

Resilient Rotterdam Strategy 2022-2027.



From risks to resilience.



City of
Rotterdam

How do we find our resilience?
That starts with the inner journey
With the love that's much stronger than you thought

Finding each other
In the street, in the neighbourhood, in the city
The constant connecting

That increases our resilience
This will allow us to come out of crises even stronger
Stronger than we thought

Empathy
Love
Finding each other in compassion

That's when true happiness is felt
In the connection
The layering

The layering of our identities
Not a single story
But the complexities

Finding each other in kindness
Receiving and giving love
The constant connecting

Identifying ourselves with all of mankind
Not just with your own group
That will result in freedom

We are connected to all living things
People, plants and animals
Every single one of earth's living creatures

Stories which separate us
Those will result in destruction
Let's not allow that to guide us

The stories which connect us
Will result in positive creation
We will find love

A clear route from one heart straight to another
To walk that route every day
Will result in connection and resilience

Bilal Taner
Bospolder-Tussendijken resident



**Resilience is a city, community,
or organisation's ability to deal with shocks and stresses.
This ability requires four capabilities:
resistibility, recoverability, learning ability and adaptability.**



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Foreword

The climate is changing. Climate change is a reality we're now constantly and increasingly being confronted with, just look at the forest fires in Southern Europe and the floods in Limburg last summer. As a low-lying city in the Dutch river delta, Rotterdam is vulnerable to the effects of climate change. Climate adaptation – adapting Rotterdam to climate change – is absolutely essential.

That's why Rotterdam was one of the first cities in the world to develop a climate-adaptive approach in 2013. The first integrated approach to make the city strong and resilient followed a few years later in 2016: the Resilience Strategy.

A great deal has been done since that time. We have managed to protect the city against high water and heavy rainfall more effectively in recent years. Partly as a result of the introduction of water squares and green roofs.

We are making the city greener in streets and neighbourhoods, on squares and on roofs and, together with residents, we're making sure vulnerable homes are kept dry.

Various innovative measures have resulted in us now having an international reputation of being an experience expert in climate adaptation. The recent establishment of the Global Center on Adaptation's (GCA) head office in the Floating Office Rotterdam (FOR) marks the broad recognition of Rotterdam's pioneering role. We're working on accelerating adaptation measures and making our cities resilient, together with various global partners.

However, the climate crisis is not the only crisis we're having to face as a city. The corona pandemic has certainly pushed us into having to confront some harsh facts over the past two years. The virus has put a huge strain on the strength and resilience of citizens, companies and governments right across the world. Here in Rotterdam too.

Six crises have been identified, which could all have a significant impact on the city during the forthcoming years. In addition to the climate crisis and the health crisis, these are the decline in biodiversity, the increase in social inequality, the increasing levels of pollution and depletion of natural resources and the increase in cyber threats.

Spatial, social and economic resilience is needed in order to make Rotterdam resilient and to keep it resilient on all fronts. That's why we decided to extend our strategy to climate, economic, social, energy, ecological and digital resilience. Good coherence between these themes will result in a future-oriented city.

Rotterdam is working on this together with a growing network of resilient companies, residents and social organisations at local, national and international levels. This allows us to ensure that Rotterdam remains a great place to live, work and stay for future generations.

Arno Bonte
Vice Mayor for sustainability, air quality, energy transition and resilience



Arno Bonte



Ahmed Aboutaleb

The river and the proximity to the sea have made Rotterdam an international port. A city which conducts business with the entire world and where people from all corners of the globe feel right at home. That is an amazing asset, which we must cherish and protect. First and foremost against the consequences of climate change, like the rising sea levels.

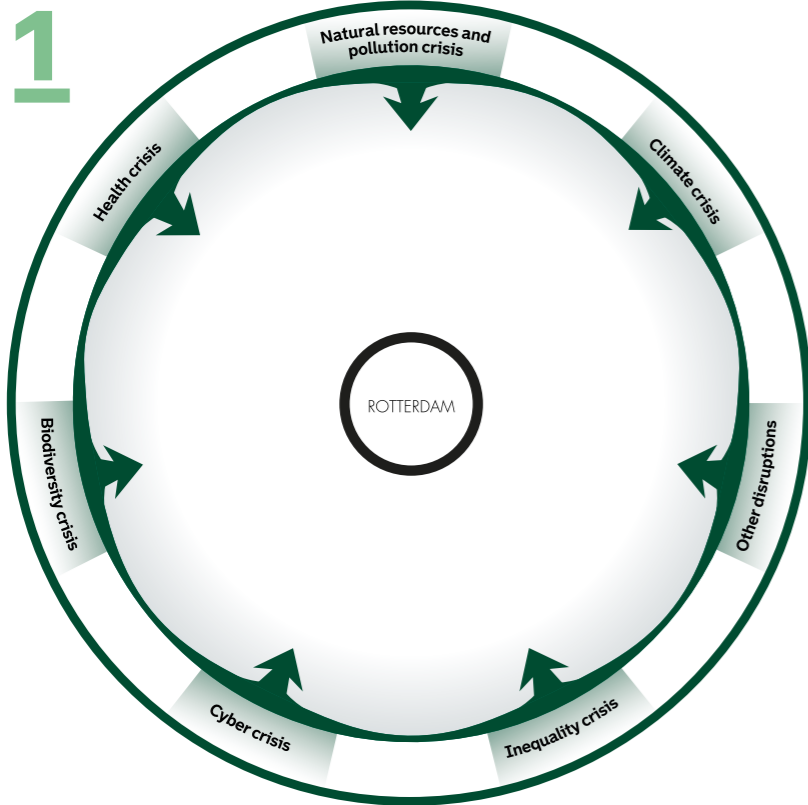
Secondly, by nurturing and protecting our society's strength and resilience. The Covid-19 pandemic has taught us that this resilience is most definitely there, but was a little slow to get going. We turned out to be not quite self-sufficient enough as a society. There were capacity problems in many areas, including healthcare and hospitals. This led to frustration and polarisation. The pandemic has certainly taught us that we need to be better prepared for future crises. Of course we can't prevent everything, but we can make sure that the impact is less significant and that we'll recover faster: a Resilient Rotterdam.

For example, the government must take on a more protective role. A government which says: how can I help you? Rather than: are you complying with all the rules? Listen, take concerns seriously, offer hope and perspective. That's what we should be starting off with. Fair access to scarce goods like housing, education, work, care and support. Plus harmony in the city is just as important. Harmony is crucial for a strong and resilient society.

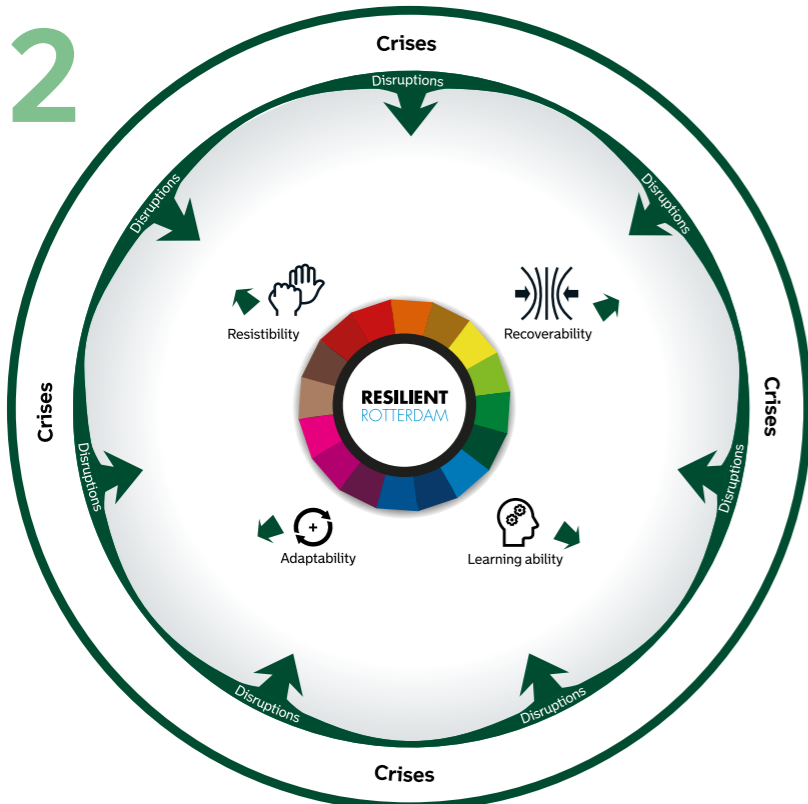
Solidarity is essential for this. We shouldn't be talking about each other, but with each other. It's important to work on joint solutions, especially when there are tensions. We can rise to all future challenges together.

Ahmed Aboutaleb
Mayor of Rotterdam

In brief



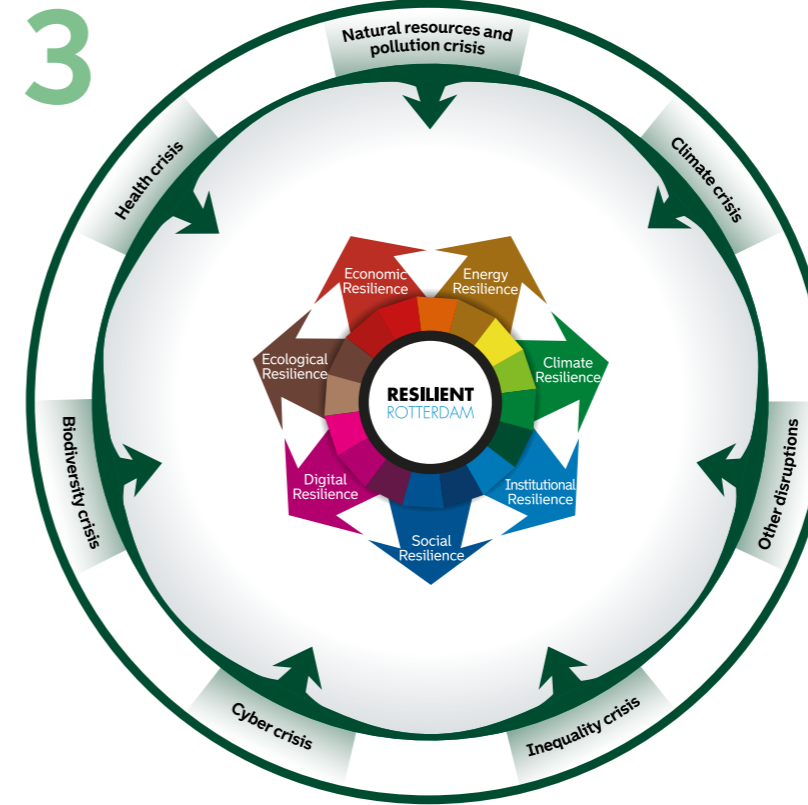
Rotterdam is under threat. The climate crisis, health crisis, inequality crisis and other crises can all lead to problems in the city. And these crises all influence and affect each other. They come with a large number of risks, but definitely some opportunities too.



A resilient Rotterdam will be able to handle all crises, thanks to four capabilities:

- Resistibility (the capability to resist shocks and stresses)
- Recoverability (the capability to recover from shocks and stresses)
- Learning ability (the capability to acquire knowledge and skills from shocks and stress experienced)
- Adaptability (the capability to adapt and change in order to thrive)

All four of these capabilities are required to structurally tackle crises, problems and risks.



Resilience is essential for a prosperous, happy and economically stable city. That's why it should be clearly reflected in everything the city does. Rotterdam will be focussing on tackling crises through seven different themes during the forthcoming years. In this way, we'll be progressing from risks to resilience. And we'll be doing that together with the city.

The world is changing at a rapid pace and has to deal with various crises. They influence and reinforce each other. A crisis is often accompanied by gradual changes, which is why the consequences are not necessarily immediately noticeable (like with an increasing cyber threat). At the same time, abrupt events that result in significant issues for the city (like a cyber attack) can take place from time to time. We have to respond to those problems (also called disruptions or distortions) in such a way that we'll end up coming out stronger.

This means we'll ultimately be better prepared for the next crisis. The foundation for effectively dealing with a crisis is resilience: responding with resistibility, recoverability, learning ability and adaptability. This will allow us to reduce the negative consequences of a crisis, make proper use of the opportunities and make people, the city and urban systems more resilient. Rotterdam will subsequently be able to cope with the next disruptions more effectively. A resilient Rotterdam resists, recovers, learns, adapts and grows!



1. Resilient Rotterdam – why, how and what?

1.1 Why is Rotterdam working on the city's resilience?

The world is dealing with a significant number of current and potential crises in 2022. These crises all result in serious risks. Various (international) organisations are compiling risk lists. Internationally this is done, for example, by the United Nations (UN), the International Platform for Climate Change (IPCC), the World Economic Forum (WEF) and the European Union (EU). Moreover, agencies such as PBL Netherlands Environmental Assessment Agency and De Nederlandsche Bank (DNB), play a key role in risk assessment in the Netherlands.

Not all crises and corresponding risks are equally relevant to Rotterdam. In 2021, Rotterdam created an initial overview of all possible crises and corresponding risks (long-list), based on different (inter)national risk assessments. Subsequently, research was carried out to determine which crises could affect Rotterdam, and the risks and implications it could result in for the city. We also looked at how staying, moving and working in the city would be impacted, both now and in the

forthcoming decade. A Rotterdam priority list of potential and current crises has been drawn up with this information (see also figure 1.1a), based on the principle of 'risk = probability x impact':

The three major planetary crises:

- The climate crisis
- The biodiversity crisis
- The natural resources and pollution crisis

The three socio-economic crises:

- The inequality crisis
- The health crisis
- The cyber crisis

Other disruptions (due to currently unknown threats)

The six known crises are not stand-alone events, but very complex issues with a great deal of mutual influence and reinforcement. The risks for Rotterdam related to the aforementioned six crises, are described in paragraph 1.2.

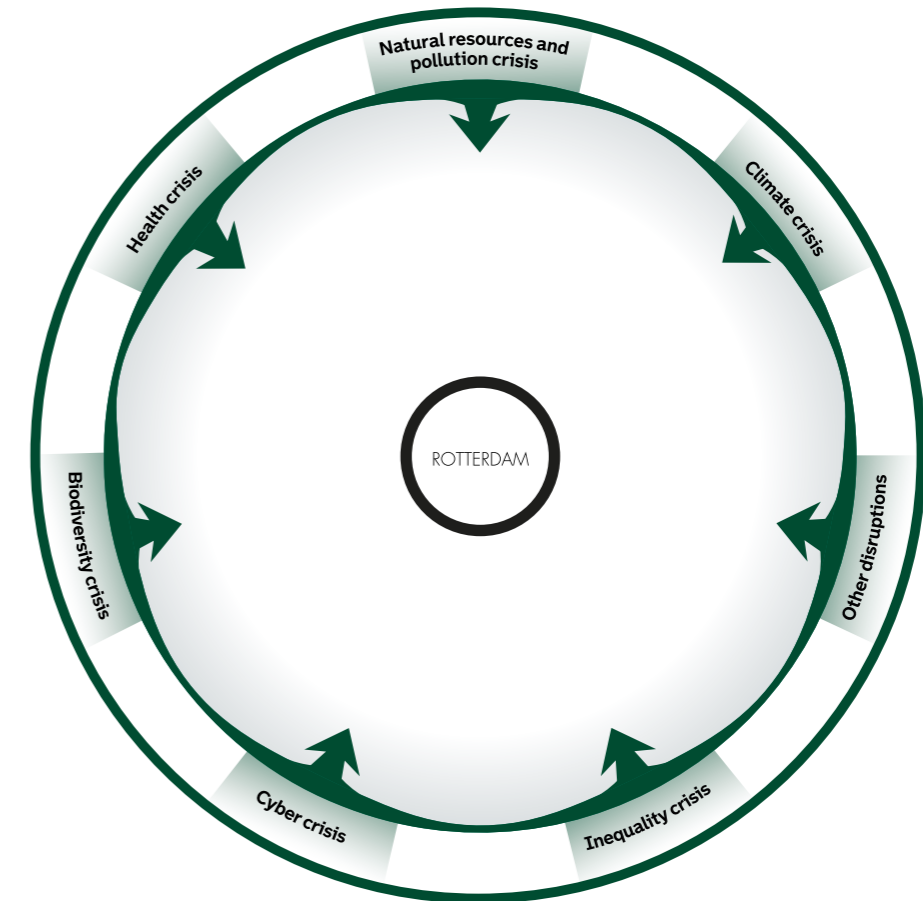


Figure 1.1a: Three planetary and three socio-economic crises have been identified for Rotterdam. Supplemented with the 'other (currently still unknown) disruptions' category.



Next to that, a resilient city should be as well prepared for the unexpected, as yet unknown, threats as possible. An example of this could be a geopolitical crisis that can lead to economic instability and the migration of refugees, including all corresponding tensions that come with it. That's why disruptions we're currently not yet aware of have also been explicitly mentioned. The unknown actually serves as motivation to work on resilience (please refer to chapter 2.7).

Threats are often gradual in nature, like rising sea levels or increasing cyber threats. This is also referred to as a 'stress'. These stresses are sometimes accompanied by a sudden event, a 'shock', such as a flood or a cyber attack. Shocks like these can lead to distortion in the city, also referred to as disruptions (see conceptual framework).

Subsequently, there should be looked at the following questions; how do we deal with this as a city? How can Rotterdam maintain a healthy and attractive living, residential and working climate, while sea levels are

rising, biodiversity is declining, the risk of pandemics and extreme weather conditions is increasing and (wealth) inequality is expanding? How can we prepare for a crisis when we are unaware of its nature and impact?

It goes without saying that resistibility, recoverability, learning ability and adaptability are becoming increasingly important. In a time full of changes, resilience is a precondition for a good living environment, for a prosperous and economically stable city with a good business climate.



We don't yet know the nature and impact of future crises, but we can try to predict them. We can respond to actual future threats much more effectively by making ourselves resilient to known and potential threats and preparing for them. How we intend to tackle this follows after the descriptions of the crises in paragraph 1.2. Paragraph 1.3 takes a detailed look at our vision and strategy, with a further explanation of the course of action that will be followed. Paragraph 1.4 provides a more detailed description of the resilience concept. Paragraph 1.5 takes a look back at lessons learned over the past five years. These lessons served as input for the approach and choices for seven resilience themes, which are set out in paragraph 1.6. And finally, in chapter 2 and 3, there will be focussed on the proposed interventions per resilience theme and the institutional interventions for making Rotterdam more resilient.

Resilience = the ability of people, communities, organisations, businesses and systems to anticipate threats or crises, regardless of their nature and magnitude, and to adapt and grow. This ability is realised through the presence of resistibility, recoverability, learning ability and adaptability (the four resilience capabilities).

Crisis = a period of great danger, difficulty or doubt, during which problems must be solved or important decisions must be made. A crisis often causes disruptions.

Disruption = a fundamental change of circumstances, which disrupts existing systems. A disruption can either occur suddenly (shock) or gradually (stress).

Shock = a disruptive event which can occur acutely and unexpectedly, and which disturbs and disrupts (parts of) the urban systems.

Stress = a disruptive development which gradually puts more and more stress on urban systems. This tension can develop into a potential shock.

1.2 The six crises and the risks for Rotterdam

This chapter describes the possible impact of and risks associated with the three major planetary crises and the three socio-economic crises on Rotterdam's priority list (see chapter 1.1). Not every crisis manifests itself in the same way. Currently, as we are dealing with the pandemic, the health crisis is clearly visible and palpable in every aspect of life. At the same time, we are already noticing the impact of a crisis that is happening gradually, below the surface; the biodiversity crisis. A resilient Rotterdam is prepared for both gradual changes and sudden disruptions. Rotterdam is by no means sitting still; many initiatives and programmes have already been put in place to help the city prepare for these crises. We must continue with that. At the same time, an integrated long-term approach is required, aimed at structurally strengthening the city's resilience.

1. Climate crisis

The sea level of the Dutch coast will rise 1.2 to 2 meters by the year 2100 if greenhouse gas emissions won't decrease. This would put Rotterdam's living and business climate under immense pressure. Even though this may seem quite far away, we should already take this into consideration in everything that is built today.

The world currently seems to be heading for a temperature increase of more than 2.6 °C. The effects of this are already noticeable and will only become more intense during the forthcoming period, also in Rotterdam:

- increasingly intense rainfall will increase the risk of flooding and damage to public and private properties;
- heat stress will lead to more and more victims. It's becoming more of a common occurrence, and the heat is getting worse too. Heat is the most acute threat in the current climate changes. It directly leads to health problems, hospitalisations and deaths. Heat can also hinder the functioning of infrastructure, such as movable bridges;
- droughts will become more frequent and will last longer – with a negative impact on greenery and foundations in the city;
- the sea level rise forecast up to the year 2100 has been revised upwards – from 1 to 1.2 meters – with a possible maximum of 2 meters if parts of Antarctica melt faster than expected. This will directly influence water levels in the city and salinisation of the soil;

- the soil is sinking more than one centimetre per year at some locations in and around the city. This is reinforced by climate change, as prolonged droughts lead to peat oxidation, followed by shrinkage of the soil.

These now visible and often tangible risks also influence other major developments:

- being insufficiently prepared for the effects of the climate crisis doesn't just reduce the economic status of Rotterdam, the region and the Netherlands as a whole, but it threatens the city's long-term development as well;
- the need to switch to an energy grid based on renewable energy sources has enormous spatial, social and economic consequences for the city.

As a city, Rotterdam also contributes to the climate crisis. Taking our contribution to the crisis out of the equation is a major task. That's why Rotterdam is committing significant investments to the energy transition. Possible risks in this field include a lack of required natural resources (see natural resources crisis); lack of electricity grid capacity, high dependencies on a European scale and the risk of energy poverty. Please refer to Energy Resilience to see how Rotterdam is anticipating on this.

Sources include: Weerwoord Rotterdam 2019; KNMI Climate Signal '21 How the Dutch climate is rapidly changing (October 2021); IPCC Sixth Assessment Report, 9th August 2021 – Headline Statements from the Summary for Policymakers.

2. Biodiversity crisis

Biodiversity is under pressure in Rotterdam. The number of plant and animal species is decreasing, and have actually halved in some species groups over the last twenty years. This doesn't only influence nature itself, but us as well; our health and prosperity are directly linked to biodiversity.

The national decline in biodiversity is evident in Rotterdam as well. Biodiversity is of vital importance to a future-proof city; our health, well-being and prosperity, our quality of life and our business opportunities are all directly linked to a healthy ecosystem. Rotterdam is certainly feeling the implications of the degradation of those ecosystems:

- the current too monotonous nature in the city has made Rotterdam vulnerable to heat stress and heavy rainfall. Currently, the city is unable to absorb enough water. An imbalance in biodiversity can also lead to pests which can affect people's health (such as

allergies and infections, which can be transmitted from animals to humans, the so-called zoonoses);

- Too little biodiversity and too much uniform urban greenery can negatively affect Rotterdam residents' general health. Scientific research has unequivocally demonstrated that more and more diverse greenery will make people healthier and also ensures people recover faster when they're ill.

The decrease in biodiversity in Rotterdam is caused, among others, by activities and processes which we are jointly responsible for as a city. This includes buildings, desiccation, salinisation of the soil, air pollution or planting projects which are too unilateral. These are all things we, as a city, can positively influence. But more and more diverse greenery in the city will also result in increased competition for space in the city. Space is also needed for the energy transition, mobility transition, circular economy and climate adaptation. However, the big challenge is to make these space claims multifunctional. That will allow us to realise healthy ecological systems in the city and, at the same time, anticipate on other challenges, like the energy transition and climate adaptation. It's therefore certainly no coincidence that Rotterdam is fully committed to greening the city and increasing biodiversity.

