ■ The soil can absorb less water during heavy rainfall ■ Increase in damage and higher costs of maintaining infrastructure

It is getting wetter

The bulb scheme of the National Adaptation Strategy (NAS) shows the various consequences of the trend: *it is getting wetter*. An explanation of the main consequences for the built environment, transport, agriculture and industry sectors follows below.



During the flood in Limburg in 2021, it was clear what local, disruptive consequences such heavy downpours can have. The bulb diagram above shows the different impacts that *getting wetter* entails. Deltares investigated what the consequences would be if the *Limburg downpour* were to fall in South Holland. This would cause large-scale flooding in this province. In many areas, there will be long-term water, which has consequences for cities, roads, greenhouse horticulture in the region and agricultural areas. The damage has been estimated at 2 billion euros. This amount can increase further due to, for example, pumping station failures and quay breaches.

It is getting wetter – Effect on the built environment

Extreme precipitation can have significant impacts on the built environment, with potential damage to both the physical structure of buildings and the building occupant. In addition to densely built-up agglomerations, the built environment in the vicinity of flowing water networks is particularly vulnerable under extreme weather conditions. As a result, in July 2021, there was large-scale flooding in Valkenburg with precipitation of up to 250 millimeters in 48 hours because the Geul was not designed for the peak discharge of water and thus covered the surrounding built environment. The flood resulted in an insured loss of 211 million euros in public and private property. Due to the increase in extreme weather conditions, and the magnitude of potential damages, the financial sector must focus on water risk in relation to the built environment.

For the Netherlands, an increase in extreme weather events mainly means an increased frequency and intensity of wet periods, accompanied by gusts of wind, lightning and hail. During extreme peak precipitation, many paved urban areas are barely able to cope with the

precipitation intensity. As a result, a large part of the precipitation water is confined to the street surface during extreme rainfall and accumulates at lower-lying rainwater bottlenecks.

Depending on the local situation, the built environment in these areas is more vulnerable to moisture damage, corrosion damage, mould formation, wood rot, cracking, frost damage and other damage items related to moisture.

In addition to damage to buildings, extreme periods of rainfall and flooding can also lead to dangerous and/or unhealthy (living) conditions for building users. In case of acute situations, extreme weather conditions can cause drowning or electric shock due to indoor water. Toxic substances in the water can contaminate food and water sources. Increased groundwater can cause damp basements, wet crawl spaces and moisture rising through the wall, which also results in an unhealthy, uncomfortable, indoor climate due to mold formation or an imbalance in moisture. The local situation determines the intensity of water/flood risks associated with a building, as a direct result of intensive precipitation (also known as pluvial flooding).

It is getting wetter – Effect on transport

The transport sector, consisting of freight and passenger transport, is affected in various ways by a wetter climate. In 2007, research by the Vrije Universiteit Amsterdam led to an extensive analysis of the impact of various climate scenarios on this sector.

First of all, they described two main effects. Firstly, a change in transport flows due to the derivative nature of transport demand. Second, change in transportation prices due to climate change that may affect transportation demand.

The first point means that the location where people want to go, or where goods are produced, is shifting as a result of climate change. The second point refers to the fact that some forms of transport are becoming more or less accessible as a result of a changing climate and are therefore becoming cheaper or more expensive.

Climate change will change the location of the production of agricultural crops, among other things. A wetter climate could shift agricultural production from the south of Europe to more northern parts. As a result, the demand for transport to transport goods from Northern Europe to the South may grow. Passenger transport is potentially subject to a reverse flow. While the average precipitation in the Netherlands is expected to decrease (and the temperature will increase), the demand for holidays in the south of Europe will decrease.

This can also be the case the other way around: where weather extremes in the south of Europe will increase, the demand for tourism in northern Europe may increase. This changing demand for transport can put upward pressure on transport prices.

The different modes of transport are affected in a different way by a wetter climate. In accordance with the KNMI climate scenarios from 2014, this mainly concerns extra rainfall on the wettest days, while the summer months will become drier on average. In the winter months, the average precipitation will increase, but on the other hand, there will be less snowfall and sleet. As a result, each mode of transport sometimes has opposite effects, which means that it is not

always possible to say unambiguously whether climate change will have a positive or negative effect on the prices and usability of transport modalities.

It is getting wetter – Effect on agriculture

The impact of a wetter climate on agriculture is huge. First of all, a wetter climate causes crop damage to crops and greenhouses. According to Wageningen *University*, damage caused by rewetting can occur in many forms. Crops can drown, soil can clog up due to heavy rainfall or soil cannot be ridden. Too much water in a short period of time can cause damage to crops.