Sources include: Rotterdam Biodiversity Implementation Plan, 2021; Compendium for the Living Environment, 2020; National Sustainable Municipalities Monitor 2020 (TELOS); IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E.S. Brondizio; Research by WUR into Nature and health in the city (Wageningen University & Research).

3. Natural resources and pollution crisis

Particulate matter, ozone and nitrogen dioxide cause moderate to poor air quality in Rotterdam. This, in turn, leads to health problems such as respiratory and lung diseases and cardiovascular diseases. The availability and recycling of essential raw materials for the energy transition is crucial for Rotterdam.

Rotterdam is Europe's largest petrochemical cluster, and plays an important role in the production of 'foreign' chemicals which can cause problems for air, water and soil. This also means that Rotterdam can particularly make a difference where the reduction of, for example, PFAS, nitrogen, asbestos and fine and ultra-fine particles is concerned.

The natural resources crisis affects Rotterdam in various ways. In addition to pollution, the impact on the energy transition is crucially important as well:

- essential materials like platinum, iridium and cobalt are needed for the production of green hydrogen. The construction of several hydrogen factories (electrolysers) is planned in Rotterdam during the forthcoming years;
- lithium, nickel, copper, graphite, manganese and rare earth metals are essential materials for the production of solar panels, batteries and wind turbines.

By 2050, 400% more of the abovementioned materials would be required to successfully realise the energy transition, and work towards a climate neutral economy. Not enough critical metals are currently being produced to meet even a quarter of the climate ambitions. On the one hand, this potential natural resources crisis could influence Rotterdam's energy transition. On the other hand, it also offers opportunities if innovative solutions for lowering the use of these resources, and a greater recycling efficiency, would be devised in Rotterdam.

Most of Rotterdam's pollution comes from air pollution and soil pollution; air pollution particularly causes all kinds of health problems. Rotterdam has therefore already set firm targets to improve air quality. This includes, for example, reducing soot emissions and nitrogen dioxide in the air. Noise nuisance also causes stress, and therefore reduced resistance.

Sources: TNO – Working towards a green future, 2021; HCSS (The Hague Centre for Strategy Studies): The New Great Game: Securing critical minerals today for a clean energy system tomorrow, 2021; RIVM, luchtmeet.nl; WHO/Europe | Environmental Noise Guidelines.



4. Inequality crisis

Rotterdam has the greatest wealth inequality of all cities in the Netherlands. This is an important factor for the inequality of opportunities amongst people in the city.

Wealth inequality has a major impact on people's lives. It is currently increasing right across the globe, and Rotterdam is no exception. This increase is a result of trends like climate change, digitalisation and pandemics. This global increase in inequality leads to greater development inequalities in opportunities for proper development, also in Rotterdam. The inequality crisis is actually a health crisis too: the difference in life expectancy spent in good health between people with a low and high level of education is more than 14 years.

Wealth inequality is expressed in the so-called Gini coefficient; the higher, the more skewed. This coefficient is the highest of all Dutch cities in Rotterdam.

The established upper layer, which has the most economic, cultural and social capital, is a rare phenomenon in the Southern focus neighbourhoods (2%). Focus neighbourhoods are neighbourhoods where the accumulation of problems due to opportunity and wealth inequality is most severe. We have a relatively

large number of young residents with little economic capital (as yet) in the South, but a relatively large amount of social and cultural capital. This gives them the potential to increase socially (29% compared to 22% in the whole of Rotterdam). The group scoring low on all fronts is overrepresented in the so-called focus neighbourhoods in Rotterdam South (24% compared to 14% in the whole of Rotterdam) - the same situation can be seen in parts of Rotterdam West. The scores for social factors, for example, are lagging behind in neighbourhoods like Bospolder and Tussendijken. The scores in that domain are comparable to the weakest Southern neighbourhoods.

These and other forms of social inequality don't promote the individual's resilience, and therefore not the community's either. Rotterdam has therefore stepped up the fight against poverty and unemployment, low educational opportunities for children, early school leaving, health problems, energy poverty and the shortage of socio-economic and digital skills.

Sources include: G. Custers (2021), The Redistributed City. Changes in the population composition of Rotterdam South; CBS (2019), Prosperity in the Netherlands; www.wijkprofile.rotterdam.nl; UN, World Social Report 2020 – Inequality in a rapidly changing world; GGD Rotterdam Rijnmond – Health Monitor, May 2019.



5. Health crisis

The chance that a Rotterdam resident will experience a pandemic in their lifetime has doubled to about 40% over the past ten years and will double again during the forthcoming years. Pandemics like COVID-19 should be regarded as a continuous risk.

Just like all other cities in the Netherlands and the rest of the world, Rotterdam was completely overwhelmed by the COVID-19 pandemic. The pandemic also proved to be more difficult to fight than originally estimated. The chance that a Rotterdam resident will experience a pandemic in their lifetime is only increasing. Therefore, we will have to start regarding pandemics like COVID-19 as a continuous risk. The corona pandemic has made it abundantly clear what action can be taken for a city like Rotterdam. COVID-19 had, and still has, both socio-economic and psychological consequences:

- declining turnover in various sectors, such as the hospitality sector and the art and culture sector;
- mental health problems, for example feelings of anxiety and stress. This was worse in vulnerable groups;
- tensions and even extreme outbreaks of violence;
- a sharp decline in trust in the government, institutions and media.

One of the risks is that we continue to underestimate the consequences of the pandemic and the risk of recurrence. Analyses conducted in the spring of 2020 still assumed one short temporary wave of contamination. Rotterdam's response was and is aimed at recovery. In recent EUR research, the recommendation was given to pay more attention to urban transformation and a higher level of resilience. Rotterdam displayed a mixed picture at the time of COVID-19: on the one hand, the city's population experienced fears and concerns about their health and position and, on the other hand, we saw a resilient city in which residents, the local government and institutions were able to provide answers to problems caused by COVID-19. The latter offers tools for further reinforcing the city's resistibility and recoverability. The health crisis goes beyond pandemics, as health issues can also be caused by pollution, heat stress or wealth inequality.

Sources include: <https://www.weforum.org/agenda/2020/03/coronavirus-glo-bal-epidemics-health-pandemic-covid-19/>; Impact of the corona pandemic on Rijnmond's economy, the Rotterdam, The Hague and

South Holland Metropolitan Area, July 2020 Dr. Walter J.J. Manshanden Olaf Koops MSc. Prof. Dr. Frank van Oort; Resilient Rotterdam – Experiences from the Corona era. A quick scan of vulnerabilities and transformation in Rotterdam's policy and research. Aurelia Schwarz, Beitske Boonstra and Jurian Edelenbos (EUR), 23rd September 2021; The city under threat: the social impact of COVID-19 on Rotterdam. Editorial team: Godfried Engbersen and Toine Wentink Uitgever: Liveable Rotterdam Neighbourhoods Knowledge Workshop, April 2020.

6. The cyber crisis

Two in three companies are at serious risk of falling victim to cyber crime. In 2019, thirteen percent of people fell victim to identify fraud, purchase and sales fraud, hacking and/or cyber bullying. While all other crimes have been declining for years, cyber crime has seen a real explosion in numbers.

Cyber crime is a rapidly increasing type of crime- in 2020, for the first time ever, there was more cyber crime than domestic burglaries. One in twenty Dutch people aged 15 or older had to deal with hacking that year. Cyber bullying and online purchase and sale fraud also affected more than 4% of the population. If we specifically look at Rotterdam, we can see that:

- the number of cyber crime cases nearly quadrupled in the first half of 2021 (225) compared to the first half of 2019 (64) in Rotterdam. The number of other types of crimes actually dropped;
- the port of Rotterdam has undergone enormous digitalisation and is therefore vulnerable to cyber crime. Several companies have already been hacked. Targeted hacks by large companies can lead to social disruption, because the port is a logistics hub;
- Rotterdam is potentially vulnerable to the hacking of water infrastructure as a result of its vulnerable location in relation to water;
- Rotterdam is committing significant investments to the energy transition. New systems are being introduced which are sensitive to cyber crime (like smart grids: intelligent electricity systems which control supply and demand);
- Rotterdam wants to become a Smart City. This will offer opportunities for the city's and port's resilience. At the same time, we should be aware of the fact that, the increasing dependence on digital systems makes us more vulnerable to, e.g., cyber crime and potential power failures/disruptions.

Sources include: Annual (2020) overview of the Netherlands in figures from Statistics Netherlands; Municipality of R'dam (September 2021) Security: progress in tackling cyber crime; Security Alliance Rotterdam region (2021).





1.3 Vision, strategy and course



Vision: where do we want to be in five years' time?

- The four resilience capabilities (resistibility, recoverability, learning ability and adaptability) will be part of all of the city's urban systems, all policies, programmes and projects by 2027.



Strategy: how to achieve that?

- We're focussing on seven resilience themes (Climate, Energy, Ecological, Social, Economic, Digital and Institutional Resilience), for which a set of interventions has been drawn up.
- We're experimenting in and with the city (like Resilient BoTu2028, Cyber resilience in the neighbourhood and Challenges).
- We're embedding the resilience philosophy in policy, selected programmes and projects in the city and region (like Rotterdam's Strategy on Spatial Planning and the Environment, Safety Programme, GGD 3.0).
- We're developing a multi-year knowledge agenda linked to the Resilient Delta Initiative (RDI – a new partnership with TU Delft and EUR aimed at major resilience challenges).

Steady, with broadening and deepening elements

Rotterdam is focussed on reinforcing the city's resilience. We are doing this in order to be better prepared for major crises and the changes which will accompany these. But also to take advantage of opportunities arising from those changes. Back in 2016, Rotterdam already developed an initial resilience strategy for the city. We have opted to focus on seven resilience themes in this new strategy, just like we did in the 2016 strategy. We will be adding a knowledge agenda and practical initiatives to this.

The new focus will allow us to broadly continue with the city's first resilience strategy (Rotterdam Resilience Strategy, 2016). In comparison with the first strategy, there is a broadening of themes, and we are now opting for a more structured and systemic approach.

To elaborate, Ecological and Economic Resilience have now been included as separate themes. This choice has been motivated by the existing urgency at the global and local level of the biodiversity crisis and the pandemic. Next to that, the theme "Rotterdam Network Society" is no longer included as a separate theme, instead, it has been integrated in the general knowledge development and safeguarding of the resilience philosophy, in both the municipal organisation and the city.

Since December 2021, Rotterdam has had a so-called 'Spatial Planning and Environmental Strategy' (Omgevingsvisie) in place. This strategy offers an important framework to structurally and integrally embed the resilience philosophy in spatial policy and related projects.

This deepening is also reflected in the development of a multi-year knowledge agenda. We'll be developing both substantive and methodical knowledge and tools together with knowledge partners. This is necessary to support and accelerate the city's resilience. The Resilient Delta Initiative (RDI – see Chapter 3 for more information) is the knowledge agenda carrier.

The learning outcomes of recent years, including the experiences gained during the pandemic, have been translated into this strategy for 2022-2027. This takes Rotterdam's approach to resilience into a new phase, with a new focus:

- from the 'what' and 'why' to the 'how';
- from ad hoc to structural and systemic;
- from consciously incompetent to consciously competent;
- from pilots to upscaling;
- from incidental research to structural knowledge development, based on a multi-year knowledge agenda.

And finally, this strategy is given a guiding and agenda-setting design, allowing the next council to draw up a more detailed 'implementation agenda' with partners within the municipality and partners in the city.

"Resilience is a precondition for a good living environment, well-being, prosperity and a good and stable living and working climate for all Rotterdam residents and Rotterdam companies."

Arnoud Molenaar,
Rotterdam's Chief Resilience Officer

1.4 The four resilience capabilities

Resilience consists of a collection of four capabilities of a person, a group, an organisation, a network, a neighbourhood, a district, a city, a society, or a culture. These capabilities are about how well people, communities or organisations deal with major and minor changes. Resilient Rotterdam focusses on how we deal with the major changes of our time, by reinforcing those four capabilities (Figure 1.4a).

The four characteristics are:

1. **resistibility:** preventing the impact of a crisis (preventive);
2. **recoverability:** the ability to recover if a 'shock' does occur;
3. **learning ability:** the ability to learn from a crisis;
4. **adaptability:** the ability to adapt and come out stronger.

These four capabilities will enable us to anticipate on different phases of a crisis (figure 1.4b), not only where preventing and recovering from disruptions is concerned, but in taking advantage of opportunities that may arise as a result of a disruption, as well.

That can also lead to growth. By being well prepared (resilient), future damage can be prevented and possible repair costs at a later stage can be avoided. Resilience also ensures 'business continuity' in the city and the municipality. In short, resilience will ultimately lead to growth, by:

- avoiding extra costs;
- identifying and exploiting opportunities;
- introducing the right measures which generate added value;
- learning, adapting and growing (transformation).

This is also known as the 'Resilience Dividend' (Judith Rodin, *The Resilience Dividend – Being Strong in a World Where Things Go Wrong*, 2014).

A resilient city is well prepared for potential incidents, crises, or setbacks; learns from them, recovers quickly, and adapts in order to thrive.

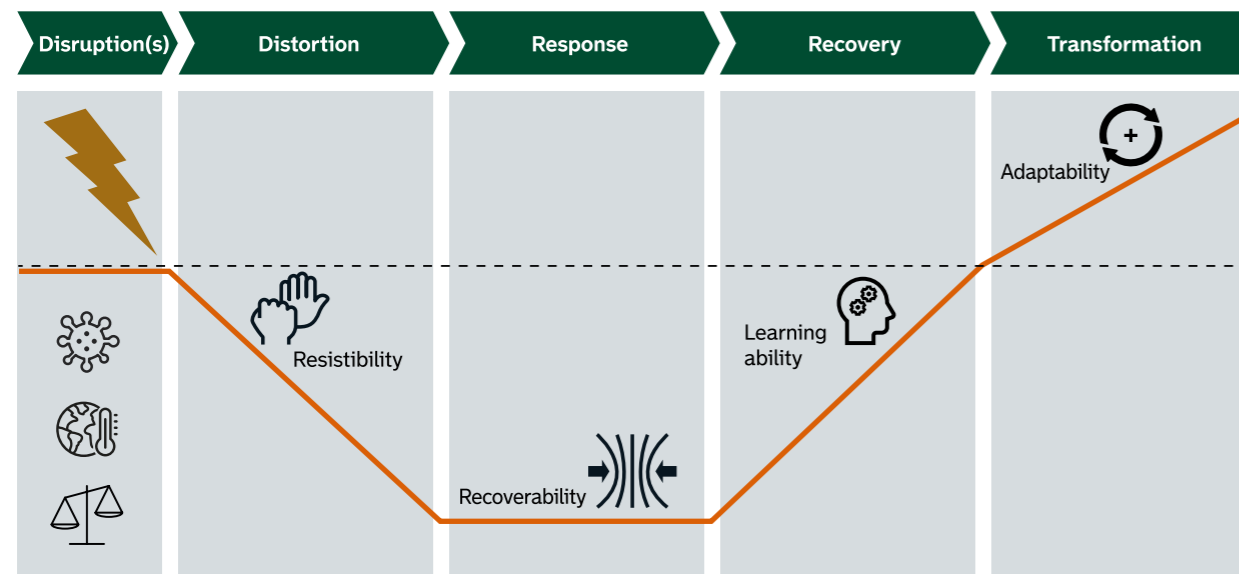


Figure 1.4b: The phases of a crisis and the skills required to be resilient.

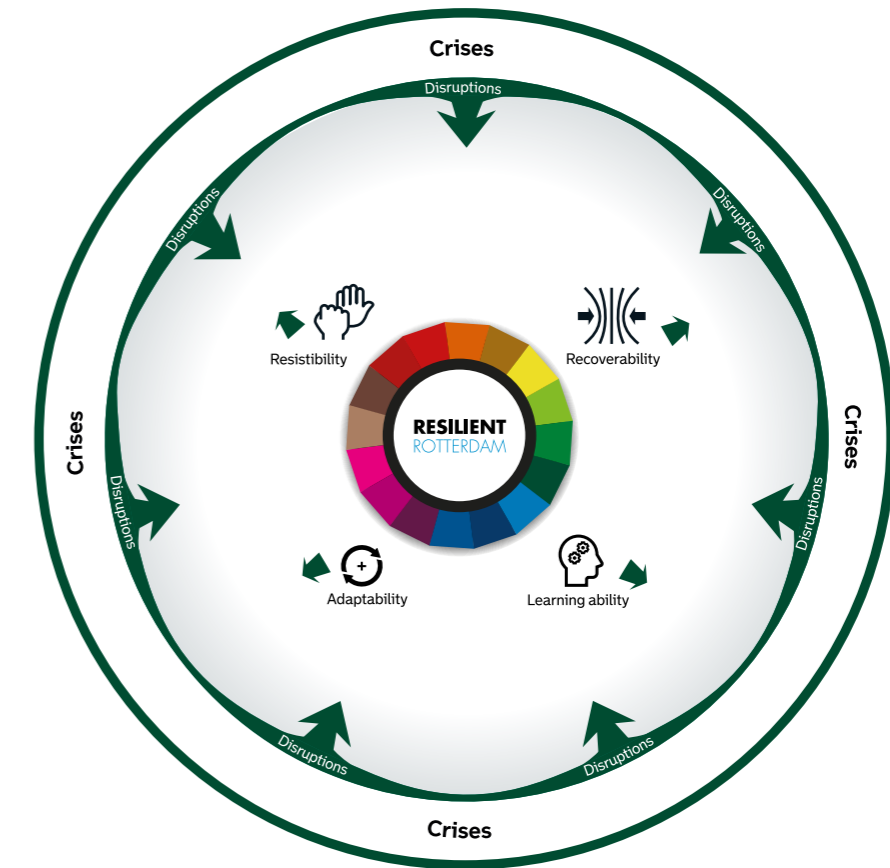


Figure 1.4a: Rotterdam is focussing on strengthening the four resilience capabilities in order to become more resilient to known and, as yet, unknown crises.

Resilience: resistibility + recoverability + learning ability + adaptability

A system's **resistibility** is determined by its ability and capacity to prevent or limit the impact of a stress or shock.

For example: a dike to hold back the water, or a firewall to prevent you from being hacked. This requires a certain degree of robustness, to demonstrate resilience.

A system's **recoverability** is determined by the extent to which recovery can take place. There is a maximum amount of change a system can absorb before it loses its ability to recover.

For example: the extent to which a neighbourhood recovers after a flood, or how an economy recovers following a pandemic. This requires a certain degree of flexibility and inclusiveness.

A system's **learning ability** is determined by its capacity to reflect on and learn from a crisis and our response to it, allowing us to emerge stronger.

Explanation: have we structurally built in our ability to reflect, making sure we can learn from the impact of a crisis? Do we now know the lessons we have learned from the pandemic, making sure we can adapt and be better prepared for the next pandemic? This requires resourcefulness.

A system's **adaptability** is determined by the courage and skills needed to change the system (transformation), making sure we can become more and more resilient and ultimately grow.

Explanation: are we able to actually implement the lessons learned, including necessary system changes and other interventions? Making sure we have become more resilient and are better prepared for the next crisis? This also requires flexibility, resourcefulness and inclusiveness.

1.5 Resilient Rotterdam: 2016-2021 lessons

This chapter looks at lessons learned from the past five years. These lessons were the input for the approach, for the choice of the resilience themes (paragraph 1.6), and for the knowledge and practice agenda (chapter 3). The lessons are based on the experiences gained during the implementation of the resilience strategy launched in 2016. Back then, the approach already aimed at knowledge development and application, implementation in pilots and embedding it in the municipal organisation. In general, we have learned that building a strong and resilient city requires a more structural and (even) more integrated approach: with a

multi-year approach for various resilience themes and the corresponding knowledge agenda; and an integrated approach at the neighbourhood level. Box 1 lists the main general lessons. Out of all the pilots conducted in the city, the neighbourhood-oriented Resilient BoTu2028 pilot (Box 2a) was and is a good source of specific lessons (Box 2b).

In Appendix 1, an impression of the main milestones and highlights from the implementation of the 2016 Rotterdam Resilience Strategy can be found.

Most important lessons learned from the 2016-2021 period

- A resilient Rotterdam requires a more structural (programmatic) and systemic (focussed on system interventions) resilience approach. This could include a multi-year commitment to crucial resilience themes, scaling up experiences at neighbourhood level, embedding the resilience philosophy in the municipal organisation and implementing adjustments where necessary.
- Part of a structural approach is knowledge development with partners, both thematically and methodically and on a multi-year basis. This is essential to gain a better understanding of how to put resilience into practice at urban level.
- A neighbourhood-oriented approach with residents and partners, aimed at resilience, truly works. We will scale up this neighbourhood-oriented approach in the future where possible.
- New forms of collaboration are needed, which will require (temporary) flexibility in dealing with the existing frameworks, procedures and programme lines.
- A resilient Rotterdam also requires a resilient municipal organisation.
- This will result in (even) more attention for integrated working within the municipal organisation (including the budget), scenario thinking and the ability to learn.
- The pandemic has taught us that our natural reflex is to bounce back to the old situation, but that it's far better to not just recover, but to bounce to a stronger level and ultimately come out more resilient.
- In addition to thematic interventions, it is essential to raise awareness and increase institutional resilience skills.
- A resilient Rotterdam requires continuity in its approach and extends beyond the council terms.
- Working on a resilient Rotterdam will lead to all kinds of spin-off: jobs, conferences, subsidies, institutes.

Box 1



Resilient BoTu2028: an example of a resilience approach at district level

In 2019, the Resilient Bospolder-Tussendijken 2028 programme, enjoyed a grand launch in Park1943; a milestone for Bospolder-Tussendijken (BoTu) and for Rotterdam's resilience approach. The programme became one of the most important pilots of the Resilient Rotterdam movement. All resilience issues came together at the neighbourhood level. The focus was laid on the social challenges. The programme is focussed on the long-term and has an integrated approach. The first lessons have now been mapped out.

By 2028, BoTu should become the first resilient neighbourhood in Rotterdam, with a social index above the urban average. We will achieve this by using the energy transition and climate adaptation in such a way that we'll be able to use them for a socially stronger neighbourhood. This will ensure that the two transitions contribute to the creation of new employment opportunities for local residents. We also refer to this 'leverage effect' as Social Impact by Design (SIbD), or 'Resilience-by-Design'. SIbD, initiated by the REBEL group, focusses on tackling social challenges through innovation and on the search for new forms of collaboration. In this process, six teams were selected through an open call, all teams work on a specific sub-issue of BoTu, and thereby contribute to BoTu's Social Resilience.

Box 2a



Interested in finding out more about this pilot project? Then take a look at the [brochure](#) or visit the [website](#).

Lessons learned in Resilient BoTu2028 (including the Social Impact by Design programme component) based on the first 2.5 years

- Use the social challenges as a starting point and make it the central focus.
- Use the other challenges and transitions as leverage for Social Resilience (such as the energy transition and climate adaptation).
- Use an integrated and programmatic approach, aimed at the neighbourhood's scale level and using a long-term perspective.
- Involve residents and key partners in the neighbourhood right from the very start and create ownership.
- The organisation should be based on participation.
- Focus on the neighbourhood's strengths (like creativity, pride and strong networks), instead of the problem.
- Use the energy present in the neighbourhood.
- Formulate a common objective which offers perspective, which inspires and provides direction ('BoTu will be Rotterdam's first resilient neighbourhood by 2028').
- Schools function well as a driving force for resilience in the neighbourhood.
- Strong social networks in the neighbourhood form the basis for community resilience.
- Look beyond the neighbourhood's boundaries. Sometimes you may find the parties or solutions you need just outside of the neighbourhood. The adjacent Merwevierhaven – the city and port's new 'maker's district' – can be a source of employment for BoTu's people.

Box 2b

1.6 The approach and the choices we make

1.6.1 System change

Rotterdam focusses on carrying out system changes at three levels when it comes to resilience (Kania, Kramer & Senge, 2018):

1. structural changes (policy, implementation, budgets);
2. relational changes (networks, connections, processes);
3. transformative changes (in relation to people, decisions and behaviour).

These are the levels at which you have to intervene in order to bring about a system change, according to Kania, Kramer and Senge (2018) – see figure 1.6a. A system change like this is important to realise a defensible, recoverable, learning and adapting Rotterdam. Without system change and the structural embedding of the four resilience principles, we remain reactive; adjusting to situations ad hoc, and only turning a limited number of knobs. This is the reason why the resilience challenge is also seen as a transition challenge.

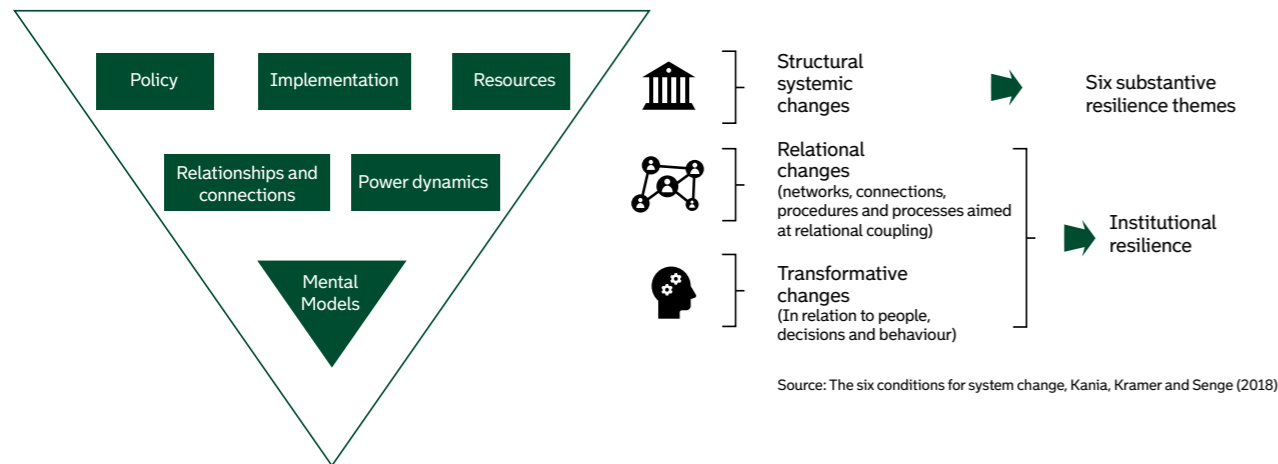
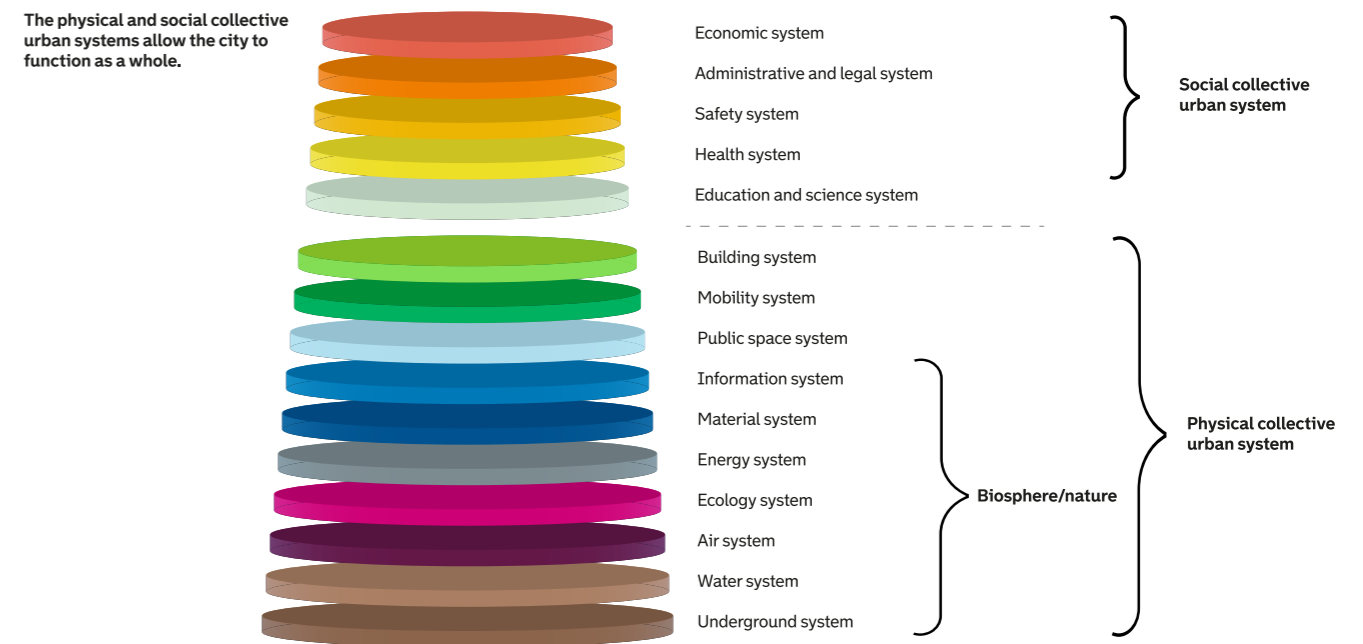


Figure 1.6a: The six conditions for system change.

We have to deal with urban systems at all system change levels (structural, relational and transformative). We'll be describing these in the next paragraph. In chapter 2, there will be elaborated on the urban systems and corresponding interventions under each resilience theme. Since there are still numerous uncertainties, it is necessary to focus on all three levels. In order to become

more resilient as a city, we should continuously collaborate with our partners (urban partners, Rotterdam residents, the municipality) in determining the right course of action. Scenario-oriented, knowledge-driven and data-driven working methods, as well as the capacity to adjust when necessary, are important parts of the approach.



- The physical systems will only function when the social systems function properly
- The social systems can only function if the physical systems function properly
- All systems must function within the boundaries within which humanity must navigate in order to continue to make sustainable use of our planet's resources (the planetary boundaries).
- Some systems have to go through a fundamental change process (transition) to ensure that the whole of all systems remains within the planetary boundaries and is resilient.

Figure 1.6b: the physical and social collective urban systems.

1.6.2 The urban systems

The focus won't be on incidents – on what's happening 'today' – throughout our journey to a resilient Rotterdam during the forthcoming years, but instead on the structures and systems behind them. The systems, giving direction and meaning to our lives in the city on a daily basis, should be changed for the better. We'll be working towards a resilient Rotterdam during the forthcoming years, by consistently equipping policy and urban systems with the four resilience capabilities.

Figure 1.6b schematically shows which crucial collective systems we distinguish between in Rotterdam. 'Crucial' means: Rotterdam can't function, or function sufficiently, without this system. 'Collective' means that they are in every respect by and for everyone. People will quickly run into problems if they're excluded from one or more of these systems. Together, these systems create opportunities for the city's development. They provide balance, allowing nature, people and organisations to grow, develop and innovate.

1.6.3 Seven resilience themes in response to the seven crises

The previous paragraphs talked about the fact that seven crises will be central to the resilience strategy. Based on the experience gained over the last few years and in consultation with internal and external partners, seven resilience themes were chosen to anticipate on the aforementioned crises. These themes represent the core of the 2022-2027 Resilient Rotterdam Strategy (Figure 1.6c). We will continue to build further on the themes from the first strategy (2016), and built connections with existing (municipal) programmes like Weerwoord (climate resilience), Cyberbeeld (cyber resilience) and the biodiversity implementation programme. We will explicitly be focussing on safeguarding the four resilience principles within the resilience themes, as well as the extent to which the interventions integrally contribute to a more resilient Rotterdam.

In the next part, a brief description of the resilience themes will be given (detailed description can be found in chapter 2). It is important to mention that the themes do not exist in a vacuum, solely linked to a specific crisis. As these crises are interconnected, so are the themes, which is why, an integrated approach based on the resilience themes is required (figure 1.6d). The resilience themes and corresponding interventions have been chosen in a way which allows us to strengthen the resilience of the entire city.

Focussing on these seven resilience themes is Rotterdam's most important line of action in its approach to become a resilient city. Two action lines linked to this are: General knowledge development and knowledge sharing (see chapter 3.1) and Resilience in practice (see chapter 3.2).

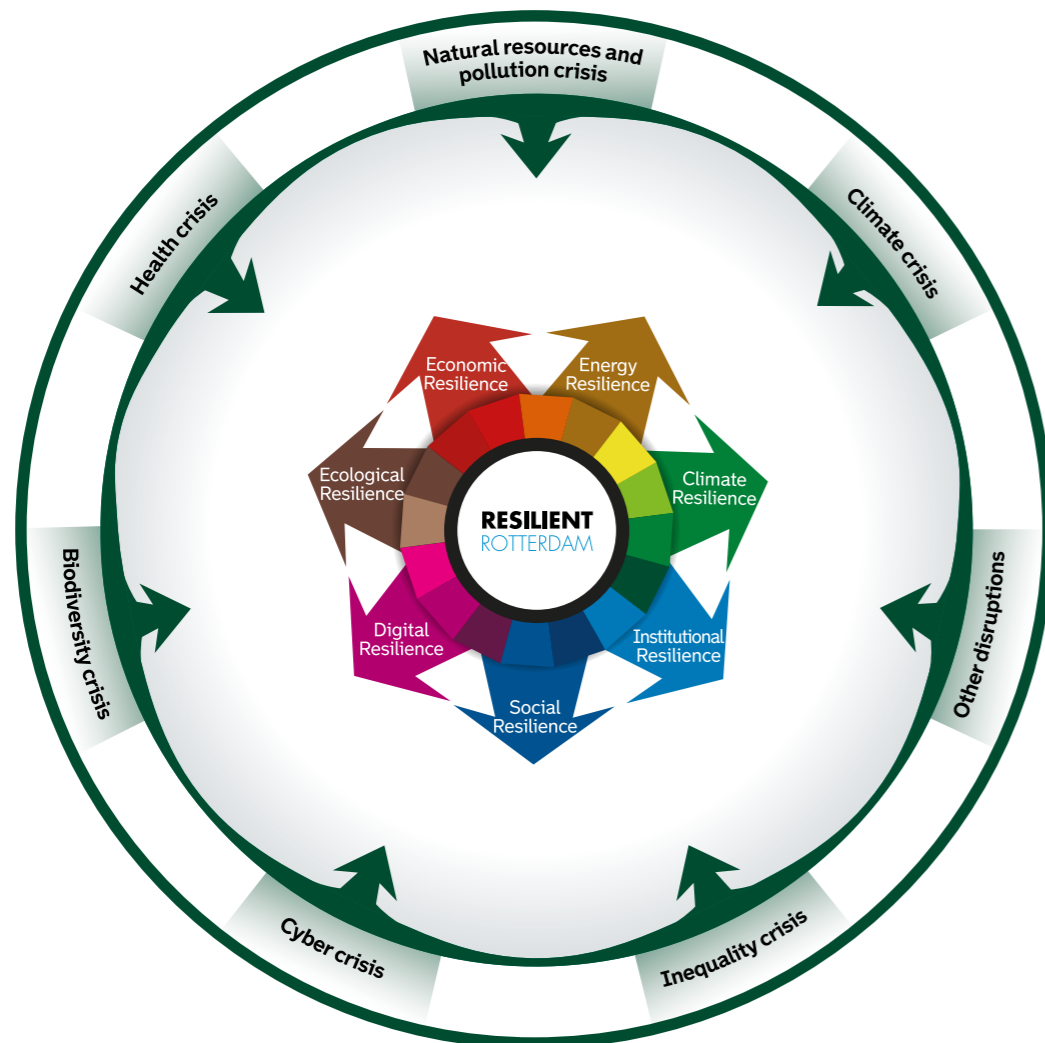


Figure 1.6c: Rotterdam is focussing on seven resilience themes to anticipate the known and currently unknown crises.

Climate Resilience

A climate-proof and liveable city for every Rotterdam resident.

The consequences of (accelerated) climate change also require the city to make structural adjustments, in addition to measures to prevent further climate change. Even though Rotterdam has been focussed on this for over ten years, acceleration and scaling up is still needed. The Climate Resilience theme mainly consists of interventions aimed at the climate crisis, and also anticipates – through an integrated approach with multifunctional measures – on the biodiversity crisis, the pollution and natural resources crisis and even the health crisis.

Ecological Resilience

A rich and healthy urban nature for a strong and resilient Rotterdam.

In light of the urgency and impact of the decline in biodiversity, the decision has been made to explicitly place Ecological Resilience on the agenda, by naming it as a separate theme in this resilience strategy. An additional argument is that this theme includes interventions which can also make substantial contributions to tackling the climate crisis, the natural resources and pollution crisis, and the health crisis.

Energy Resilience

Working on a future-proof energy system with clean and accessible energy for everyone.

The energy transition is crucial to limit the impact of the climate crisis. This will lead to many drastic changes in the energy system and possibly to new vulnerabilities. At the same time, we're becoming increasingly dependent on energy. The Energy Resilience theme is aimed at identifying and limiting those vulnerabilities. In addition to anticipating the climate crisis, the interventions are also aimed at limiting the impact of the natural resources and pollution crisis and the inequality crisis.

Social Resilience

Increasing Rotterdam residents' strength and resilience, with specific attention devoted to communities at neighbourhood level.

The impact of many crises is most notable among socially and economically vulnerable groups in the city. Increasing inequality is looming. How are we going to explicitly focus on the resilience of communities at, for example, neighbourhood level? That's the core question within the Social Resilience theme. Interventions are mainly aimed at tackling the inequality crisis and increasing resilience in relation to the health and cyber crisis.

Economic Resilience

A stronger and more resilient economy, with Climate and Cyber Resilience and circularity as opportunities for strengthening the Rotterdam business climate.

Dealing with the increase of constant threats ('stresses') and the corresponding sudden disruptions ('shocks') requires a turnaround in the economic system towards greater resilience. The Economic Resilience theme mainly includes interventions in relation to the inequality, natural resources and pollution crises, and also contributes to anticipating the biodiversity, climate and health crises.

Digital Resilience

Making Rotterdam and its residents more cyber resilient, using Cyber Resilience as a precondition for a good business climate and using data and digital innovations for a more resilient Rotterdam.

The increasing dependence on digital techniques on the one hand, and the persistence and sophistication of cyber threats on the other, are causing an increase in possible shocks and stresses. While the Digital Resilience theme mainly includes interventions in the cyber crisis, it also generates answers to the health, inequality and climate crises.

Institutional Resilience

Strengthening and anchoring of the four resilience capabilities, with a focus on the municipal organisation and associated projects, programmes and processes.

The Institutional Resilience theme is mainly concerned with general interventions applicable to all crises, including potential and unprecedented/unknown crises. Institutional Resilience is generally aimed at strengthening, embedding and applying the resilience capabilities of resistibility, recoverability, the learning ability and adaptability. This is the foundation for a resilient Rotterdam and gives substance to resilience as a precondition for a future-proof and inclusive city. Institutional Resilience is aimed at embedding the resilience philosophy to be better prepared for possible disruptions and to emerge stronger if something does happen.

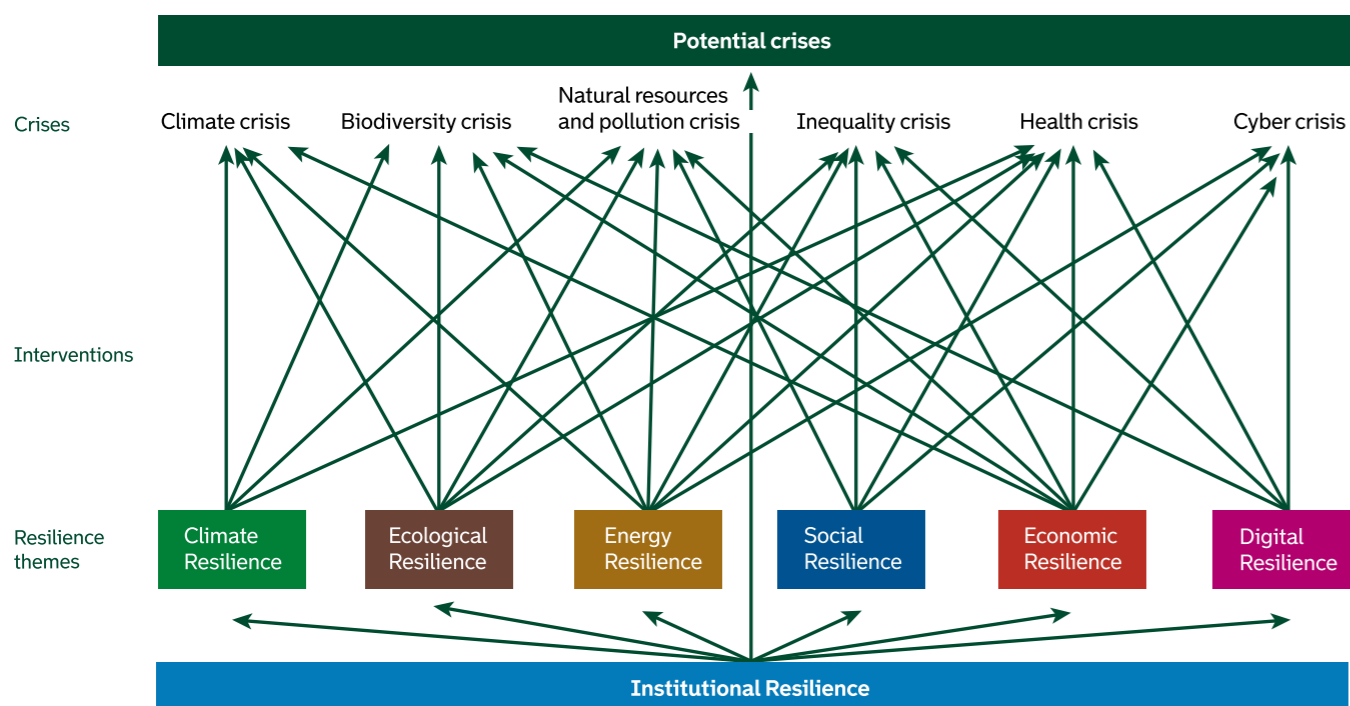


Figure 1.6d: The interventions linked to the various resilience themes make the city more resilient to the majority of the identified crises.

1.6.4 Finally: what we are and aren't doing

Resilience touches everything. That's why we're making a number of substantive choices in this resilience strategy. Choices for things we are going to do (seven resilience themes), but also in relation to what we aren't going to do, or things which will be less explicitly included in the future implementation agenda.

- The city is the main point of attention, with or without the port, depending on the theme. Please refer to chapter 3.2 to read what we do regionally.
- We are not taking the possible threat of terrorist attacks as a possible shock into account here. This threat has been placed with designated organisations like the NCTV, the police and Regional Safety Authorities.
- The focus is on community resilience (resilience at neighbourhood level) within Social Resilience and not so much on the resilience of the individual citizen (see chapter 2.4).
- We are in the midst of a health crisis (the corona pandemic) at the time of writing.

We don't discuss the situation in healthcare in this strategy; this too has been assigned to other bodies, such as ministries and the Health Council. However, we do use lessons from this crisis and take a closer look at the socio-economic impact on the city (see Chapter 2). We have translated this into various resilience themes: Social, Economic and Ecological Resilience.

- Substantive choices have been made, and we also make choices in roles which the municipality can or cannot take on. Depending on the intervention, the role of the municipality varies from being the driving force, setting the agenda and initiating matters, to facilitating, to being a partner in a coalition. The different roles have not yet been worked out in detail. Chapter 2 describes the interventions for each resilience theme and we indicate, in a general sense, who we see as potential partners, both externally (the city) and internally (the municipal organisation). Chapter 3 discusses the role of the municipality's central driver team for resilience.





2. Resilience themes

Rotterdam anticipates on the seven major crises described in chapter 1 (climate, biodiversity, pollution/natural resources depletion, inequality, cyber, health and the unknown and potential crises) with seven resilience themes:

- **Climate Resilience**
- **Ecological Resilience**
- **Energy Resilience**
- **Digital Resilience**
- **Social Resilience**
- **Economic Resilience**
- **Institutional Resilience**

In this chapter, firstly, the urgency of each resilience theme will be discussed. Secondly, the current policy context, the resilience objective and the basic choices, aimed at a more resilient Rotterdam, will be outlined. Finally, a compact summary of potential interventions and knowledge questions will be given. Together with stakeholders and municipal departments, there will be elaborated on the potential interventions and knowledge questions, which should ultimately be translated into research and programmes. The knowledge questions concern larger issues and sometimes specific issues which may become relevant to the theme in question during the forthcoming years.

We have also indicated which Sustainable Development Goals (SDGs) apply to each resilience theme. The SDGs are seventeen goals, agreed by 193 countries (including the Netherlands) who are members of the United Nations. They are global goals for sustainable development; an end to extreme poverty, inequality, injustice and climate change. Since 2001, Rotterdam has been a member of the VNG's (Association of Dutch Municipalities) "Municipalities 4 Global Goals" campaign. The added value of the SDGs can be found in their use as a common language within the organisation, with partners in the city, the people of Rotterdam, as well as on the national and EU-level.

The relationship between the SDGs and resilience is twofold: first, the structural commitment to the SDGs contributes to a more resilient Rotterdam. In this way, efforts on, e.g., poverty eradication, health, affordable and clean energy, directly contribute to the corresponding resilience themes. Second, the structural commitment to resilience contributes to achieving the SDG-ambition. The continuity and thereby the impact generated by focussing on the SDGs, is strengthened by taking the resilience principles into consideration.



As Corporate Director of Urban Development, I have seen what we, as Rotterdam, can learn from a crisis over the past 1.5 years. The impact of corona was and is substantial, but it also shows that more is possible both within the city as well as within our own organisation than we would ever have thought possible. This resilience is very important! I, therefore, add great value to developing the right skills to become even more resilient as an organisation. I'm referring to the four core capabilities: resistibility, recoverability, learning ability and adaptability.

We really need this to be able to effectively handle the major transitions we're dealing with, such as climate and energy. Fortunately, we're already well on our way to developing and acquiring those competencies. I have already seen this reflected in several projects and processes, like with Rotterdam's new Spatial Planning & Environmental Strategy (Omgevingsvisie), working on a global city for everyone. Our city's adaptability really has taken up an excellent position here.

A resilient city and organisation doesn't just happen. One specific aspect that helped us in this, is that, five years ago, Rotterdam became the first city in the Netherlands to draw up a resilience strategy. This resulted in the broad resilience perspective currently being a regular agenda point within the municipality

and in our conversations with the city. In this way, it is becoming a structural part of Rotterdam's mentality and behaviour. The sustainable development goals (SDGs) challenge us to think in terms of broad prosperity even more, exactly at the intersection of the various issues we're dealing with (physical, social, climate, quality of life, etc.). We're managing to find more and more interfaces in and with the city, in neighbourhoods with residents and businesses, partly as a result of the broad resilience strategy. The BoTu programme is an appealing example of this.