A wetter climate can also have an impact on ecosystem shifts. Certain crops cannot be grown on Dutch soil (as good as before). Another major impact of a wetter climate is a possible increase in crop diseases.

The quality of the water decreases due to sewer overflow when there is too much water. This water can contain pathogens that can affect crops. The prevention of diseases and pests is important here. The combination of heat and wetting can stimulate fungi, which can cause grass to die.

It is getting wetter – Effect on industry

The machinery industry, food, beverages and tobacco industry and the chemical industry are particularly large in the Netherlands. The impact of a wetter climate is being felt in these industries.
In the event of severe flooding, there may be disruption to the industrial process. This may be due to no or delay in the supply of raw materials. The disposal of semi-finished products or the end product is also at stake in the event of flooding. In the event of heavy rain showers, the (partial) halting of the process is a risk. The shutdown of industry causes economic damage. The most vulnerable to extreme rainfall are the just-in-time companies. These have little stock and are therefore vulnerable to a lack of supply. The food industry is also vulnerable to slowdowns. Fresh produce is susceptible to failure or delay. This ultimately leads to rejection of the product.

It is getting wetter - Adaptation strategies

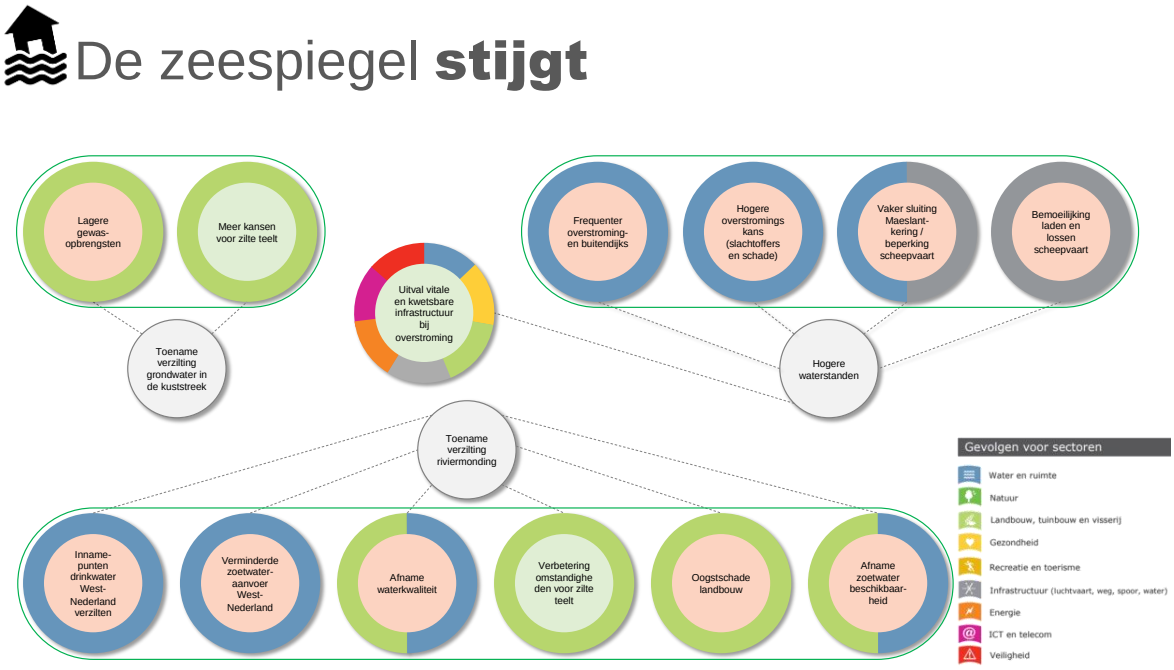
Getting wetter has led to adaptation strategies that are important for the economy, such as the Soil and Water Guiding Decree and the Delta Programme's Integrated River Management Programme.