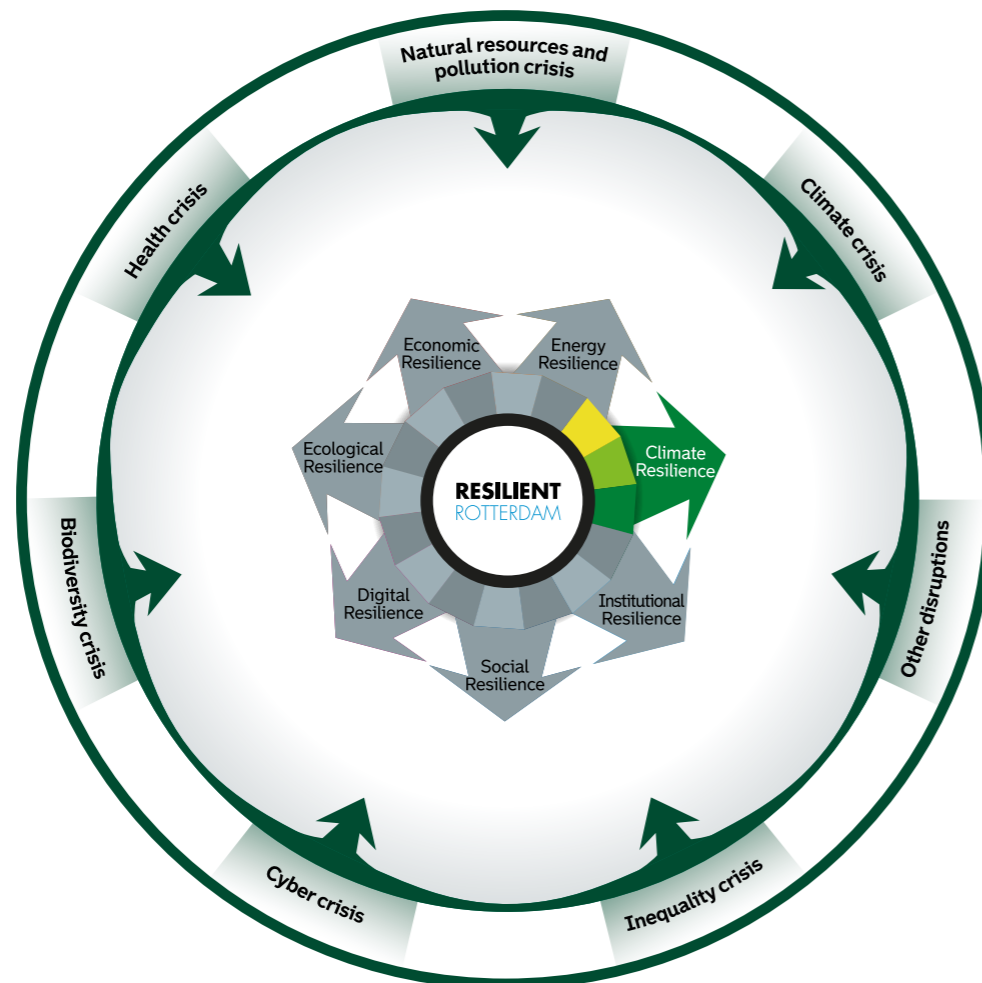
Looking back, I can see that we've hugely benefitted from the resilience course set at that time; the projects launched, the knowledge developed, the networks built up, and the important companies and institutions that were involved. So, that's definitely progress! Still, the world continues to surprise and, yes absolutely, threaten us, with new events and changes all the time. Not doing anything is not an option, that's why it's very good that we now have a follow-up resilience strategy for the next five years.

Hermineke van Bockxmeer
Corporate Director of Urban Development
The Municipality of Rotterdam



2.1 Climate Resilience

Climate Resilience – being prepared for and adapt to climate change is a precondition for broad prosperity and a stable business climate.



Urgency

CO₂ and other greenhouse gas emissions have led (and continue to lead) to global warming and climate system changes. That's why Rotterdam is fully committed to the energy transition and invests in so-called mitigation measures (measures to combat global warming). Yet, climate change is already showing itself; in extreme rainfall, heat and droughts, but also in an accelerated rising sea level, intrusion of salt water and fluctuating river levels. This is already causing problems; we have seen small-scale flooding in buildings, soil subsidence, faults with moving bridges, damage to foundations, more blue-green algae, pests and food and health problems. Next to that, climate change can certainly negatively affect the Rotterdam business climate in the future, particularly the acceleration of rising sea levels. We are at the very forefront of climate change as a city by the sea and river, 80% below sea level.

Current policy

Rotterdams Weerwoord – Urgency document (2019)
– Preparing our city for a more extreme climate together. This Rotterdam climate adaptation programme is the most important starting point for the Climate Resilience theme.

Approach: focus on all adaptation themes (rainfall, flooding, groundwater, drought, heat and subsidence).

Implementation in four tracks:

- public space;
- existing properties;
- new properties;
- Rotterdam residents in motion.

The core of the implementation is that we do it together with partners like the regional water authorities, housing associations and, of course, the citizens of Rotterdam.

Rotterdams Weerwoord is working towards a multi-year programme framework and long-term scenarios.

The 2021-2022 Rijnmond Drechtsteden Delta Programme (part of the national Delta Programme).

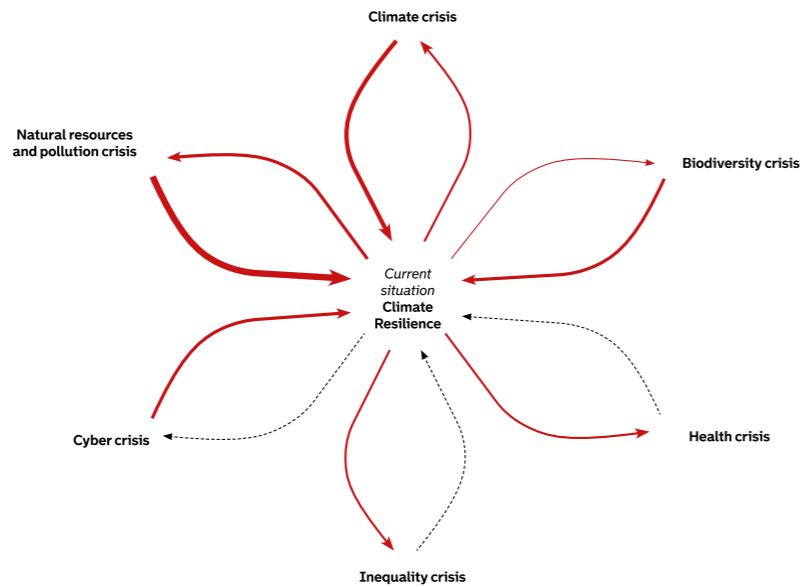
This programme is the policy framework for water safety. Approach: regional collaboration between municipalities, regional water authorities, safety regions, the province, the Port Authority and the national government. Continuation of dike improvement in the context of flood protection; policy development outside the dikes. Desired: broadening to adjacent transitions and resilience themes.

Objective

Working on a climate-proof and liveable city for every Rotterdam resident.

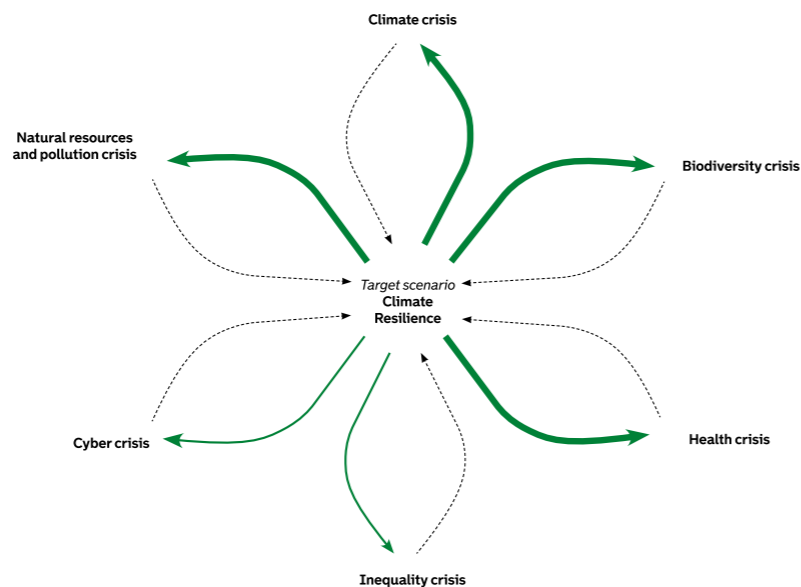
Current situation Climate Resilience

Continuity in climate resilience is absolutely essential in order to confront the climate crisis. The cyber threats inevitably result in additional risks (in connection with vulnerable technical water infrastructure). Soil, air and water pollution are causing declines in biodiversity and natural ecosystems, leading to the reinforcement of climate change. At the same time, climate change has a negative impact on biodiversity (for example, the disappearance of species) and on the natural resources crisis (for example, the use of fossil fuels and the transition to other technologies). There are health risks (eg heat stress) and inequality may increase (costs associated with making homes climate-proof).



Target scenario Climate Resilience

Climate change won't have any negative consequences on infrastructure and society. At the same time, the measures are such that we'll also be able to cope with most other crises more effectively and the city has become more attractive too.



Choices and approach

General:

Climate change is continuing and intensifying, which is why Rotterdam wants to scale up the implementation of climate adaptation. This requires a programmatic approach with clear frameworks and a concrete package of measures. The intention is to further concretise the approach in 2022 in the "Weerwoord 2030 Programme Framework".

This approach is crucial for the city's overall strength and resilience; climate adaptation is a precondition for good growth and a resilient economy (chapter 2.5). And we can now respond to several crises as a result of the broad scope (rainfall, flooding, groundwater, drought, heat and subsidence) and the choice for an integrated approach. For example, the right greening can effectively contribute to the collection of rainwater and increase biodiversity.

The approach to climate adaptation must be structural, systemic and integral:

Structural: by means of a multi-year programmatic approach to several dossiers: Rotterdams Weerwoord, the national Delta programme and Resilient Rotterdam. This includes a specific focus on spatial upscaling, linked to the new neighbourhood approach.

Systemic: targeted interventions in the urban water system and outdoor space, private properties and even the social system (see figure 2.1a). With more attention devoted to protecting our vital systems and to safeguarding the resilience principles in climate adaptation projects and programmes.

Integral: a multidisciplinary approach, determining and utilising opportunities (for example in the seven city projects), in line with several urban challenges and transitions, such as the multifunctional roofs programme.

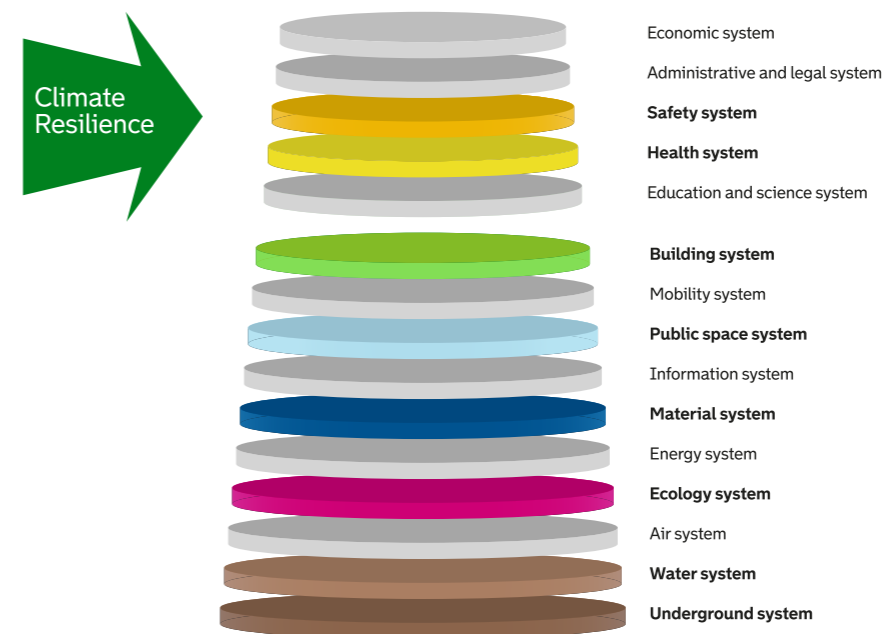


Figure 2.1a: Climate Resilience's main attention is devoted to applying the resilience capabilities (resistibility, recoverability, learning ability and adaptability) to Rotterdam's systems with a focus on water, public space and the social collective.

Specific spearheads:

In addition to the current policy, we are aiming for a multi-year resilience knowledge agenda with prominent attention for climate resilience. Thereby, the focus should be primarily laid on the implications of the accelerating sea level rise, when it comes to the construction task in the short and medium term, as well as the economic business climate in Rotterdam (Figure 2.1b).

A second spearhead is the explicit focus on leveraging the effects of climate adaptation (and the energy transition), in relation to social strength and the resilience of neighbourhoods. In this aspect, we continue to build on the experiences gained in Resilient BoTu2028.

Potential interventions

1. Partly steering towards (Climate) Resilience as a lever for resilient neighbourhoods, learning from Resilient BoTu 2028.
2. Helping to embed the resilience philosophy in the National Delta Programme.
3. Advocating and using Rotterdam's adaptation expertise for international missions in the field of water, adaptation and resilience.
4. Advocating interests at the Global Center on Adaptation and further elaborating on Rotterdam's adaptation expertise input and the method of collaboration.

5. Contributing to identifying and putting current and new topics on the agenda, with the Resilient Delta Initiative as the main framework. Please also refer to the knowledge agenda.
6. We'll be working on a Rotterdam heat plan over the next six years, with support provided by the EU.

Knowledge agenda

1. What are the consequences of the accelerated sea level rise for the regional business climate?
2. Development of scenarios for future use of space and associated communication strategy.
3. How can we realise heat-resistant properties?
4. Mapping out the consequences of warming the subsurface for pipes and facilities.
5. Climate adaptation in relation to inequality, health and behaviour.
6. Mapping out avoided and yet to be avoided damage from climate adaptation.
7. Water safety and the built environment (locations and requirements in relation to, for example, the high-rise vision).
8. Further developing vulnerabilities of vital infrastructure and cascade effects as a result of flooding.
9. Investigating vulnerabilities in local and regional critical infrastructure.
10. Exploring the need for building standards for the areas outside the dikes and developing these if necessary.

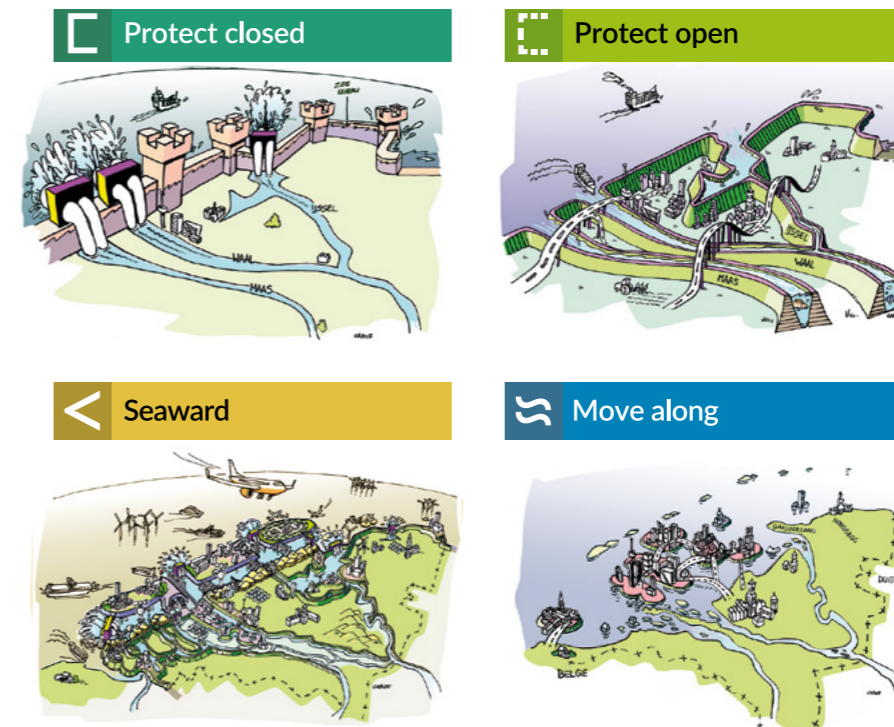


Figure 2.1b: A first impression of four global action perspectives for the west of the Netherlands, in order to anticipate long-term accelerated sea level rises. Each action perspective has major spatial consequences and will inevitably result in short-term choices (building types and construction locations). (© Carof image suppliers on behalf of Deltares)

Source: Haasnoot, M, F. Diermanse, J. Kwadijk, R. de Winter, G. Winter, 2019, Strategies for adaptation to high and accelerated sea level rises. An exploration. Deltares report 11203724-004.



“Not taking the long-term consequences of climate change into account, or insufficiently taking these into account, in the current housing development will lead to additional costs and damage in the future and to possible complications for climate-adaptive solutions which will require further elaboration, consideration and decision-making during the forthcoming years.”

Delta Commissioner, ‘Spoor2’ advisory letter for housing and climate adaptation, 3rd Dec. 2021

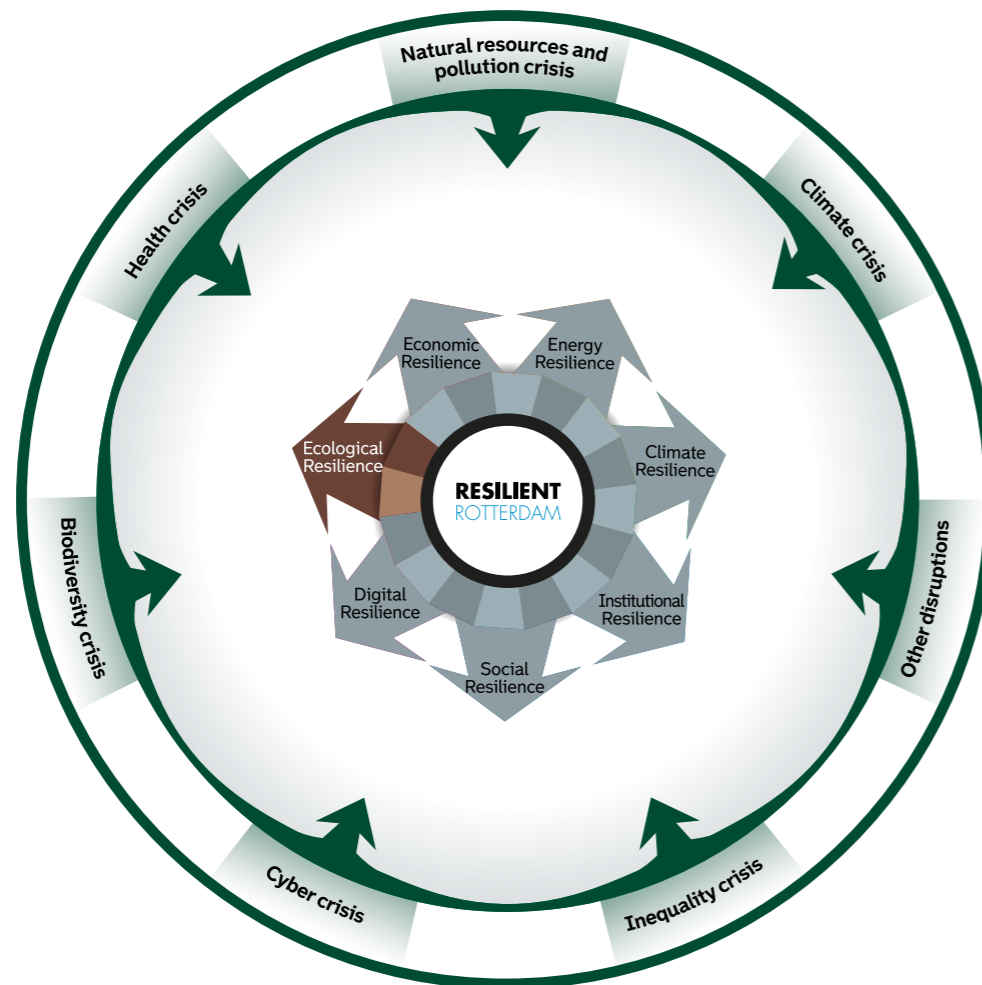
Strategic partners:

- External: including neighbourhoods, residents, regional water authorities, safety regions, housing corporations, Rijkswaterstaat, Delta Commissioner, Province of South Holland, RDI TU Delft, EUR, Global Center on Adaptation (GCA), Resilient Cities Network and C40;
- Internal (Municipality of Rotterdam): including City Management, Urban Development, Social Development.



2.2 Ecological Resilience

A resilient, natural ecosystem is crucial for the city's quality of life, climate resilience, health and attractiveness.



Urgency

Since 1900 (CLO), biodiversity has decreased by 62.5% in the Netherlands. Plant and animal species are disappearing as a result of human activities (such as land use and pollution) and the changing climate. Natural processes and cycles won't work properly if biodiversity is too low. This will cause so-called 'ecosystem services' of nature (Figure 2.2a) to stop in the long run. A resilient ecosystem is important for the city's quality of life, climate resilience, health and attractiveness. Rotterdam needs to realise further greening in order to remain a liveable city. This requires an integrated approach, not only aimed at greenery, but also at improving soil, water and air quality.

Current policy

The Biodiversity Implementation Agenda (2021) is how Rotterdam started tackling the biodiversity crisis. The ambition: Rotterdam restores, preserves and – where possible – strengthens biodiversity in all Rotterdam biotopes. Three pillars:

- quick benefits;
- transition;
- embedding.

This is the main starting point for the Ecological Resilience theme.