Table risks: it is getting wetter

Risks It is getting wetter	Chance Adaptation Scenario	Impact Agriculture	Industry	Transport	Built environment
Flooding due to increase in extreme rainfall		■ Damage to crops ■ Wet cultivation as an opportunity	■ High water: Impact on supply chain as extreme downpours sweep across Europe. ■ Electric shock, toxic substances, pollution ■ Interruption of business	■ Damage to equipment ■ Higher water levels in rivers ■ Transport prices can increase due to less transport on rivers due to high water	■ Water damage to assets ■ In case of location risk: depreciation of assets ■ Acute situations
Increase in the frequency and intensity of hail	Current: Water and soil controlling, 2050: PBL scenarios, 2100: Deltares scenarios	■ Damage to harvests and greenhouses ■ Damage to stables and equipment	■ Hail damage to solar panels	■ Major damage to transport vehicles and fleets ■ Damage to distribution centers	■ Hailstone damage
Increase in the frequency and intensity of summer storms (fall winds, etc.)		■ Damage to crops ■ Disruption of forests and trees	■ Storm damage to industrial estates	■ Damage to equipment	■ Damage to assets, falling trees
Increase in lightning		■ Fire in stables due to lightning strikes. ■ In combination with drought, there is a risk of forest fires with an impact on rural areas	■ Fire industrial estates. Release of toxic substances. ■ Short circuits and more frequent interruptions	■ Damage to equipment	■ Fire in buildings due to lightning strike
Decrease in snow		■ Decrease in freezing harvest	■ Reduction of roof pressure of industrial buildings	■ Reduction of roof pressure distribution centres ■ Decrease in traffic congestion	■ Decrease in roof pressure

Sea levels are rising

The bulb diagram of the National Adaptation Strategy (NAS) shows the various consequences of the trend of *rising sea levels*. An explanation of the main consequences for the built environment, transport, agriculture and industry sectors follows below.



Sea Level Rise – Effect on the Built Environment

One of the most immediate consequences of rising sea levels is the increased risk of flooding. Cities and coastal areas are exposed to the danger of flooding, which can cause significant damage to real estate and public infrastructure such as roads and bridges. The physical structure and stability of buildings can be severely compromised, leading to high repair costs and loss of property value.

In addition to the direct damage to buildings, there is also indirect damage that has a knock-on effect on the economy and the built environment. Businesses that rely on operational facilities in coastal areas, such as ports and shipyards, could be disrupted. This leads to economic losses, loss of employment, and disruption to the local economy, which in turn affects the real estate market and quality of life in affected areas.

Vital infrastructure such as water treatment plants, power plants, and communication networks are often located in low-lying coastal areas. Rising sea levels are putting these critical facilities at risk, which can lead to outages of services that are essential to urban areas. The disruption of vital functions can have a negative impact on the habitability of cities and the ability to respond effectively to emergencies.

Areas that are repeatedly affected by flooding lose their long-term viability. Homeowners and real estate investors may face loss of property value and even difficulty selling property due to the growing risk of flooding.

Rising sea levels are also having an impact on the physical space available for urban expansion and infrastructure. New construction projects and development opportunities can be hampered, affecting the growth of urban areas. In addition, increasing vulnerability to flooding can lead to migration of residents and businesses to safer regions, resulting in a loss of community and economic activity.

Sea level rise – Effect on transport

Rising sea levels increase the risk of flooding, which has a significant impact on transport infrastructure.

Roads, waterways, public transport terminals and airports are becoming vulnerable to direct damage. Flooding can lead to temporary closures of transportation routes, resulting in delays, costs, and loss of business continuity. The damage to vehicles and the need for extensive repairs amplify the negative impact.

Increased water levels due to rising sea levels result in operational disruptions and additional costs in the transportation sector. Loading and unloading ships are becoming more complex and time-consuming due to the need to lift goods to greater heights. In addition, higher water levels can disrupt river passage, complicating the efficiency of freight transport and shipping.

Rising sea levels are leading to a decrease in the physical space available for the transport sector. This restriction may force companies to cease or relocate operations. This results in loss of investments, discontinuity in services and disruption of the logistics chain. The relocation of businesses has broader economic and social implications, such as job losses and reduced local economic activity.

Sea Level Rise – Effect on Agriculture

Rising sea levels extend beyond the waterfront and have profound impacts on crops, livestock production, and overall agricultural production. The crucial risks and impacts of rising sea levels on the agricultural sector are discussed below.

The risk of flooding due to rising sea levels poses significant challenges for agriculture. Flooding can lead to crop failures, jeopardizing food supplies and causing financial losses for farmers. Additionally, essential agricultural assets such as greenhouses, farms, agricultural equipment, seeds, and crop stocks can be damaged, threatening farmers' operational efficiency and financial stability. In severe cases, land can become unusable for several years, disrupting agricultural production.