Examples of ecosystem services in the Netherlands

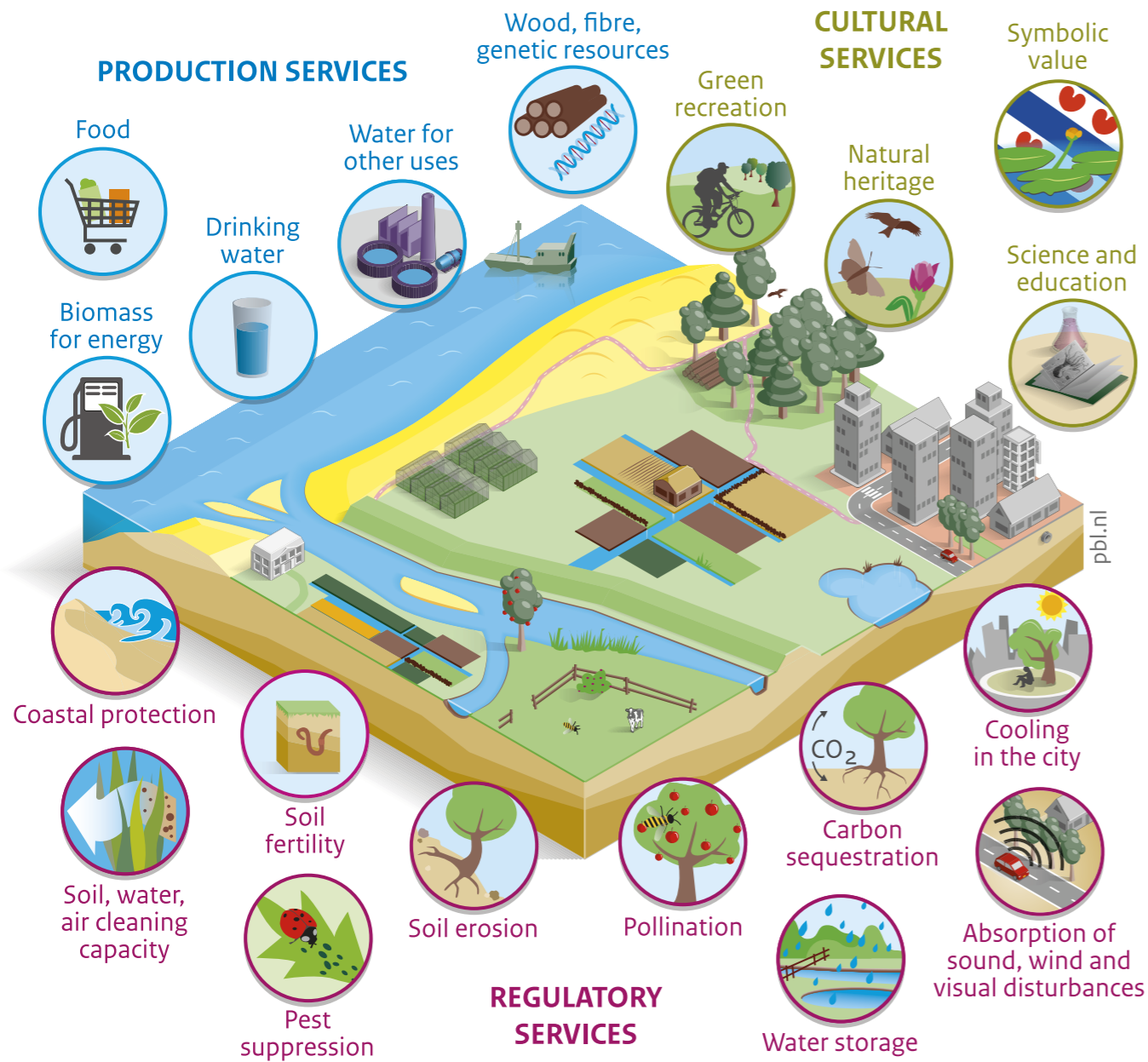


Figure 2.2a: Nature is the source for all kinds of products and services, the so-called 'system services'. Source: www.PBL.nl.

Objective

To realise a rich and healthy urban nature for a strong and resilient Rotterdam!

Current situation

Ecological Resilience

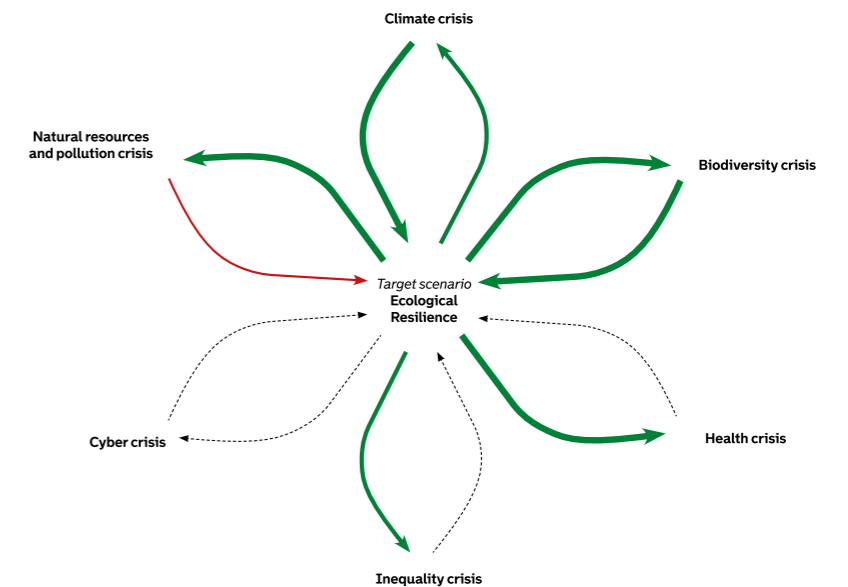
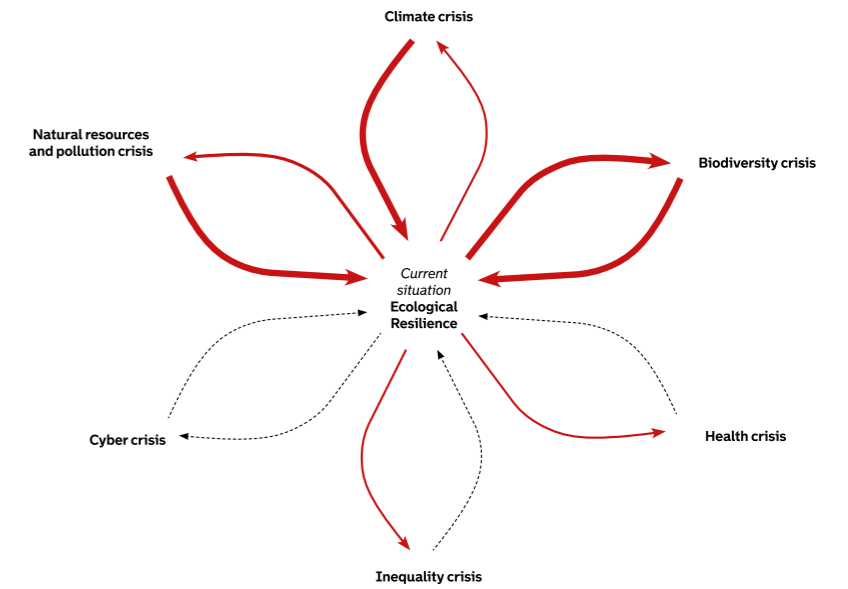
The resilience of Rotterdam's current natural system is under pressure due to the biodiversity crisis. This is caused by fossilisation, light pollution, too much intensive management (mowing, felling), little variation in planting, soil depletion and invasive exotics. In turn, this is being reinforced by the climate crisis (more droughts, increasing heat) and the raw materials and pollution crisis (including nitrogen, phosphates and PFAS). Consequently, this negatively impacts health (e.g. through pests), and inequality (e.g. less liveable neighbourhoods).

Target scenario

Ecological Resilience

Rotterdam has a flourishing biodiversity which, through a multitude of ecosystem services, has a dampening effect on the effects of climate change and on the effects of raw material usage and pollution. Biodiversity in the city makes a positive contribution to the broad prosperity in all neighbourhoods (quality of life, health, less inequality).

Ecological resilience stands for realising a resilient natural ecosystem. We will be doing this by specifically working towards a higher level of biodiversity, whereby the emphasis is not only on diversity in flora and fauna, but also on improving soil, water and air quality, for example, as part of a healthier living environment. This integrated approach will also allow us to increase the city's overall strength and resilience.



Choices and approach

General:

Rotterdam is opting for the restoration, preservation and, where possible, strengthening of biodiversity. This will increase the city's overall strength and resilience. Greenery and a healthy natural ecosystem have a positive effect on aspects like air quality, health, the absorption of extreme rainfall, the attractiveness of outdoor spaces and the reduction of heat stress.

Rotterdam will use Ecological Resilience to focus on a structural, systemic and integrated approach:

Structural: a multi-year programmatic approach and the embedding of Ecological Resilience in Rotterdam's projects and programmes. This will enable us to realise better control of increasing the natural ecosystems' strength and resilience and therefore realise a more resilient Rotterdam.

Systemic: contribute to an integrated approach, aimed at improving the various different natural ecosystem components and all related urban systems, such as the built environment and even the social system (Figure 2.2b).

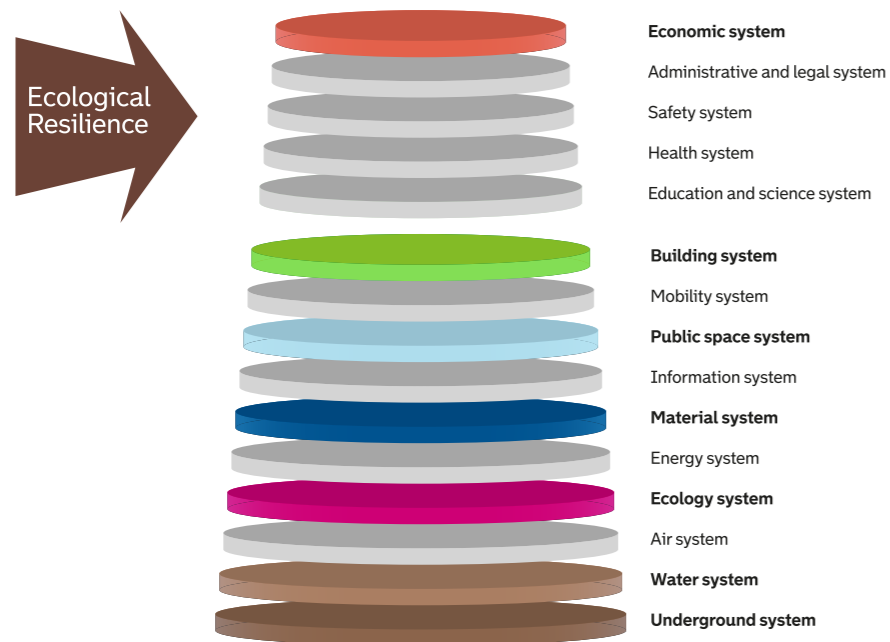


Figure 2.2b: The primary focus is laid on applying the resilience capabilities (resistibility, recoverability, learning ability and adaptability) to the Rotterdam ecological system and the associated systems (built environment, materials system and social collective system). In addition, the public spatial system and the economic system are important connection points as well.

Integral: a multidisciplinary approach, anticipating on multiple urban challenges. This could include nature-friendly banks, which will anticipate on the climate crisis, the biodiversity crisis and the pollution crisis.

Specifically:

Steering towards anchoring the resilience principles in the biodiversity approach:

Resistibility: ensuring that urban ecosystems are strong and less affected by pollution, land use and climate change.

Recoverability: Rotterdam's ecosystems must be able to quickly recover in the event of a setback, to a condition which is better than before the setback.

Learning ability: ensuring that lessons are learned from the breakdown and construction of biodiversity in the city. **Adaptability:** ensuring that the ecosystem's adaptability is increased and that the municipal organisation adequately initiates any necessary adjustments.

Potential interventions

1. Anchoring resilience principles in Rotterdam's approach to biodiversity.
2. Include Ecological Resilience in embedding resilience in the organisation and city in a more structural way.
3. Draw attention to the integration of biodiversity in Resilient BoTu 2028 and, if possible, scale up to other neighbourhoods as part of the resilience approach. Utilise the tools that have been developed within the context of the Biodiversity Implementation Agenda.
4. Support for Nature Inclusive Building through a more structural link to the resilience approach.
5. A continuation of efforts to make riverbanks more natural and expanding tidal parks is highly desirable (the current LIFE Urban Adapt programme runs until 2023), partly in view of the biodiversity objectives (Ecological Resilience) and the link to climate adaptation (Climate Resilience).
6. Structural deployment of the Resilient Cities Network (RCN) by gathering information regarding other cities' methods and lessons related to linking biodiversity to resilience.

Knowledge agenda

General:

- Linking biodiversity issues and Ecological Resilience to the Resilient Delta Initiative (multi-year partnership with universities, see chapter 3.1)'s multi-year knowledge agenda.

Specifically:

- Research on the resilience of native and exotic species of plants and animals to climate change.
- Research on the relationship between enhancing biodiversity and avoided damage (for example, for pest control or hay fever due to too much allergenic planting).
- Acquiring more insight into the relationship between biodiversity and ecosystem services.
- Improving methodologies for making biodiversity and functioning in (urban) ecosystems transparent and measurable.

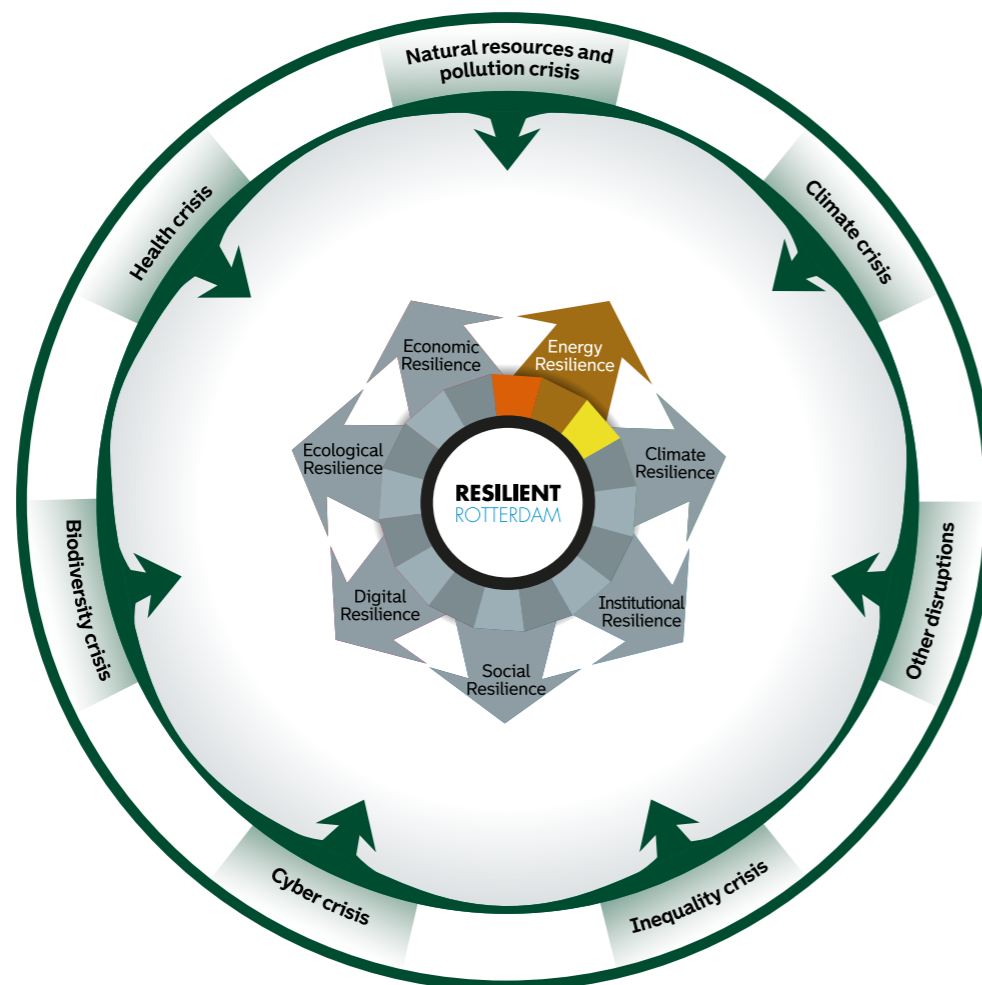
Strategic partners:

- **External:** including residents, City Nature agency, the Port Authority, nature and environmental organisations;
- **Internal (municipality of Rotterdam):** including the Urban Management Department (Biodiversity programme, Circularity programme); the Urban Development Department, Engineering Department, Sustainability department.



2.3 Energy Resilience

Resilience is one of the energy system vision's core values. The current and future energy system must be clean, reliable, robust, resilient and adaptive.



Urgency

Rotterdam wants to be climate neutral by 2050. That's why we started working on the energy transition. This is the only way to achieve Rotterdam's climate objectives, improve the quality of life in the city, anticipate on the depletion of natural resources and make Rotterdam less dependent on energy from other regions. The energy system is going through radical changes and is becoming more diverse, complex, smarter and decentralised. This will result in major consequences for buildings and the city's spatial planning, both above and below the ground. At the same time, the system's capacity is under severe pressure, which has a negative effect on the business climate, on the realisation of the building task and on the energy transition itself. Simultaneously, the natural resources crisis is taking on a new dimension as well: the energy transition requires new raw materials, like iridium and cobalt. There is already a shortage, resulting in geopolitical tensions; in other words, a multitude of changes and (new) vulnerabilities, while we, as a society, are completely dependent on energy. The starting point is that our energy system continues to meet the values we consider important: we want to ensure that our energy supply is clean, smart, resilient and fair. (source: Rotterdam Energy System Vision, Municipality of Rotterdam 2021).

Current policy

Rotterdam Climate Agreement (2019)

Approach: Rotterdam is working on realising a climate neutral city. This means no more CO₂ will be released during the generation, transport, conversion, storage and use of energy. At this moment in time, a total of 55 climate deals have already been concluded with residents, organisations and companies to tackle climate change and the energy transition, within the context of the Rotterdam Climate Agreement.

Rotterdam Energy System Vision (2021)

Approach: we start from three principles when making choices in the energy system:

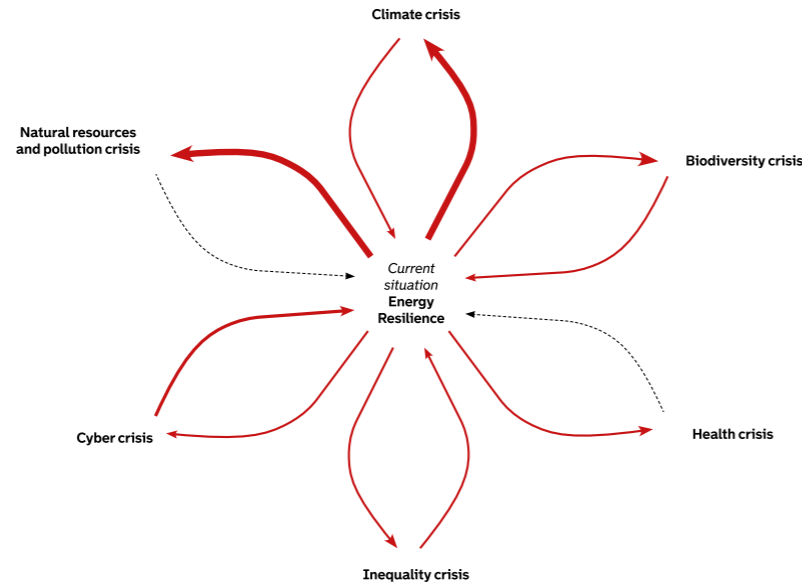
- public interests are the central focus point when making our choices, whereby we aim for a clean, smart, resilient and fair energy system;
- the municipality takes responsibility *and* cooperates;
- we work adaptively, integrally and digitally.

Objective

A future-proof energy system with a clean and affordable energy supply for everyone.

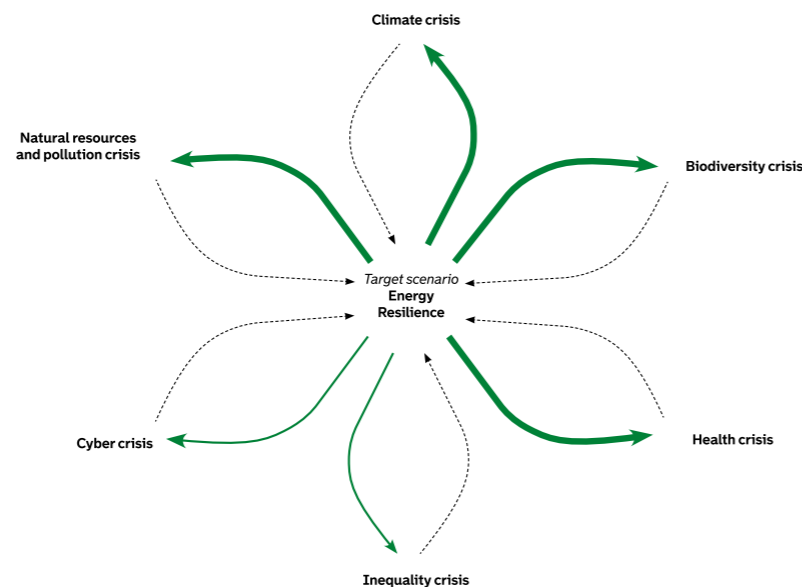
Current situation Energy Resilience

The current energy system is one of the causes of the climate crisis and amplifies the biodiversity crisis (for example due to nitrogen and the claim on biomass), the natural resources and pollution crisis (with particulate matter and pollution from the fossil industry), the inequality crisis (including energy poverty), the health crisis (effects of energy poverty, particulate matter and air pollution) and the cyber crisis (because energy and the internet are closely intertwined). And vice versa, the natural resources and inequality crisis are responsible for part of the Energy Resilience challenge. There's also a cyber threat (including risks associated with smart grids), inequality equates to risks for Energy Resilience (lack of space and resources) and the biodiversity crisis affects Energy Resilience (for example, the cooling function nature can have).



Target scenario Energy Resilience

We have to anticipate on the climate crisis and the natural resources crisis by adjusting the Rotterdam energy system over the forthcoming decades. This should be done in a way that improves biodiversity, reduces inequality, improves people's health and makes the system resilient to cyber attacks. As shown in figure 2.3a, there are many interfaces with other resilience themes. Energy Resilience is used in working towards a resilient energy system, in a way in which it makes a maximum contribution to the entire city's resilience as well.



Choices and approach

Rotterdam is opting for furthering the sustainability of the energy system. This is necessary to increase the city's and port's overall physical and social strength and resilience. This will allow the energy transition to contribute to good growth, which will ultimately lead to opportunities for everyone. One condition to enable this, is to ensure that resilience obtains a leading role in carrying out necessary system choices. This has now been set out in Rotterdam's new Energy System Vision (2021). In 2022 and beyond, the developed 'resilient energy system assessment framework' will be further developed and implemented.

In order to increase the city's resilience, while ensuring that the new systems are robust and flexible, a systemic, programmatic and holistic approach would be required.

During the forthcoming years, we will be confronted with various system choices with regards to furthering the sustainability of Rotterdam's energy system. In doing so, it's essential to not solely focus on sustainability, but on the new energy system's resilience as well. This is necessary, as there's, e.g., already a lack of capacity of the energy grid, and some systems, such as smart grids, are vulnerable to cyber attacks. Therefore, steering towards a resilient energy system, with involved partners, requires a programmatic approach.



Because the embedding of the resilience principles will be discussed step by step and with every new system choice. The relationships with all other challenges, such as social and climate resilience and the overall contribution to a resilient Rotterdam, are leading here. This is a holistic approach.

Per resilience principle this means:

Resistibility: aiming for system robustness (resilience to cyber attacks, sufficient capacity and stability), focussing on dependencies and opportunities on a European scale. We will also continue to focus on affordability and employment for Rotterdam residents (social resilience).

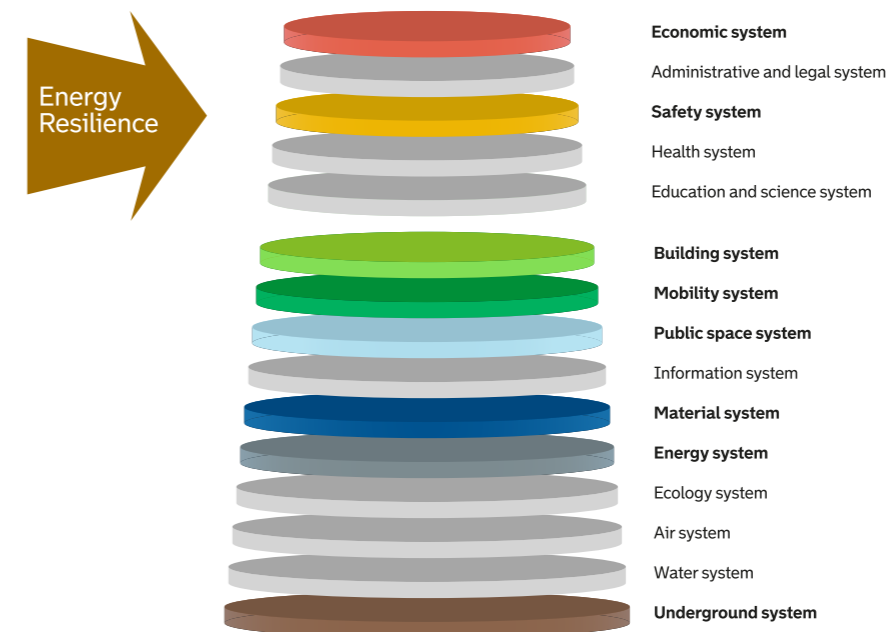


Figure 2.3a: Energy Resilience doesn't just concern the energy system. Attention must also be paid to the link with many other systems, due to the interrelationship with other urban systems and the coherence of the resilience themes (framework).

Recoverability: in the event of a power failure, rapid system recovery is crucial, but users (residents) also need to be better prepared for these kinds of situations.

Learning ability: the involved organisations and users' ability to learn must be in order, making sure they are better prepared for the next disruption each time.

Adaptability: ideally, lessons lead to adjustments. This requires the capacity to carry out system interventions, and to adjust organisations to this reality. Developing a learning curve and using 'system glasses' to make minor or major adjustments will contribute to a higher level of resilience.

Potential interventions

- Contribute to the further development and implementation of the Energy Resilience Framework as an assessment framework for future choices and investments in the energy system (Figure 2.3b). This will further operationalise resilience as a guiding principle in the energy system vision.
- Mapping out the current energy system's resilience (including robustness, capacity, stability). This is how a zero measurement is created as a basis for the further application of the Energy Resilience Framework.

- Lobbying for legislation that enables the accelerated reinforcement of the energy infrastructure (e.g., the possibility of pre-financing under the Energy Act, energy system as an organising element).
- Accelerating municipal processes and procedures for decision-making about strengthening the energy system (e.g. accelerated handling of procedures for, for example, low and medium voltage stations and associated infrastructure).

Knowledge agenda

- Develop an increased insight into the Cyber Resilience of (new) Energy Systems (such as smart grids, together with TU Delft).
- Learning from Resilient BoTu2028; how the energy transition can be used as a lever for the city's resilience at different levels (city, port, neighbourhood), through, e.g., employment.
- How can energy transition lead to a reduction in energy poverty?
- Obtain knowledge about the relationship between the energy transition and the built environment, such as the multifunctional use of space and a resilient subsurface system vision.

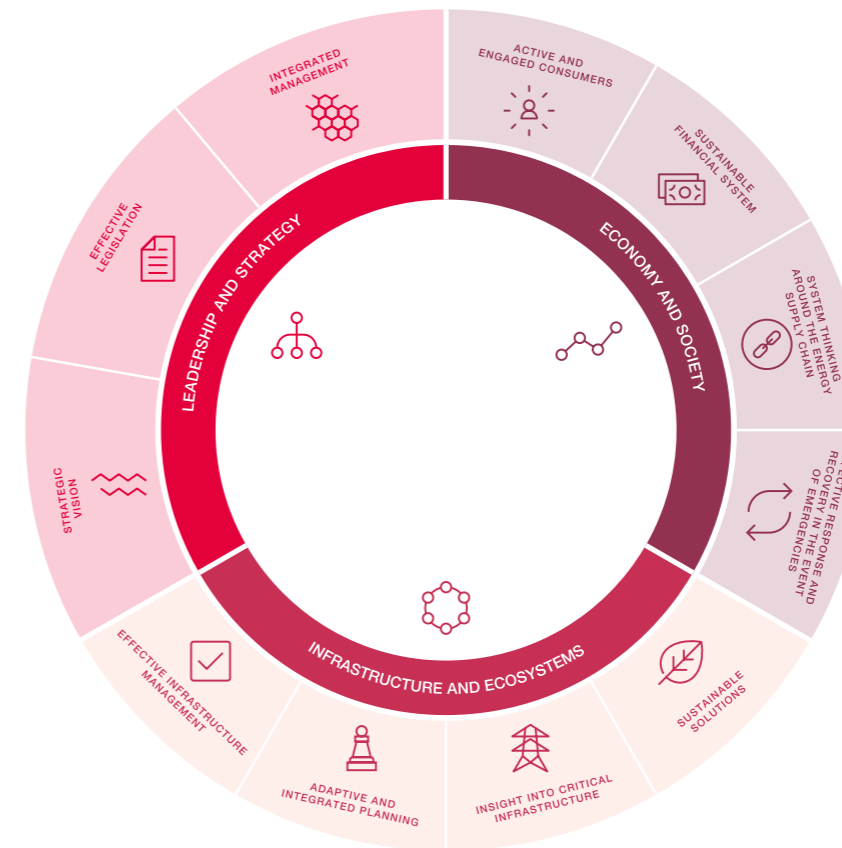


Figure 2.3b: Energy Resilience Framework: this tool creates a testing framework and tools for the municipality and involved bodies to use resilience as a guiding principle for a future-proof energy system in which citizens and businesses have the certainty that energy is supplied and affordable.

Interfaces with other resilience themes:

Energy and Climate: the urgency of climate change has now led to stricter global climate targets. As stipulated by the climate objectives, the use of fossil fuels is limited and should gradually be phased out. The energy transition is an important part of the answer to this. We are currently facing the reality of climate change, which is why, it is even more important to actively work on a climate-proof city and energy system.

Energy and Cyber: the energy system is becoming more and more intertwined with our digital reality. New digital vulnerabilities are emerging due to continuous digitalisation. For example, 'smart grids' are susceptible to cyber attacks. That's why cyber resilience is now increasingly important within the energy domain.

Energy and Social: the energy transition must not lead to greater inequality. In fact, it's our ambition to ensure that the energy transition is used as a lever for social resilience: reducing energy poverty and increasing employment. This is part of Resilient BoTu2028.

Vulnerability of European Energy Network

On 8 January 2021, a European-wide blackout was narrowly prevented. The loss of a link in a substation in Croatia led to a chain reaction of disrupted power connections, causing the network to split into two parts for more than an hour.

(Sources: Joep Westerveld, Energiea, 11 jan 21, K. Remi, 18-01-2021, European electricity supply blackout expected within 5 years.)

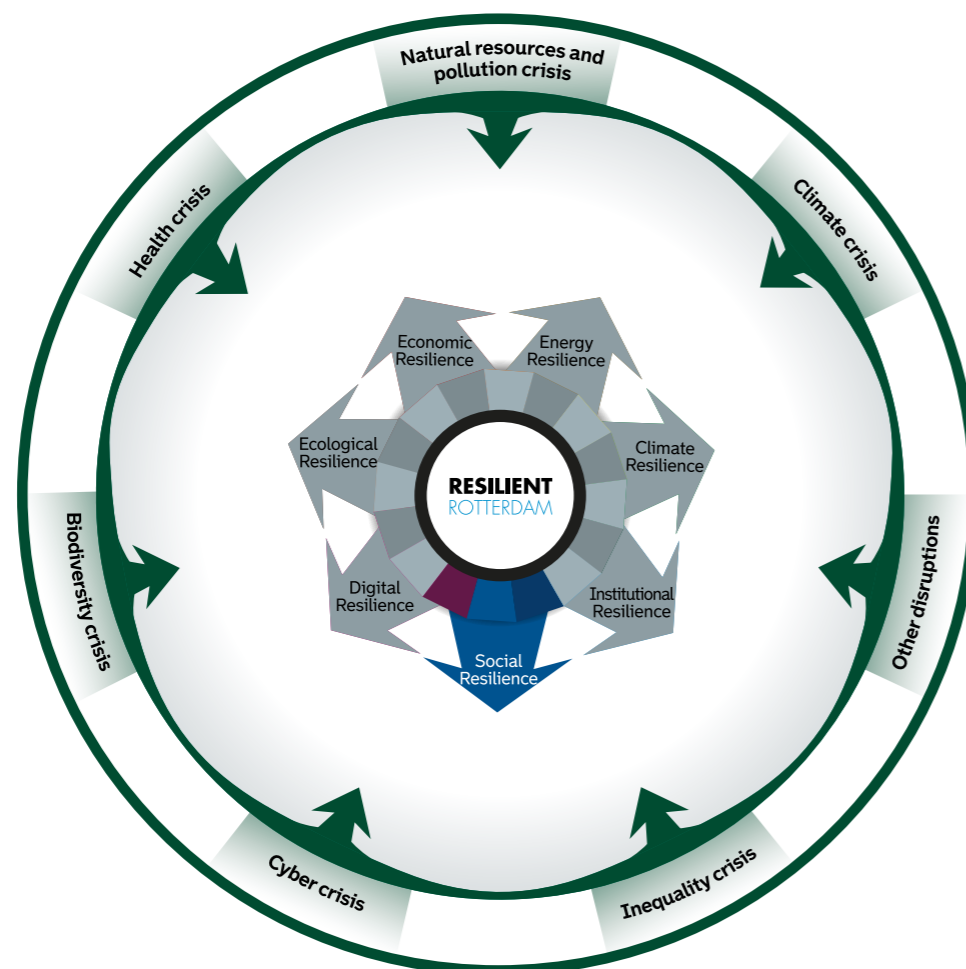
Strategic partners:

- External:** including partners via the Sustainability department, network administrators, users, knowledge institutions and Resilient Cities Network and C40;
- Internal (municipality of Rotterdam):** including Urban Development, Sustainability, Engineering Department, Mobility, Economy, Social Development, City Management and the Circular Economy programme.



2.4 Social Resilience

Social challenges are the main focus in many neighbourhoods. The ambition in this, is utilising the energy transition and climate adaptation to strengthen Social Resilience.



Urgency

Socially and economically vulnerable groups in the city feel the impact of many crises the most. Housing, energy, food and transport are becoming more and more expensive. This is reflected in the highest inflation rate in forty years (6.4%, according to CBS, Jan. 2022). The consequences of gentrification are noticeable too. There's less and less room for unskilled labour within the employment market. These are all developments which serve to increase inequality. What does this demand from an individual or group's resilience, or indeed the government's resilience?

It doesn't just demand greater adaptability from people who live on the fringes of these developments; the government, organisations and systems also need resilience and flexibility to deal with these situations. It's abundantly clear there's a task to work on joint resilience, whereby the government and citizens demonstrate flexibility and resilience together. We can no longer achieve enough by constantly adjusting existing policies. There's no silver bullet. How we structurally increase the social strength, resilience and adaptability of communities and individuals in the city is the key question which Social Resilience focusses on. Naturally in combination with the other resilience themes and in addition to the existing policy.

Current policy

The Municipality of Rotterdam has many policies, programmes and working methods in place which focus on aspects of Social Resilience: Neighbourhood teams, 'Uit de Knoop', Rest Rotterdam (poverty and debt), Gezond010 (Healthy010), Relax, Rotterdam against Racism (inclusion and anti-discrimination), Heel de Stad (Social support and youth care) and the Human Measure project.

The Social Development (SD) department has committed itself to the SDGs (the United Nations' Sustainable Development Goals) and selected six which are considered to be leading during the forthcoming years: SDG's 1, 3, 4, 8, 10 and 16.

SD also looks ahead, for example, in the 2040 Future Outlook for Social Domain; it identifies three tracks: perspective, vitality and connectedness. We use the opportunities offered by the energy transition and climate adaptation for employment in the city and neighbourhood, in collaboration with the Work and Income (W&I) department.

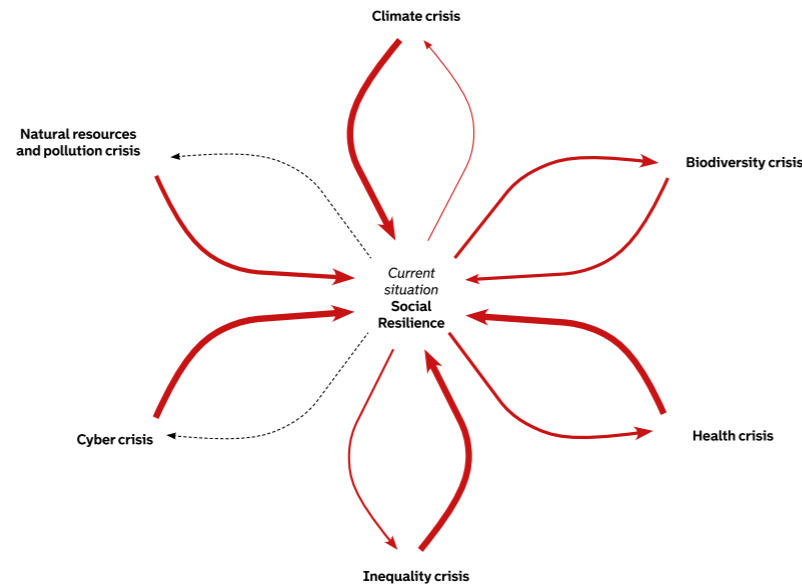
These activities together form the most important starting point for the Social Resilience theme.

Objective

Increasing Rotterdam residents' resilience, building on the resilience already present (for example in BoTu), with specific attention devoted to reducing the social inequality, and increasing the resilience of communities at the neighbourhood level.

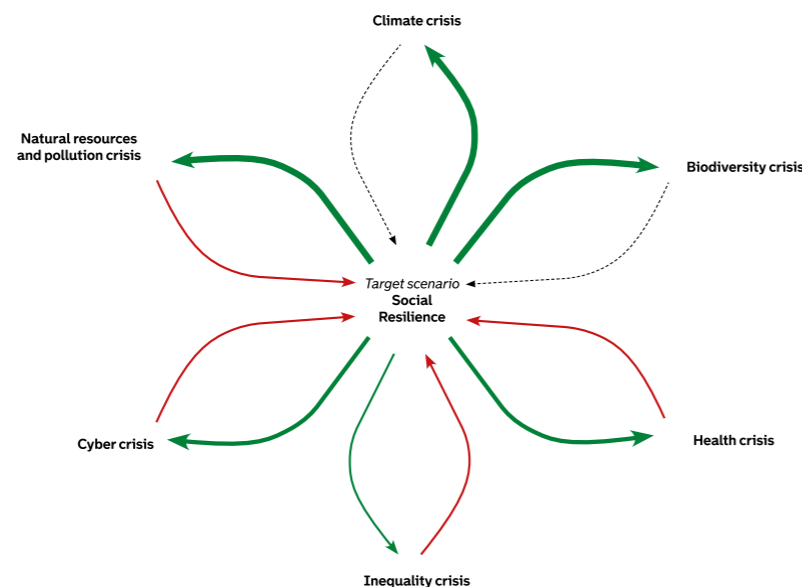
Current Social Resilience situation

Virtually all crises have a reinforcing effect on the inequality crisis and therefore also on the city's social resilience. And vice versa, social resilience also limits the negative impact of all other crises.



Target scenario Social Resilience

The aim is to strengthen the city's Social Resilience in such a way that the negative impact of the crises can be resisted and even turned into levers for a more resilient Rotterdam.



Choices and approach

A resilient Rotterdam starts with resilient Rotterdam residents. Therefore, Rotterdam is committed to increasing equality and reducing poverty, debt and loneliness. This, in turn, contributes to strengthening the resilience of vulnerable residents in Rotterdam. At the same time, Social Resilience is about all Rotterdam residents. Economic Resilience focusses on key sectors, like the digital, circular and sustainable economy. This will generally result in new jobs and training for Rotterdam's working population.

Social Resilience requires an integrated approach, more ingenuity and management based on the leverage effect of transitions, like the energy transition and climate adaptation.

Moreover, the interventions aimed at Social Resilience require an integrated approach, aimed at collective systems like health, education and the economy, but also, for example, housing, because of the relationship with all crises (Figure 2.4a).

On top of existing policies, we should be resourceful to strengthen the Social Resilience approach. We are organising this resourcefulness by collaborating with companies in the city, (higher) education and institutes like the Veldacademie, using the 'Knowledge Workshop'

as the working method. Innovative working methods such as Social Impact by Design also deserve to be followed up.

Resilient BoTu2028 has shown that leveraging the transition tasks for Social Resilience at the neighbourhood level is an interesting approach. This deserves to be followed up, further elaborated on and, where possible, scaled up. We want to choose and implement the interventions linked to Climate and Energy Resilience in such a way that inequality decreases. And we must prevent inequality from increasing. The necessity to do so, can be seen in the following example; as the realisation of climate adaptation often goes together with the development of property and neighbourhoods, it results in a value increase. In turn, the increase of resilience to the climate crisis takes place among people with a relatively high income.

Specifically:

The emphasis is laid on community resilience, preferably at the neighbourhood level. It became clear how important this is during the pandemic. In this way, more Rotterdam residents can be reached, and the foundation for "individual resilience" will be laid. Next to that, by focussing on community resilience, issues like increasing polarisation (as seen during the pandemic) and racism, can be addressed as well.

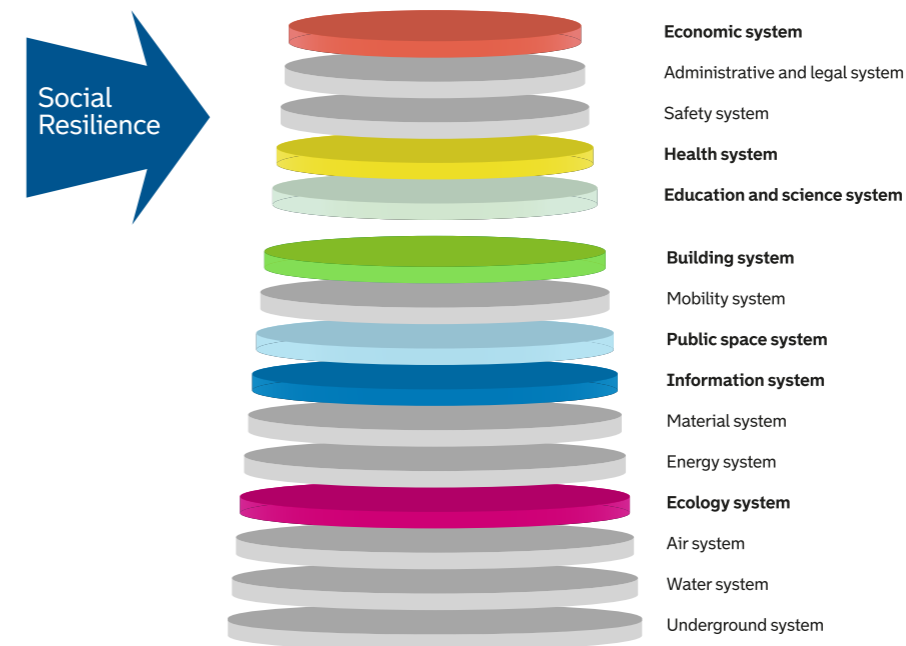


Figure 2.4a: Social Resilience doesn't just require interventions in the social collective systems like health, education and the economy. There are also interfaces with, for example, the physical building system (housing). The search for which systemic interventions are necessary, is part of the knowledge agenda and, in particular, the joint exploration with the Economy in Urban Development.

In the context of Social Resilience, Rotterdam will focus on embedding the four resilience principles in the municipal organisation. In doing so, attention is paid to inclusion and diversity.

And finally, following numerous positive experiences in recent years, we will explore how we can use art and culture more programmatically to realise a more Resilient Rotterdam.

Potential interventions

1. Structural exploration of the Social Resilience approach, together with the Social Development (SD) department, with a focus on community resilience.

2. Transition challenges as leverage for a socially resilient neighbourhood. Potential partners are: Inclusive Climate Action Rotterdam (ICAR); UNIC (EUR European challenge programme) and the R100 (challenges with top students).

3. Link the transition challenges to employment to increase social resilience in the neighbourhoods.

4. Scale up Social Resilience lessons (for example, from the corona pandemic) from Resilient BoTu2028 (Figure 2.4b).

5. Participate in the Digital Resilience pilot for Individual resilience in the neighbourhood as a partner.

6. Research resilience training in schools.

7. Determine how we can work with Together for a Strong and Warm Rotterdam (coalition of, among others, Dona Daria, Rotary, NVO-NCW) to strengthen social resilience.
8. Explore, together with SD and partners in the city, how art and culture can be programmatically used to realise a more Resilient Rotterdam (general).
9. Specifically in relation to 8: take part in Music Resilient Cities and the Boijmans/Wotan/Rafl coalition.
10. Specifically in relation to 8: explore possibilities with the Rotterdam cultural institutions' directors' meetings.
11. We want to continue the Gezond010 (Healthy010) policy, in which a healthy living environment and people's resilience are important themes.

Knowledge agenda

- Aim for a leading role for Social Resilience in the Resilient Delta Initiative agenda.
- Continue the collaboration with, among others, EUR (including the affiliated Vital Cities and Citizens) and the Veldacademie with regards to furthering knowledge development about social resilience in Rotterdam.

“Culture contributes to social resilience, helps develop 21st century skills and is essential for the development of identity and personality. By supporting the arts and cultural sector in its transition to greater resilience, agility and strength in the longer term, it remains part of the fabric needed for an inclusive, solidary, sustainable and prosperous society.”

Source: New Deal Culture Think Tank Advice (May 2021)

Strategic partners:

- External: for example, Resilient Delta Initiative, Music Resilient Cities, Boijmans/Wotan/Rafl, EUR (and the affiliated Vital Cities and Citizens), Veldacademie, Inclusive Climate Action Rotterdam (ICAR), UNIC (EUR's European challenge programme), the R100 (challenges with top students), Resilient Cities Network and Netwerk Gezond 010;
- Internal (Municipality of Rotterdam): including Social Development, Urban Development.

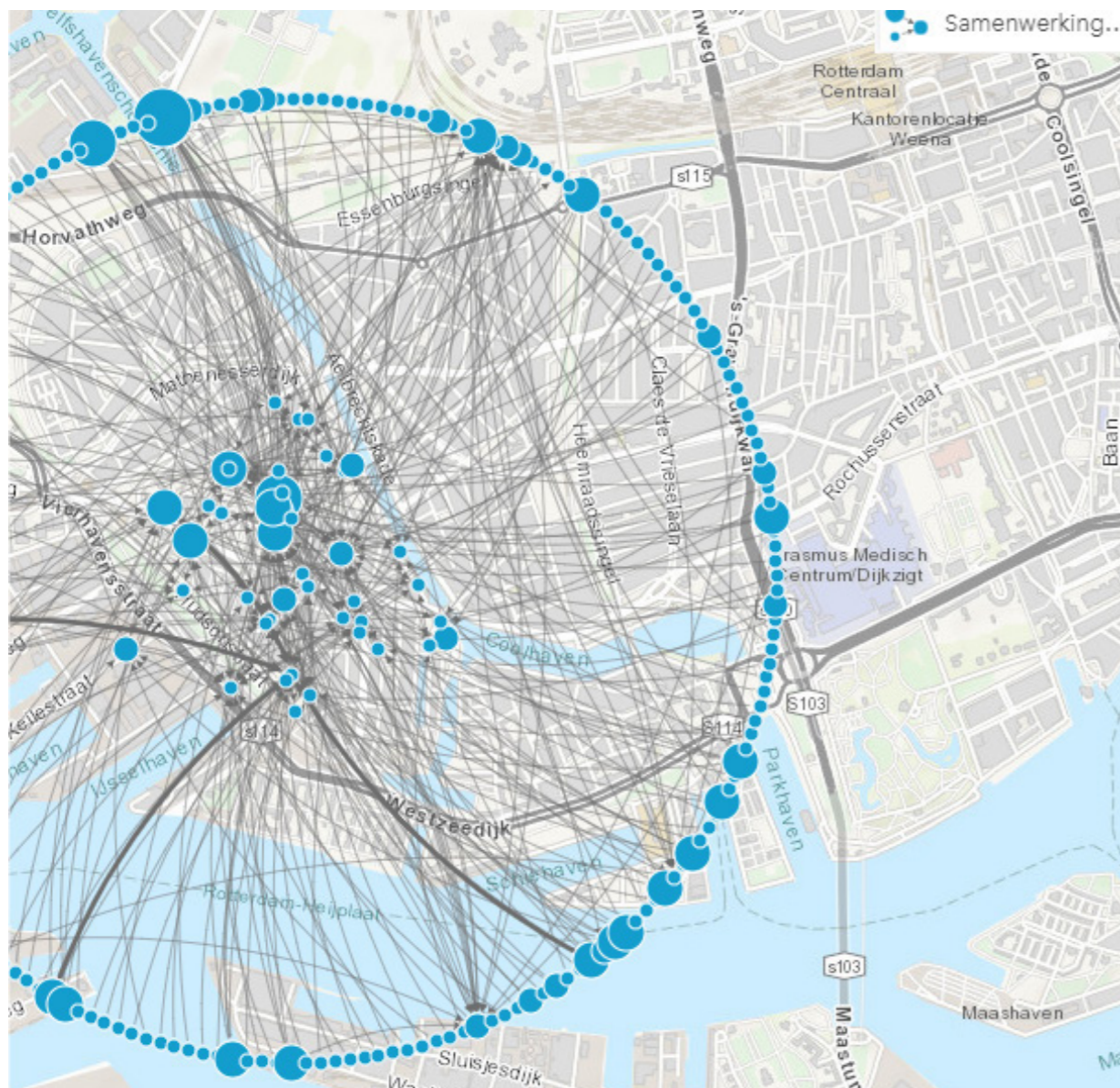


Figure 2.4b: Informal networks in BoTu contributed to the neighbourhood's resilience during the pandemic.