Increased water levels, as a result of rising sea levels, make agriculture and horticulture more difficult. The land can become soggy, and in severe cases, the water can flow over farmlands, making it difficult to grow and harvest crops. Additionally, the changing landscape may bring new challenges, such as the need to grow other crops that are more resilient to waterlogging.

Livestock farming may also be affected, with potentially negative consequences for food supply and economic stability.

Salinisation of agricultural land in coastal areas poses a risk due to rising sea levels. This change in soil composition affects the available crops and can lead to a reduction in yield. Farmers face the challenge of selecting other crops that are more resistant to salinity, which affects biodiversity and the ecosystem of agricultural areas. Additionally, the salinization of coastal areas can lead to a scarcity of drinking water, which endangers the health and well-being of the community.

Salinisation in estuaries has similar consequences to coastal salinisation, with an additional negative impact on fish stocks. The change in salinity levels in water can lead to a shift in habitat, migration, and reproduction of fish, affecting the fishing industry. This, in turn, affects the food supply and economic stability, and increases the pressure on alternative food sources. In addition, agricultural land is becoming less fertile due to salinisation, which means that fewer crops can be grown and there can be a shortage of drinking water again.

The decrease in physical space due to rising sea levels can lead to the termination and relocation of farms. The need to cease operations or continue operations elsewhere affects not only individual farmers, but also wider agricultural production and food supply.

Sea level rise – Effect on industry

Rising sea levels due to climate change pose a significant threat to the industrial sector without prevention and impact management. The consequences could have a far-reaching impact on industrial operations, supply chains, and business continuity. The main risks and impacts of rising sea levels on the industry are discussed below.

The risk of flooding causes significant damage to the industry. Buildings can be damaged, leading to operational delays and financial losses. Additionally, the damage to raw materials and inventory in warehouses and storage facilities can disrupt the supply chain, causing production losses and supply issues. The risk of stranded assets, such as obsolete installations in low-lying areas, increases and increases the financial risk.

Increased water levels due to rising sea levels can result in supply chain issues. Industrial operations that rely on a constant supply of raw materials can be disrupted, leading to production delays and operational inefficiencies. In addition, certain loading and unloading facilities may become unusable.
Salinisation in coastal areas due to rising sea levels has the potential to have significant impacts on industry. The scarcity of drinking and cooling water in such areas can affect operational capacity, as these essential resources are needed for industrial processes. In addition, changing water quality and availability can affect the productivity of industrial operations, with negative effects on both financial returns and environmental impact.

The decline in physical space due to rising sea levels is having a serious impact on the industrial sector. Businesses face the looming risk of stranded assets – existing infrastructure and facilities

that are no longer profitable. Terminating and relocating businesses from low-lying areas is becoming a necessary strategy to ensure operational continuity and maintain financial stability.

Sea Level Rise - Adaptation Strategies

Sea level rise has led to adaptation strategies that are important for the economy, such as the Delta Programme's Sea Level Rise Knowledge Programme.

Table of risks of sea level rise

Risks Sea level rise	Chance Adaptation Scenario	Impact Agriculture	Industry	Transport	Built environment
Flood	2050: Protection against sea level rise (Delta Plan) 2100: Deltares 4 scenarios	■ Crop failure ■ Damage assets (greenhouses, farms, equipment, seeds, etc) ■ Soil unusable for several years	■ Damage building ■ Damage to raw materials ■ Supply chain issues ■ Production loss ■ Chance of stranded assets	■ Damage to vehicles ■ Damage to roads, waterways, public transport, airports ■ Temporarily no transport possible	■ Direct damage to assets ■ Indirect damage ■ Loss of life ■ Vital signs affected ■ Chance of stranded assets
Higher water level		■ Agriculture and horticulture hampered by high water levels ■ Other crops ■ Impact of animal husbandry	■ Supply chain issues (downstream) ■ Distribution problems (upstream)	■ Additional costs for loading and unloading ■ Restriction of transport on rivers	■ Impact of the area outside the dikes
Salinisation of the coastal region		■ Change of crops ■ Fewer crops ■ Less drinking water	■ Drinking and cooling water scarcity		■ Drinking water scarcity
Salinisation of the estuary		■ Impact of fish stocks ■ Change of crops ■ Fewer crops ■ Less drinking water	■ Drinking and cooling water scarcity		■ Drinking water scarcity
Decrease in physical space		■ Terminating and relocating businesses	■ Stranded assets ■ Terminating and relocating businesses	■ Terminating and relocating businesses	■ Stranded assets ■ Migration