Source: STRONG TOGETHER DURING CORONA TIMES – A study into social initiatives and collaboration in Bospolder-Tussendijken. Field Academy, 2021.



2.5 Economic Resilience

Resilience is a guiding principle for a more future-proof society and economy. Climate and Cyber Resilience specifically, are a precondition for Economic Resilience.

Urgency

Throughout time, we experience different types of crises. Crises show us the vulnerabilities present in a system, as the 2008 financial crisis demonstrated that Rotterdam's economy is vulnerable to economic shocks. These effects can be related back to the one-sided economic structure that is present. Next to that, several dominant sectors in Rotterdam are currently at the end of their life cycle and are up for renewal and transformation.

Dealing with this general increase in constant threats ('stresses') and the consequent sudden disruptions ('shocks') require adjustments to the economic system; more resilience is needed. A resilient economy is innovative and flexible, yet robust and inclusive. Resilience, in particular Climate and Cyber Resilience, are preconditions for the city of Rotterdam's economic functioning and the business climate.

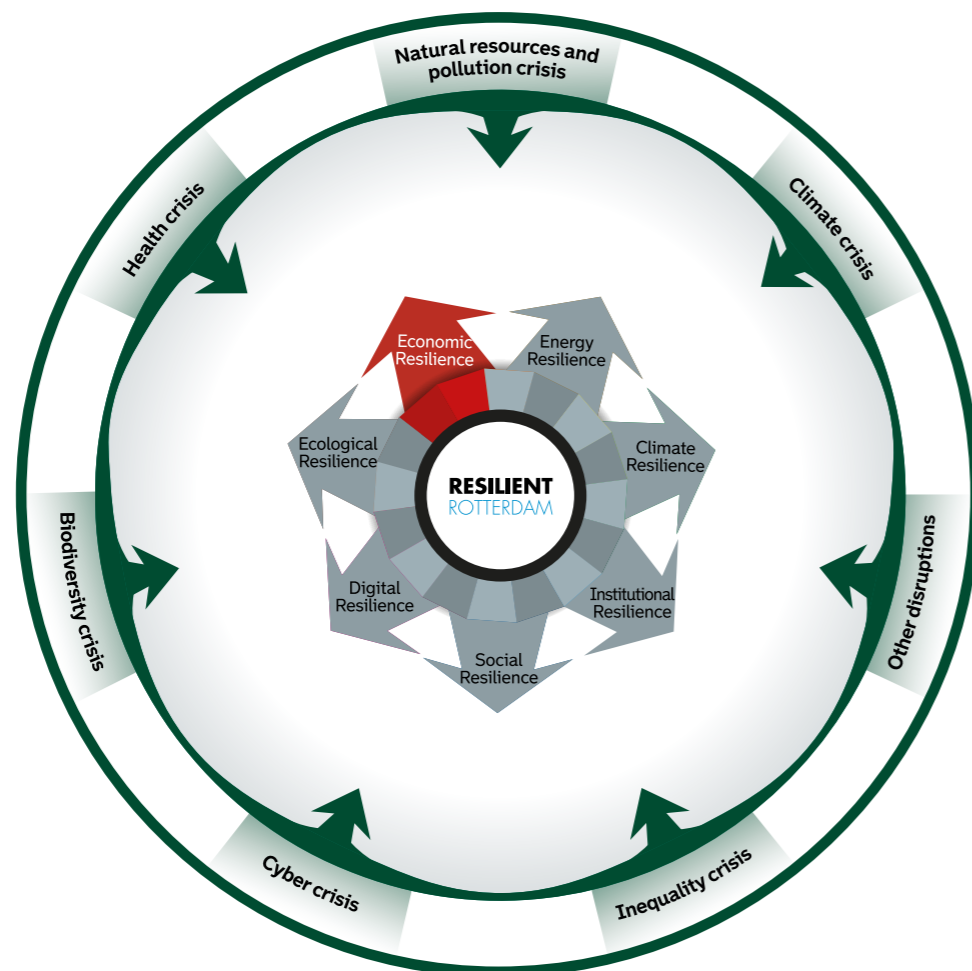
Current policy

Rotterdam 'Bouncing Back Better' (Rotterdam Sterker Door) (2020) – The Municipality of Rotterdam's COVID-19 Crisis Recovery approach focussed on the short term.

Objective: keep the local economy running and emerge stronger with targeted support measures, a recovery package and investments.

Approach: illustrative for the approach are the seven large urban projects (Big7). The Big7 gives the economy a boost, and simultaneously, it contributes to making the city more attractive, greener, climate-proof and sustainable.

The corona crisis confirmed the lesson that we already learned during the 2008 crisis; our economic system is indeed vulnerable. It also demonstrated the existence of mutual dependencies, created with globalisation- a true wake-up call one may say. At the same time, we already found ourselves in a climate crisis and a decline in biodiversity (Figure 2.5a). It has become clear that, this was not sufficiently acknowledged as a crisis in itself. Next to that, significant risks are posed to our economy by the pollution of the living environment, depletion of natural resources, increasing wealth and income inequality, the speed of digitalisation and corresponding cyber threats, not to mention geopolitical tensions.



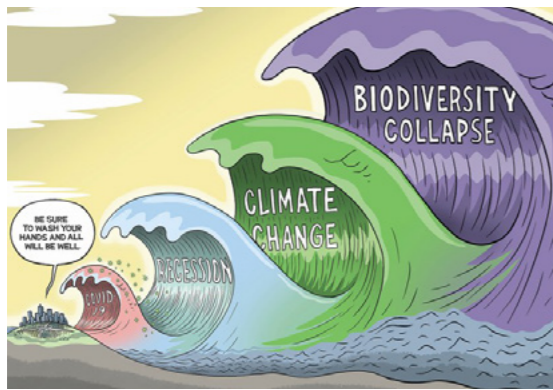


Figure 2.5a: A cartoon which has now been globally shared depicts that we're dealing with a series of crises: pandemic, economic, climate and biodiversity crisis.

Recovery and Renewal Agenda – Rotterdam Economy (2020) focussed on the longer term.

Objective: transition to a digital, circular, sustainable and inclusive economy.

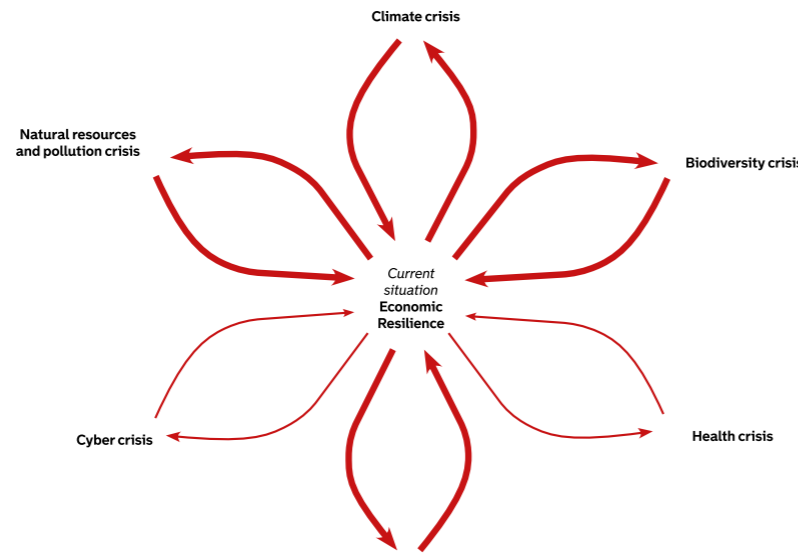
Approach: on the basis of six pillars (municipal services, broadening the economy, human capital, entrepreneurs & innovation, city of attraction and transitions) with programmes and implementation projects focussed on the Rotterdam economy's recovery and renewal.

Objective

A more resilient economy by focussing on a digital, circular and sustainable economy. Climate and Cyber Resilience are preconditions for a stable and strong business climate.

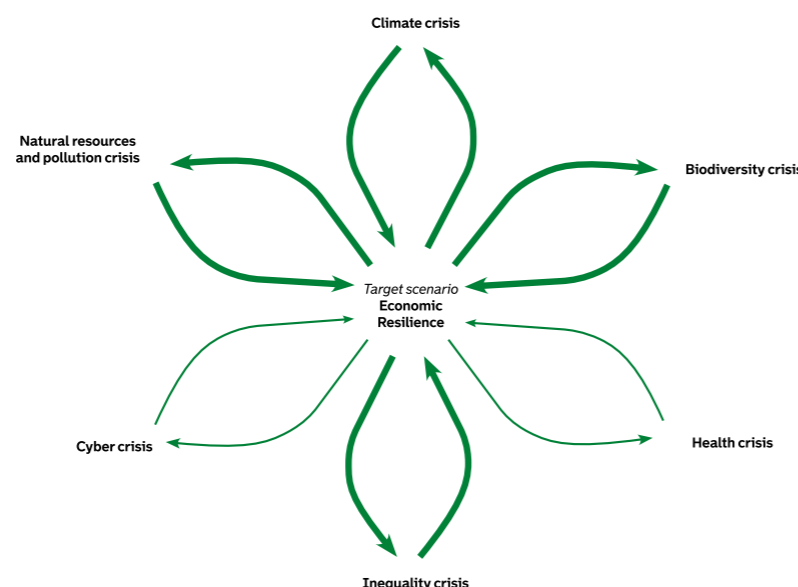
Current situation Economic Resilience

The current crises have a negative impact on the economy. At the same time, the same economic system is (partly) the cause of the same (planetary) crises.



Target scenario Economic Resilience

Integrated efforts for all resilience themes are required to break through this and we must increase our learning ability and adaptability (general resilience). The desired situation is an economy which is so resistible and recoverable to crises that an economic crisis no longer reinforces other crises.



Choices and approach

Rotterdam is committed to a digital, circular and sustainable economy, as this lays the foundation for a resilient city. We will therefore be proactively steering towards resilience as a precondition and as one of the guiding principles for the city's economic policy. This new economy, aimed at broadening, innovation and human capital, creates new employment opportunities for everyone. This will ensure a resilient economy also contributes to a socially resilient Rotterdam.

This requires Rotterdam's economic system (and associated systems – figure 2.5b) to undergo structural change. To do so, we must disconnect the prosperity of citizens, communities and companies from the use of materials and strive for a fully circular, climate neutral and resilient economy.

The Roadmap Next Economy (RNE) launched in 2016 serves as an important starting point for the transition to a digital, circular and sustainable economy. This line has been continued in the Recovery and Renewal Agenda (HVA). The 'contribution to the economy's resilience' was already an important criterion in the HVA for the choice of pillars and projects for recovery and

renewal of the economy. In order to realise greater resilience, efforts have been made to develop a diversified sector structure, strengthen the innovative capacity of the business community and a qualified employment market and labour participation. The aim is to be less vulnerable to economic shocks. A resilient economy is resistible, recoverable, agile and adaptive- not just where pandemics are concerned, but for any crisis and disruption, with the emphasis on Climate and Cyber Resilience. The aim is therefore to embed the resilience component even more explicitly in the new economic policy, specifically in relation to resistibility, recoverability, learning ability and adaptability.

The transition to a more circular, sustainable and digital economy which has already been initiated is seen as a precondition for a more resilient economy. Such an economy will contribute to the city's self-reliance and will ensure we are better prepared for the natural resources and pollution crisis.

Per resilience capability this means:

Resistibility: ensuring 'the economy', i.e. companies, entrepreneurs and institutions, is more resistant to disruptions;

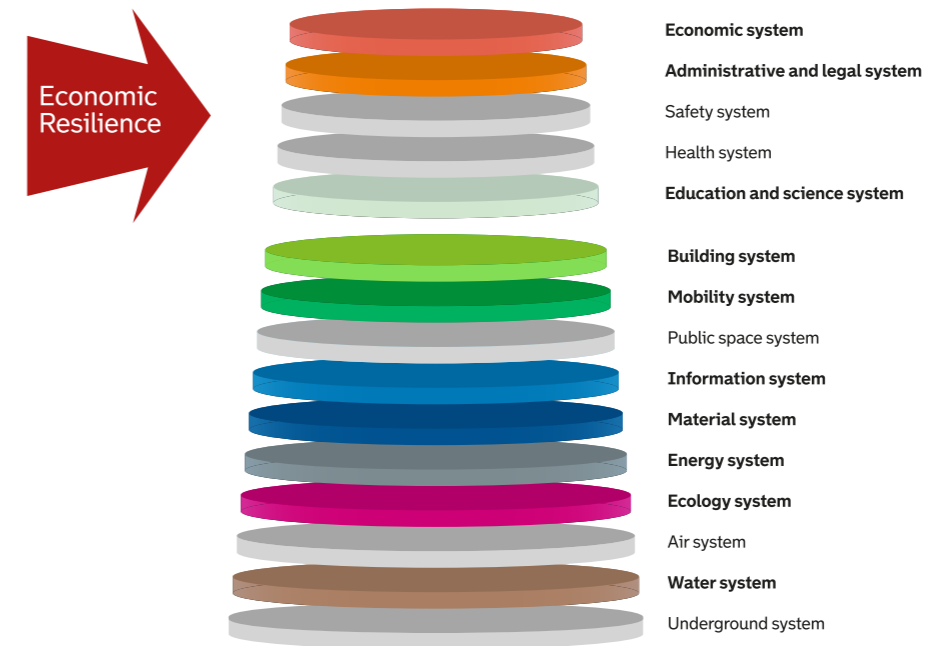


Figure 2.5b: Economic Resilience doesn't just require interventions in economic systems, there are also interfaces with most physical systems. The search for which systemic interventions are necessary forms part of the knowledge agenda and, in particular, the joint exploration with Urban Development Economy.

Recoverability: in the event of a setback, companies, entrepreneurs and institutions in the city must be able to recover quickly to a level that is better than before the crisis.

Potential interventions

1. General: working towards a structural translation of the resilience principles into, and embedding in, a new economic policy.
2. Translating lessons from the pandemic and the crisis and recovery approach into action perspectives. This will ensure that next to recovering, we will be better prepared for the next crisis (with EUR as a knowledge partner).
3. From threat to opportunity: further elaborating on the preconditions of Climate and Cyber Resilience for a stable business climate and exploring how we can use this as a marketing instrument (even more effectively). Climate Resilience is already being used like this, which leads to attracting companies and creating employment. The aim is to build on this further and also to use Cyber resilience as a marketing instrument.
4. Exploring how we keep the economic business climate stable in relation to discussions and publications about extreme sea level rises.
5. Further elaborating on how the resilience philosophy can enrich the 'circular' approach and vice versa, specifically for the circular economy component.

"We will also reinforce the city's strength and resilience by structurally working on a digital, circular and sustainable economy."

*Petra de Groene,
Director of Economy and Sustainability*

**Aurelia Schwarz,
Beitske Boonstra and Jurian Edelenbos (EUR),
23rd September 2021:**

"Rotterdam's corona crisis and recovery approach focusses on existing and new vulnerabilities. Interventions focus on the individual or specific target groups. System change and transformative resilience (coming out stronger so we are better prepared for the next crisis) and the long-term perspective remain underexposed, and only occur incidentally and on an ad hoc basis. A general and holistic approach to resilience, connecting different opportunities, stakeholders, systems and subsystems is essential in the longer term, but is still in its infancy."

Source: Resilient Rotterdam – Experiences from the Corona period.
A quick scan of vulnerabilities and transformation in Rotterdam's policies and research conducted by Aurelia Schwarz, Beitske Boonstra and Jurian Edelenbos (EUR), 23rd September 2021.

Knowledge agenda

Linked to the Resilient Delta Initiative:

- Focussing on providing insights into the short-term consequences of extreme sea level rises for the economic business climate (see also section 2.1)
- Continuing the collaboration with EUR in relation to further studies into how the transformative part of resilience can be embedded in policy more effectively. We use the recovery from the pandemic as a case study and we pay specific attention to both Social and Economic Resilience (see box).

The Delta Commissioner asks the Cabinet for billions to maintain Dutch credit status

The Netherlands must place investments in water safety and infrastructure much higher on the agenda, otherwise the country will lose its 'Triple A' status with international credit rating agencies, warns Delta Commissioner Peter Glas.

FD: Vasco van der Boon Rob de Lange
28th March 2021 09:00.



Just the reporting of extreme long-term sea level rises (2 metres rise in sea level by the end of this century) can have a short-term effect on the economic climate. Global investors and property investors are already drawing up blacklists of vulnerable regions in the world. What if Rotterdam ends up on these lists? How do we prevent companies from leaving before 'the water comes?' Managing the discussion and the associated communication is important to prevent premature economic stress.

Strategic partners:

- External: all consumers, producers and financial institutions in Rotterdam, knowledge institutions, Resilient Cities Network;
- Internal (Municipality of Rotterdam): including Urban Development, Economy, Administrative and Concern Support.



2.6 Digital Resilience

Digital Resilience allows us to anticipate on cyber threats, we focus on Cyber Resilience for a strong business climate and we use data and digital innovations for a Resilient Rotterdam.

Urgency

The (digital) tech revolution is exponential and moving at a pace which is almost impossible to keep up with. For example, mobile data traffic is almost three hundred times higher than ten years ago (hardware.info, Nov 2021). The corresponding datafication of society is the most fundamental change in 250 years and goes far

beyond a (third or fourth) industrial revolution. 'Digital' affects virtually all urban systems (Figure 2.6a) and intervenes at the most fundamental level imaginable. It's no longer a parallel reality to the socio-physical one, but is inextricably intertwined with it. With implications and challenges in all social fields, which demand resilience from both the city and its citizens.

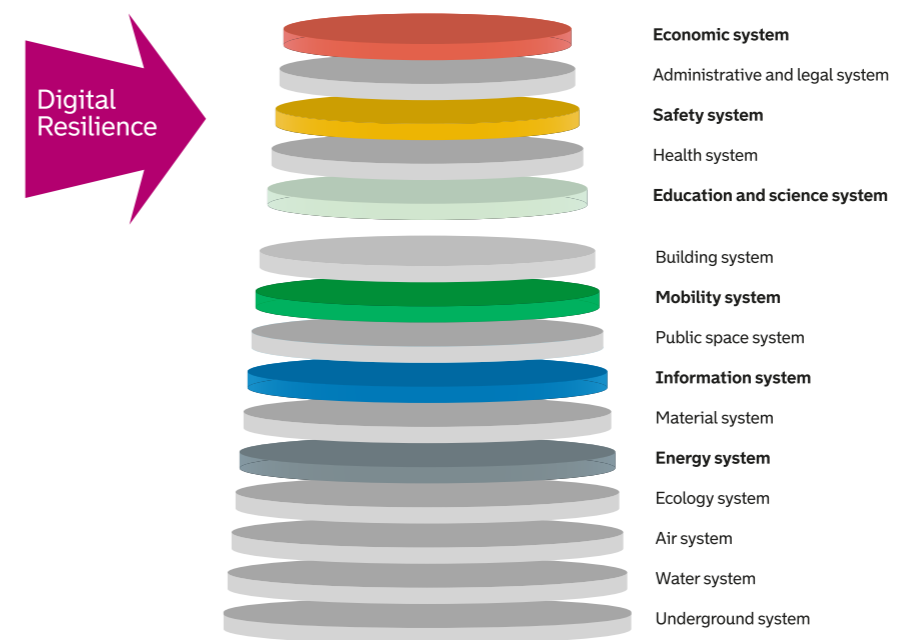
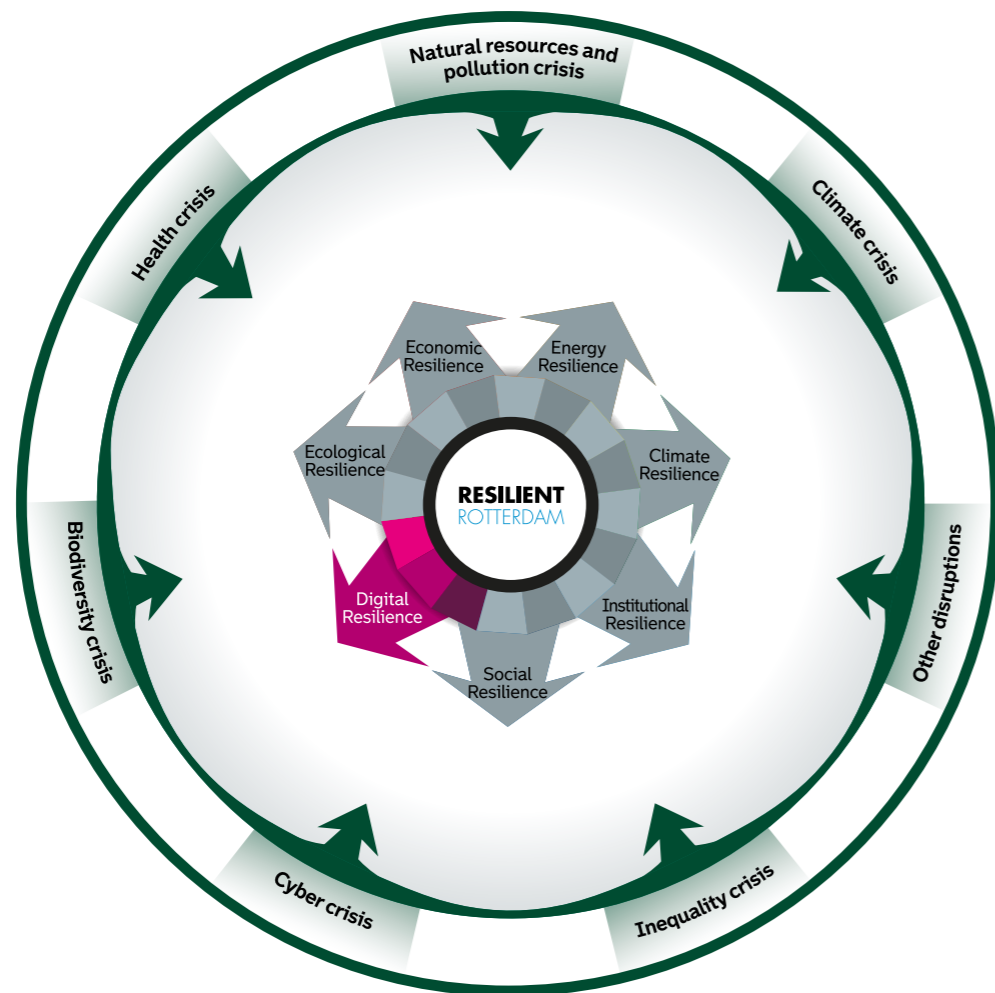


Figure 2.6a: Digital Resilience requires system interventions at all levels, both in the physical and the social collective system.