Appendix 4: Examples of products and services for climate adaptation

This appendix contains examples of products and services currently offered by various financial institutions. Most of the contributions have been made directly by the institutions in the working group themselves, but also partly based on public information such as web pages. In addition to an explanation of the type of product or service, and well-known examples, we also indicate the **following characteristics in bold**, so that a lot becomes clear at a glance:

1. Type of instrument: analysis, information, price incentive, financing, conditions
2. By whom: investor, financier (bank), insurer, fund, other
3. For whom: municipality, water board, province, homeowner, residential tenant, housing corporation, developer, entrepreneur
4. Scale: Parcel, District, Region, National
5. Time horizon / lead time: 0-5 yrs | 5-30 yrs | > 30 yrs

Analyses and advice

Within the financial sector, substantive knowledge about climate adaptation is increasingly being built up, and investments are being made in analysis methods and instruments. The resulting insights are not only used for internal practices such as risk management and strategy determination, but also with customers and other stakeholders. Financial institutions can also take on a connecting or facilitating role, for example by connecting different stakeholders and providing substantive support.

1. Type of instrument: **analysis, information**, price incentive, financing, conditions
2. By whom: investor**, financier (bank), insurer**, fund, other
3. For whom**: municipality, water board, province, homeowner, residential tenant, housing corporation, developer, entrepreneur**
4. Scale: **Parcel, District, Region, National**
5. Time horizon / lead time: **0-5 yrs | 5-30 yrs | > 30 yrs**

Examples:

- A.s.r. has developed a tool, the Climate Risk Tool, which uses data from the KNMI's climate impact atlas and Climate Adaptation Services (CAS) to map the climate risks for real estate. The tool has been further developed on the basis of the framework for adaptive buildings of the Dutch Green Building Council (DGBC). All properties are given a score for each climate risk theme, heat, drought, floods and extreme precipitation. This tool enables a.s.r. to take location-specific adaptive measures for its real estate properties.

- Since 2017, a.s.r. and Rabobank have been working with clients on the development of a Biodiversity Monitor and Open Soil Index in the Dutch dairy and arable farming sector. The monitor measures the improvement of biodiversity performance on the farm, by measuring a shared set of KPIs. In 2022, 60 farmers shared their 'data from the land' data via the

biodiversity monitor. In 2022, 353 farmers used the open soil index, which allows them to both measure and improve the quality of their soil.

- On the sustainable living platform, a.s.r. also provides information about adaptation options such as green roofs. In addition, a.s.r. regularly sends its customers information – via the website or newsletters – about measures they can take to make their homes more sustainable.

- Rabobank has set up a national programme to make business parks more sustainable. Within this programme, they enter into alliances between municipalities, business associations and other stakeholders. Projects within the programme range from the greening of a business park on behalf of municipalities to a commercial investment in green roofs, permeable parking spaces and water collection for companies.

- With the 'Sustainable Living' portal, Univé helps its 1.7 million members (but also non-members) on their way to Sustainable Living. Within this portal, Univé offers comparisons, tips on how to become more sustainable yourself and subsidy options. And to understand where to start, Univé offers a free savings scan in collaboration with Greenchoice.

- For the entire portfolio, Altera Vastgoed commissioned the Climate Adaptation Services Foundation (CAS) to carry out a gross climate risk scan that assesses the risks of flooding, heat stress, flooding, pile rot, wildfires and differentiation at area level. A net climate risk scan was carried out for the objects where the gross risks were high/very high. This takes into account building-specific characteristics, such as the presence of sun protection or a green roof. In the event of a high/very high net risk on one of the themes, an action plan has been drawn up for each asset to mitigate this risk. This action plan is included in the long-term maintenance budget (MJOB) of the object. These different phases ensure clear communication with stakeholders (including foreign investors) and ensure that Altera meets the requirements for Do No Significant Harm of the EU Taxonomy.

- With the ING Calcasa Home Check, (potential) private customers can receive a report on characteristics of the home that help determine its value. The report provides information about leasehold, foundation, flood risk, energy label and owners' association.

Encouraging adaptive measures among existing customers

Climate adaptive measures can be expensive to implement at first. Financial institutions can still use price incentives or conditions to persuade their customers to make those investments.

1. Type of instrument: analysis, information, **price incentive**, financing, **conditions**
2. By whom: investor**, financier (bank), insurer**, fund, other
3. For whom**: municipality, water board, province, homeowner, residential tenant, housing corporation, developer, entrepreneur**
4. Scale: **Parcel, District, Region, National**
5. Time horizon / lead time: **0-5 yrs | 5-30 yrs | > 30 yrs**

Examples:

- A.s.r. helps farmers to switch to sustainable agriculture by giving a discount on the canon or rent of 5%-10% when the sustainability requirements in terms of soil, biodiversity and business are met. The sustainability requirements have been drawn up in consultation with the sector.

- Interpolis gives a discount on tempered glass in greenhouse horticulture. Tempered glass is stronger and therefore leads to less damage in hail, storms and snow pressure.

- From 2023 onwards, employees at Achmea will be able *to use a Climate Budget* of €2500 net (based on full-time) to make climate-conscious choices. This amount is intended for products and services that contribute to sustainability, including rain barrels or a green roof. As an initiative, the climate shop is also available to other employers. In Flanders, employees can receive a maximum of €250 (tax-free) in *eco vouchers* per year.

Innovation and incentive funds

[comment] Funds are used to make finance available to companies or projects that are normally difficult to finance. For example, certain projects can be difficult to get off the ground because it is difficult to obtain risk-bearing capital, for example because an innovation is not yet fully market-ready. Funds can be designed for a specific target group and intended result, and are therefore very suitable for financial institutions to enable climate adaptation.

1. Type of instrument: analysis, information, price incentive**, financing**, conditions
2. By whom: investor, financier (bank), insurer, **fund**, other
3. For whom**: municipality, water board, province, homeowner, residential tenant, housing corporation, developer, entrepreneur**
4. Scale: **Parcel, District, Region, National**
5. Time horizon / lead time: **0-5 yrs | 5-30 yrs | > 30 yrs**

Examples:

- The *NWB Water Innovation Fund* focuses on innovative and sustainable projects of water boards. You can think of innovations in the field of climate adaptation, climate mitigation, circular economy, biodiversity, water quality, flood risk management and the energy transition. The NWB Water Innovation Fund provides equity or subordinated capital in the form of a loan. It always involves co-financing: the fund contributes a maximum of 50% of the total required risk-bearing capital and at least 1/3rd of the total required risk-bearing capital is contributed by one or more water boards. The maximum funding contribution from the fund is €2 million per application.

- With the *Sustainable Damage Repair Manifesto*, sustainable repair should become the norm in dealing with damage, instead of replacing it. Schoonmakend Nederland, NIVRE (Dutch Institute of Registered Experts Foundation) and the Dutch Association of Insurers have drawn up a manifesto for this purpose in 2023 with principles for future damage repair.

- *Hagelunie's innovation fund* provides financial support to innovation projects for agriculture and (greenhouse) horticulture. Its roots lie with NV Hagelunie, the insurer for the plant-based sectors. Hagelunie offers a financial contribution of 50 percent of the costs for research projects in agriculture, including more efficient methods of management and the reduction of damage risks in agriculture or horticulture.

Sustainability-linked loans

Sustainability-linked loans *(SLL*) are financial products that are linked to Key Performance Indicators (KPIs) in the field of sustainability: as soon as a customer meets these predetermined objectives/KPIs, the customer receives a lower interest rate or premium. This type of loan is now offered to various financiers, and offers the possibility to also make agreements about making projects and organisations more climate-proof or adaptive. Cooperation with the EIB on 'Impact Loans' can also offer new opportunities for stimulating adaptation.

1. Type of instrument: analysis, information, **price incentive, financing,** conditions
2. By whom: investor, **financier (bank),** insurer, fund, other
3. For whom**: municipality, water board, province, homeowner, residential tenant, housing corporation, developer, entrepreneur**
4. Scale: **Parcel, District, Region, National**
5. Time horizon / lead time: **0-5 yrs | 5-30 yrs | > 30 yrs**

Examples:

- In some cases, the European Investment Bank (EIB) offers impact loans directly linked to climate adaptation to companies and projects in the Netherlands, for example to drinking water company *PWN*. Impact loans from the EIB are also often available at a lower rate through commercial banks such as ABN AMRO, Rabobank and ING, as well as public banks BNG and NWB.

- Loans to companies - Rabobank has been offering SLLs for several years now. In 2022, part of the sustainability-linked loans were provided to the Food&Agri sector, for example to Coca-Cola Europacific Partners (CCEP) in the beverage market. CCEP wants to use the funding to encourage its suppliers to act more sustainably.

- In addition, there is also *the Rabo Impact Loan*, which gives frontrunners a discount on interest when they use one of the *40 sustainability labels*. Rabobank is working with the European Investment Bank (EIB) for the Impact Loan.

- Loans for projects - The *Green Projects Scheme* is a joint scheme of the Ministries of Infrastructure and Water Management and Finance for green financing. Various banks make use of the scheme and are therefore recognised as banks *with a green fund*. They can apply for a green certificate from RVO and use it to finance their customers' sustainable projects at a lower interest rate. As a result, savers and investors who deposit money benefit from a tax advantage. For example, the *Floating Office* has been made possible in part thanks to the Green Projects Scheme. Thanks to the green certificate issued by RVO, they received a financial benefit from a loan from ABN AMRO Groenbank BV.
  Since 2016, the scheme has also had a Climate Adaptation project category, with the following subcategories:
  - Retention area
  - Building- and site-related water storage
  - Innovative cooling of buildings
  - Vegetation roofs

  - Groundwater in peat meadow areas

- Loans to governments - In 2021, NWB Bank provided a first SLL to *the Zuiderzeeland Water Board*. NWB Bank's SLLs normally have a term of 5 years, after which the financing transitions into regular financing without any interest rate discounts. Performance that promotes climate adaptation can be one of the sustainability objectives, in addition to, for example, climate impact, biodiversity or diversity within the organisation.

Sustainability-linked investments

Investments by asset managers and insurers are assessed in advance. Sustainability aspects are increasingly important in the assessment, which also includes climate adaptation. Information about climate adaptation is used in relation to the investments in three ways: (1) excluding investments that do not meet the criteria, (2) giving more weight to companies with a positive contribution and (3) investing in organisations or projects that have climate adaptation as their primary goal.

1. Type of instrument: analysis, information, price incentive**, financing**, conditions
2. By whom: **investor**, financier (bank), **insurer,** fund, **other**
3. For whom: municipality, water board, province, homeowner, residential tenant, housing corporation**, developer, entrepreneur**
4. Scale: Parcel, District**, Region, National**
5. Time horizon / lead time: **0-5 yrs | 5-30 yrs | > 30 yrs**

Examples:

- All of a.s.r.'s investments are screened for sustainability on the basis of a.s.r.'s SRI, a *Socially Responsible Investment policy,* which excludes companies that do not contribute to the sustainability criteria and gives companies that make a positive contribution more weight in the portfolio (best in class investing). In addition, a.s.r. finances companies, organisations, funds and projects that, together with a financial return, have as their primary goal of promoting the energy transition or nature restoration. The aim is to have 4.5bn of impact investments on the balance sheet by the end of 2024.

- For every investment proposal, Altera Vastgoed includes a sustainability section in which the most important ESG risks are assessed. The Climata Adaptation Services Foundation (CAS) has developed an acquisition tool to map out the climate risks. The tool is a gross climate risk scan that assesses the risks of flooding, heat stress, flooding, pile rot, wildfires and differential settlement at area level. If the tool shows that a risk is high/very high, Altera will factor additional capex into the investment proposal to mitigate these risks.

Green/Sustainable Bonds

Green or sustainable bonds are a way to raise financing with a predetermined destination. If it is determined that the bond benefits climate adaptation, the bond can ensure that more climate adaptation financing is available and/or that it is available at a lower interest rate. The bonds are limited by the need for financing, and so are the investment opportunities for investors in climate adaptation.

1. Type of instrument: analysis, information, price incentive**, financing**, conditions
2. By whom: investor, **financier (bank),** insurer, fund, other
3. For whom**: municipality, water board, province**, homeowner, residential tenant, housing corporation, developer, entrepreneur
4. Scale: Parcel, District**, Region, National**
5. Time horizon / lead time: 0-5 yrs | **5-30 yrs | > 30 yrs**

Examples:

- Since 2014, NWB Bank has been issuing bonds intended to finance climate adaptation, with a total of approximately 8 billion euros issued. The bonds will be used to finance the water boards.

- Since 2019, the Dutch State has been issuing bonds intended to finance climate adaptation, with a total of approximately 3 billion euros issued. The bonds will be used to finance the Delta Programme.

Facilitating innovation and development

By participating directly in companies, financial institutions can further facilitate the actual implementation of climate-adaptive measures. This is not necessarily a core task of a financial institution, and will not be possible for every institution due to statutory or strategic constraints.

1. Type of instrument: analysis, information, price incentive**, financing**, conditions
2. By whom: **investor, financier (bank), insurer, fund, other**
3. For whom: municipality, water board, province, homeowner, residential tenant, **housing corporation, developer, entrepreneur**
4. Scale: **Parcel, District, Region, National**
5. Time horizon / lead time: **0-5 yrs** | **5-30 yrs | > 30 yrs**

Examples:

- Bouwfonds (BPD), a subsidiary of Rabobank, develops buildings that take extreme weather conditions into account more than conventional and existing buildings. The basic principle is, for example, that water is retained in basins and that roofs are cooled by allowing plants to grow on them, see 'Delft Poortmeesters'. BPD is also developing a 'Climate Dike' in Reeve near Kampen. The sea barrier also offers space for 600 homes. In addition, Rabobank is also participating with the start-up Rabo SmartBuilds, which builds modular mid-market rental homes throughout the Netherlands.

- Interpolis offers the installation of a green roof as a service and organises a purchase discount. The service consists of a roof scan on the basis of which the homeowner can decide whether or not to have a green roof installed (with a purchase discount). Green roofs help

prevent heat stress and flooding. In addition, the green roof protects the roofing, so that the roof lasts twice as long on average. Insured persons with Interpolis will then also receive a temporary discount on the insurance when installing a green roof from Interpolis.

- With Sustainable Security*, Unive offers* agricultural and other business customers the possibility of replacing old asbestos roofs with a new roof, full of solar panels. In most cases, this costs nothing. It's very simple: For many of our agricultural and other business customers, replacing an asbestos roof is a costly investment. We are helping with this, together with Greenchoice and Rabobank.

Insurance products with a broader definition

Climate damage insurance usually covers the financial consequences of extreme weather such as excessive rainfall, hail and storms to properties. Insurers are expanding coverage to add damage caused by the failure of non-primary flood defences and to insure climate-adaptive measures.

1. Type of instrument: analysis, information, price incentive, financing, **conditions**
2. By whom: investor, financier (bank), **insurer,** fund, other
3. For whom**: municipality, water board, province, homeowner, residential tenant, housing corporation, developer, entrepreneur**
4. Scale: **Parcel, District, Region, National**
5. Time horizon / lead time: **0-5 yrs | 5-30 yrs | > 30 yrs**

Examples:

- With a report from 2018 and a position paper from 2020, the Dutch Association of Insurers advised its members to add the failure of non-primary flood defences to the residential home coverage. Climate change is expected to increase this risk. With this extension of coverage, policyholders are better covered.

- A.s.r. ensures climate-adaptive measures such as water-absorbing roofs and climate-adaptive building values. In addition, a.s.r.'s new home insurance policy optionally reimburses up to a maximum of 10% of the amount of the claim for sustainability measures after damage.

- As of 1 September 2022, Unive has a new coverage that insures damage caused by incoming pollution, for example by contamination of someone else's solar panels. This coverage is added to the Environmental Damage Insurance and the Cleanup Costs Insurance. As of December 1, 2023, this coverage will also be added to the private home insurance.

- Unive follows the advice of the Dutch Association of Insurers with regard to the failure of non-primary flood defences and has added this to Home Insurance, Building Insurance and Movable Property Insurance.

Schemes and funds via SVn, and municipalities and provinces

Municipalities and provinces have the opportunity to make specific resources available on certain subjects in order to offer attractive loans. Various municipalities have set up schemes with the

Dutch Municipalities Housing Incentive Fund (SVn) that can also be used for climate adaptation. These can be schemes for private individuals, social real estate or companies.

1. Type of instrument: analysis, information, price incentive**, financing**, conditions
2. By whom: investor, financier (bank), insurer, fund, **other**
3. For whom: municipality, water board, province, **homeowner,** residential tenant, housing corporation, developer, **entrepreneur**
4. Scale: **Parcel**, District, Region, National
5. Time horizon / lead time: 0-5 yrs | 5-30 yrs **|** > 30 yrs

Examples:

- Dozens of municipalities have a scheme for future-proof housing or a sustainability loan for homes for its residents. Climate adaptation is also included in specific measures. Examples are *Nijmegen* and *Krimpenerwaard*.

- Dozens of municipalities have a scheme specifically for entrepreneurs and associations (of owners) to make the (business) building more sustainable. Climate adaptation is also included in specific measures. Example: *Boxtel* and *Sint-Michielsgestel*.

- The Province of Gelderland has a *Fund for the Sustainability of Social Real Estate*. The fund focuses on sustainability, but part of the loan can be used for climate adaptation measures.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