The increasing dependence on digital processes on the one hand, and the persistence, sophistication and intensification of cyber threats (Section 1.2) on the other, have resulted in an increasing threat of shocks and stresses. We refer to this threat as ‘the cyber crisis’. This includes targeted hacks, but also phishing and fake news. We have also noted that, where traditional crime is decreasing, digital crime is actually increasing. The National Coordinator for Counterterrorism and Security (NCTV, 2021) stated that, the impact of the ineffective functioning of digital processes is major; organisations are unable to do their jobs, personal data can end up on the street, and facilities can fail. This is because digital processes are increasingly forming ‘society’s nervous system’. And the Netherlands isn’t yet sufficiently resilient to cyber attacks.

There are certainly also enormous opportunities in relation to digitalisation, in addition to vulnerabilities and threats. For example in relation to employment, innovations and the business climate. Responding to this in time certainly also forms part of the urgency.

Current policy

The ongoing **Cyber Resilience programme**, including the new cyber image for the city (ready Q1 2022). The aim is to develop an up-to-date cyber image for Rotterdam and a corresponding implementation agenda. Approach: managing a cyber-resilient Rotterdam, a digitally capable and resilient Rotterdam society, knowledge sharing between organisations, cyber-chain collaboration in Rotterdam, cyber crime mitigation and crisis management.

Digital Rotterdam (2020)

Objective: to be an exemplary city in the digital reality by 2025. The added value represented by digitalisation is optimally deployed for social, societal, physical and economic challenges. Targeting:

- everyone has access to a safe digital Rotterdam;
- being self-reliant in the digital city. Rotterdam residents learn additional skills;
- a municipality that is available 24/7 and offers tailor-made solutions;
- a clean, liveable and sustainable city;
- new jobs.



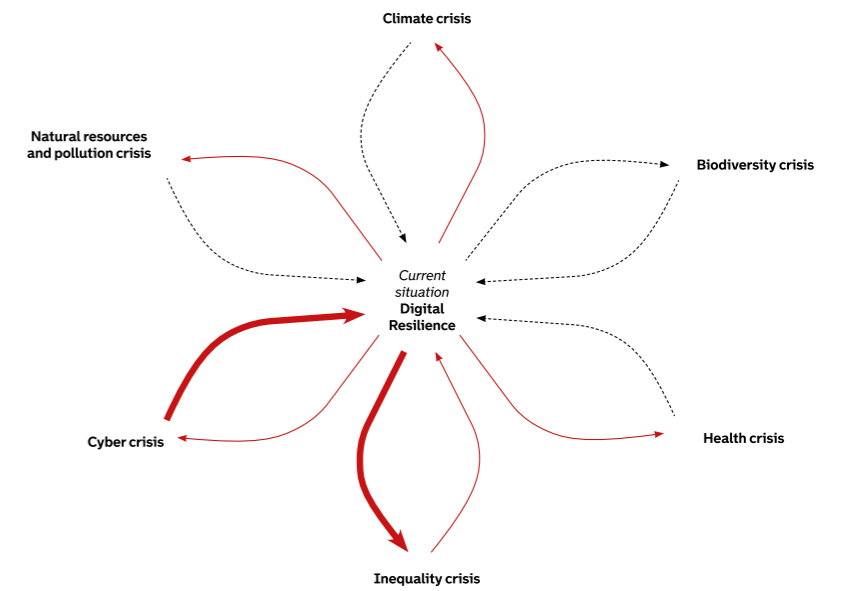
Objective

Making Rotterdam and the people of Rotterdam so resilient to cyber attacks that they don’t lead to major disruptions. Optimal use of Cyber Resilience as an opportunity and basic condition for a good business climate, and using data and digital innovations in a more targeted manner for a more resilient Rotterdam.

Cyber Resilience is a precondition for a good business climate, just like Climate Resilience: Rotterdam as the world’s most water- and cyber-safe port.

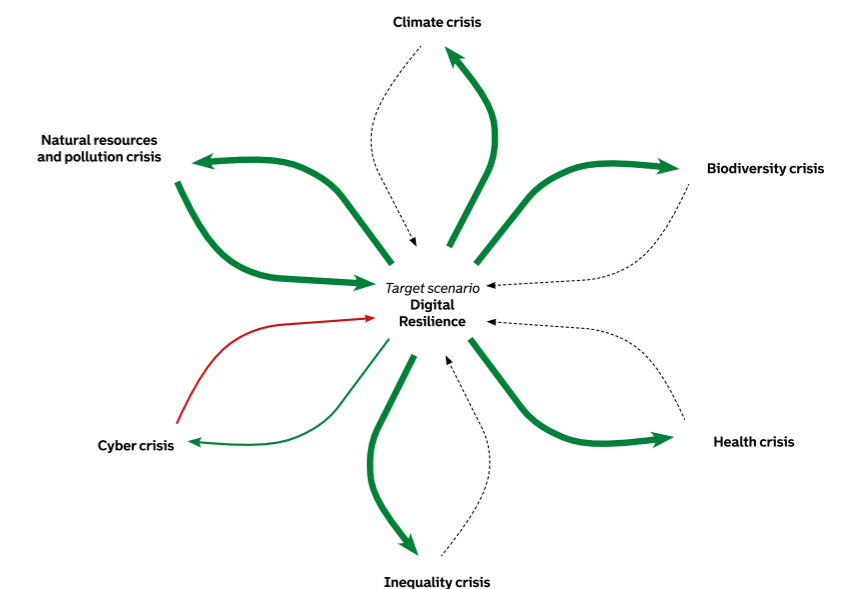
Current situation Digital Resilience

The growing number of cyber-related incidents is putting pressure on the city’s and society’s cyber and digital resilience. Cyber risks can have a reinforcing effect on climate risks (like cyber crime targeting water infrastructure). Cyber attacks can directly or indirectly lead to health issues and hit vulnerable groups the hardest, resulting in an increase in inequality. Vice versa, inequality can reinforce the lack of digital resilience and negatively affect Digital Resilience.



Target scenario Digital Resilience

The vulnerability to cyber threats has decreased significantly in the desired situation and the other crises have no negative impact on our Digital Resilience. Vice versa, Digital Resilience will allow us to anticipate on other crises more effectively, especially by making better use of data and instruments, like digital twins. Digital Resilience also contributes to, for example, Energy and Economic Resilience.



Choices and approach

Rotterdam is committed to a digitally resilient city, to digitally resilient Rotterdam residents and to the use of digital innovations and data for a more Resilient Rotterdam.

Team Cyber Resilience, the Chief Digital Officer, Smart City Rotterdam, Digital City and team Resilient Rotterdam will be working together closely.

Together, we will aim to safeguard the resilience principles:

Resistibility: focussing on Rotterdam's digital resilience by encouraging and helping citizens, entrepreneurs and companies to introduce measures. A specific principle we apply here is 'Cyber Security by Design' (digital security is in a product's design and procedures).

Recoverability: the city (communities and infrastructure, for example) must be able to quickly recover to a level better than where it started in the event of a setback in the digital domain. Crisis management and cyber crime consequences prevention are focus points here.

Learning ability: ensuring that cyber events lead to a learning curve so any future cyber risks can be tackled more effectively.

Adaptability: systemic adaptations must be made possible as a result of the learning curve. Data-oriented working is becoming crucial.

It's important to mention that the municipality is dependent on others in the realisation of all these objectives. In addition, citizens and companies themselves remain responsible for their digital resilience. We can only encourage and stimulate this as a municipality.

Potential interventions

1. Contributing to the development and implementation of the actions from the new Rotterdam Cyber Overview (snapshot of Rotterdam's overall cyber threat and opportunities).
2. Commitment to tackling digital crime in collaboration with relevant stakeholders.
3. Managing Cyber Resilience as a basic condition and as a Unique Selling Point for the Rotterdam business climate.
4. Increasing Rotterdam residents' digital resilience (focussed on, for example, skills, hacking and fake news) at neighbourhood level, starting in BoTu (including IT Campus, Directorate Safe and CDO).

5. Managing the implementation of the Cyber Resilient water and mobility infrastructure analyses.
6. Taking advantage of opportunities: Digital City and specific data-oriented and functional use for the city's resilience.
7. Integrating resilience as a guiding principle in the Open Urban Platform (Figure 2.6c);
8. Managing and participating in the regional sectoral cyber strategy.
9. Further elaborating on how the resilience and digitalisation transition paths converge and ultimately can reinforce each other.

Knowledge agenda

- Cyber Resilience and Digital Twin Resilient Rotterdam are on the Resilient Delta Initiative's agenda.
- Specifically focussing on knowledge development with TU-Delft in relation to the Cyber Resilient Energy infrastructure.
- Working with the leading group of cities, EU Joint Research Centre, ICLEI, RCN towards an EU Smart Resilient Cities knowledge agenda, with a leading role for Rotterdam.
- Acquiring a better insight into cyber resilience and (potential) victims and perpetrators at neighbourhood level.

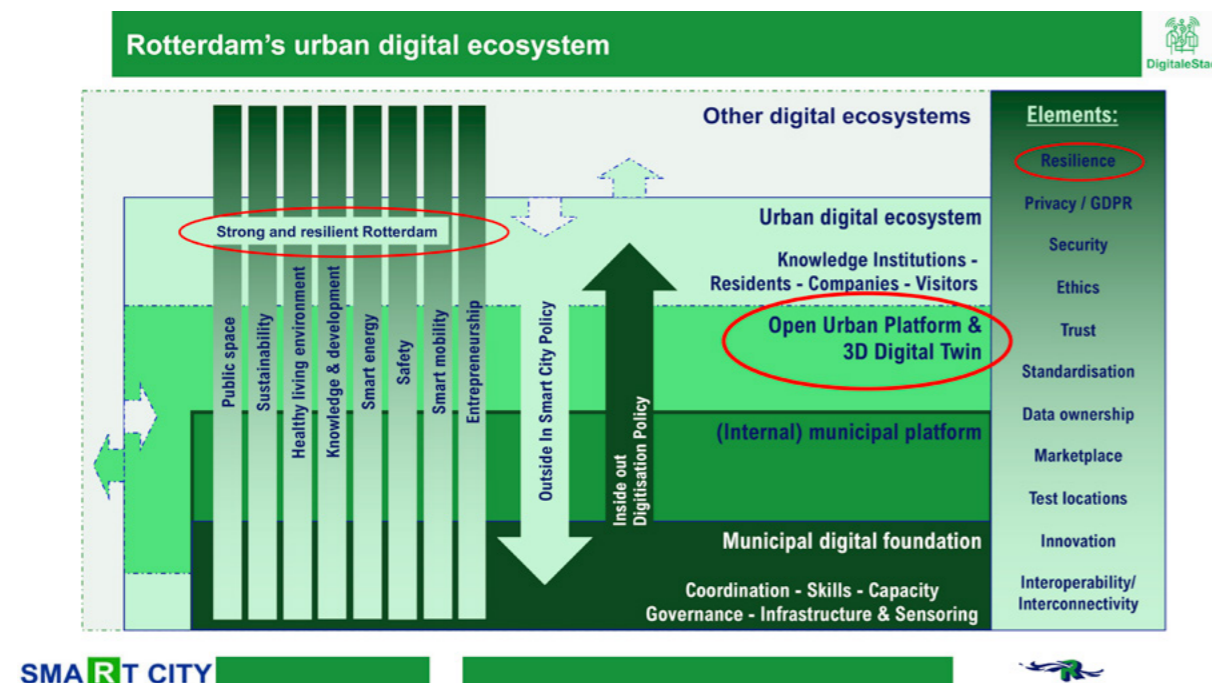


Figure 2.6c: Resilience as a guiding principle in the Open Urban Platform to be developed by the municipality, which will become a central public digital platform to support a strong and resilient Rotterdam and its residents.

"Cyber resilience has become increasingly important in recent years. Firstly, because technology is developing at an incredibly rapid pace, resulting in all kinds of opportunities, but also many challenges and risks. Plus these risks can be very substantial. Thirdly, cyber incidents can have a major impact, for example the hacking of a hospital system. It's essential to arm yourself for that as a city."

Marit Andersen – Cyber Resilience Officer, Municipality of Rotterdam

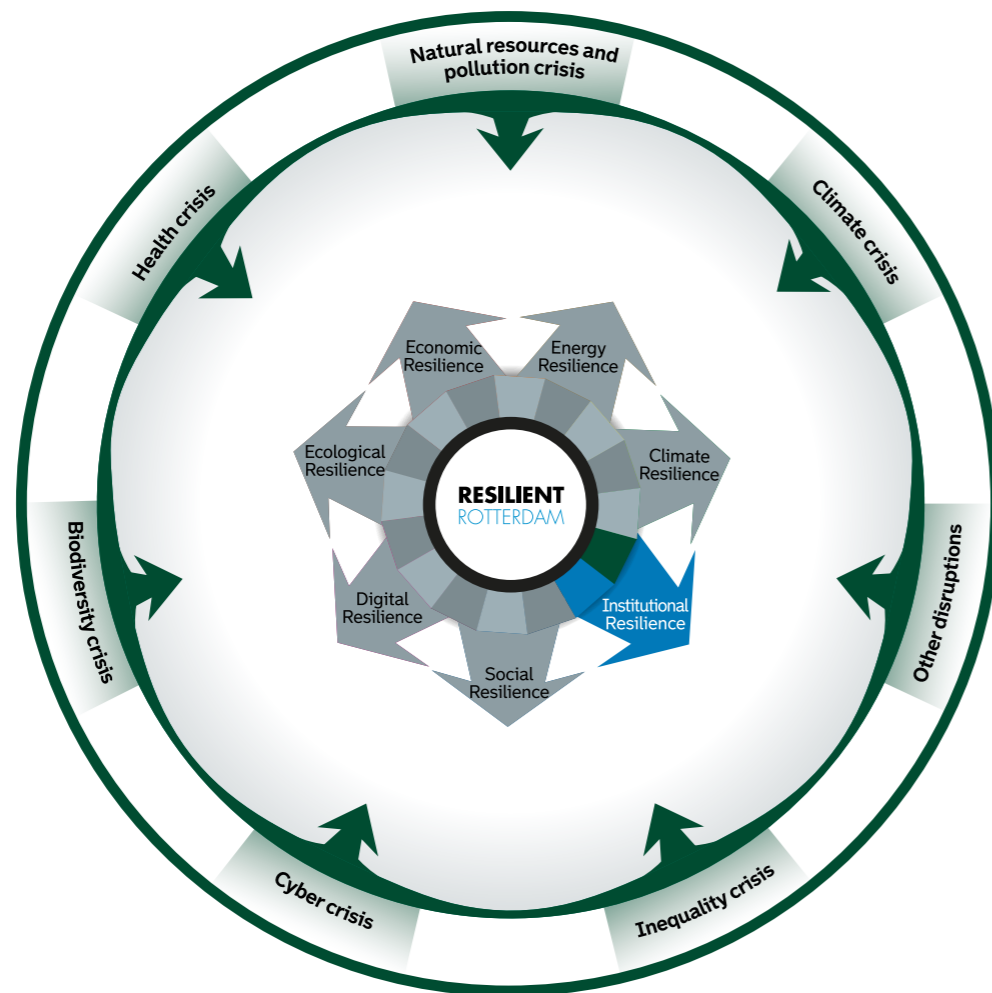
Strategic partners:

- External: including IT Campus, RDI, Port Authority, umbrella organisations, SME's, Resilient Cities Network, etc.
- Internal (Municipality of Rotterdam): including the Safe Directorate, CDO Office, Smart City, Digital City, Urban Development department, City Management department, Cluster BCO: International Affairs.



2.7 Institutional Resilience

How do we develop, strengthen and anchor the four resilience capabilities in the city?



Urgency

We live in a time of continuous, accelerated, often mutually reinforcing changes. Changes in the form of crises accompanied by stresses and sometimes disruptive shocks. Effectively dealing with known crises, being better prepared for, as yet, unknown crises and taking advantage of opportunities are now preconditions for a good living environment and a prosperous and economically stable city with a good business climate. It's clear that possessing resistibility and recoverability, as well as the ability to learn and subsequently adapt, are becoming increasingly important.

The four resilience capabilities (resistibility, recoverability, learning ability and adaptability) are not automatically present in people, societies, neighbourhoods, or organisations. In order to be prepared for unexpected events, which can be accompanied by stresses and/or shocks, we must strengthen and develop those qualities.

Practice has shown us that, there's often a lack of learning capacity, and that it's especially difficult for, e.g., organisations to adapt.

Without system change and the structural embedding of the four resilience principles, we remain reactive; adjusting to situations ad hoc, and only turning a limited number of knobs.

Urban resilience is still a relatively new policy area. Even though Rotterdam has been a pioneer for several years when it comes to urban resilience, we're still facing numerous fundamental knowledge questions. That's why the start of the Resilient Delta Initiative by the regional universities has come along at just the right time (chapter 3.1).

Current policy

Rotterdam Resilience Strategy (2016). The 2022-2027 strategy is the successor of the 2016 strategy. Highlights and lessons learned so far are included in Chapter 1.5.

Sustainability Compass (Dec. 2020). This stands for a green and healthy city with clean air. The ambitions listed in the compass are divided across various different themes. Like the energy transition and the transition to a circular economy.

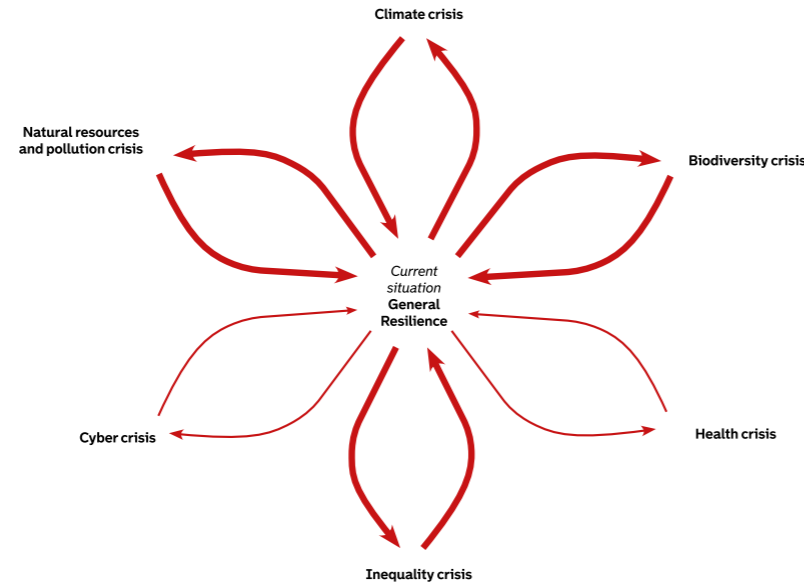
Plus the policy dossiers that are linked to six substantive resilience themes (chapters 2.1 - 2.6).

Objective

Strengthening and anchoring the four resilience capabilities and properties, focussed on the municipal organisation and corresponding projects, programmes and processes.

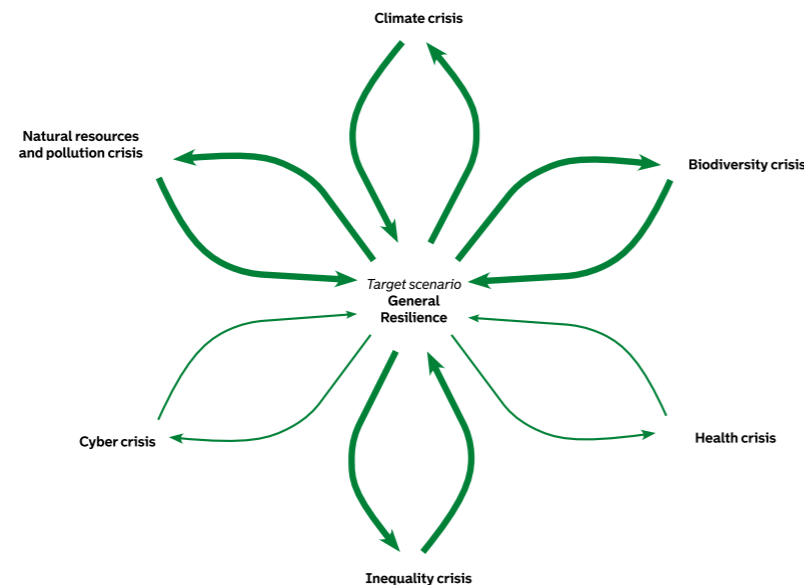
Current situation Institutional Resilience

Cities and organisations that do not possess the resilience capabilities are already unable to effectively respond to existing crises, let alone to unknown crises.



Target scenario General Resilience

Desired situation: we are resilient if the resilience capabilities are present and we can bounce back and emerge stronger from crises.



Choices and approach

Awareness and embedding the resilience philosophy: the task is to increase awareness of the resilience philosophy and to embed it in the organisation(s). The interventions are aimed at structurally developing, teaching and applying the four basic capabilities for resilience. Rotterdam's Spatial Planning & Environmental Strategy is an important 'vehicle' for the structural anchoring of the resilience philosophy.

It all starts with awareness. This leads to a change of mindset, one in which there is always looked through the resilience lens to one's own actions, projects, organisations, or the community.

Embedding the resilience philosophy in the municipal organisation is an important basis for working on the city's overall resilience. At the same time, the municipality is starting a dialogue with the city by talking to the business community, citizens, (social) umbrella organisations and neighbourhood councils. We want to work with these partners in the city to increase awareness, get feedback on the strategy and collect ideas to strengthen the capabilities of resistibility and recoverability. This is in addition to the collaboration with the stakeholders already mentioned for each resilience theme.

The resilience philosophy is already embedded in various parts of the municipal organisation, or there is an intention to do so in 2022. Examples include:

- Cyber Resilience (by developing a Cyber Resilience programme and appointing a Cyber Resilience Officer);
- Energy system vision, in which resilience is included as one of the core values and a preliminary resilience framework has been developed;
- The GGD (Municipal Health Service), Safety and Risk Management Directorate, will integrate resilience into further policy development from 2022 onwards.

The seven resilience qualities, which are scientifically substantiated (see figure 2.7a), are an important aid for strengthening the four resilience capabilities. The relationship between the seven qualities and the four basic capabilities is visualised in diagram 2.7b.

Potential interventions

1. Dialogue with the city: talking to the business community, citizens, (social) umbrella organisations and neighbourhood councils, with the aim of increasing awareness about the resilience philosophy, receiving feedback on the strategy and collecting ideas for further implementation.
2. Continued development of the Resilience Toolkit (a set of tools, including the resilience scan), including training, to support the resilience principles.
3. 'Resilience Proof': developing a resilience checklist or 'quality mark' which projects and programmes (ideally) must comply with.
4. Strengthening the resilience embedding approach with the Urban Development department's 'Next-City-approach'.
5. Structurally (continuously) work on a resilient municipal organisation.



Figure 2.7a: The seven resilience qualities, to be used as a checklist when developing the four basic capabilities and safeguarding the resilience philosophy.

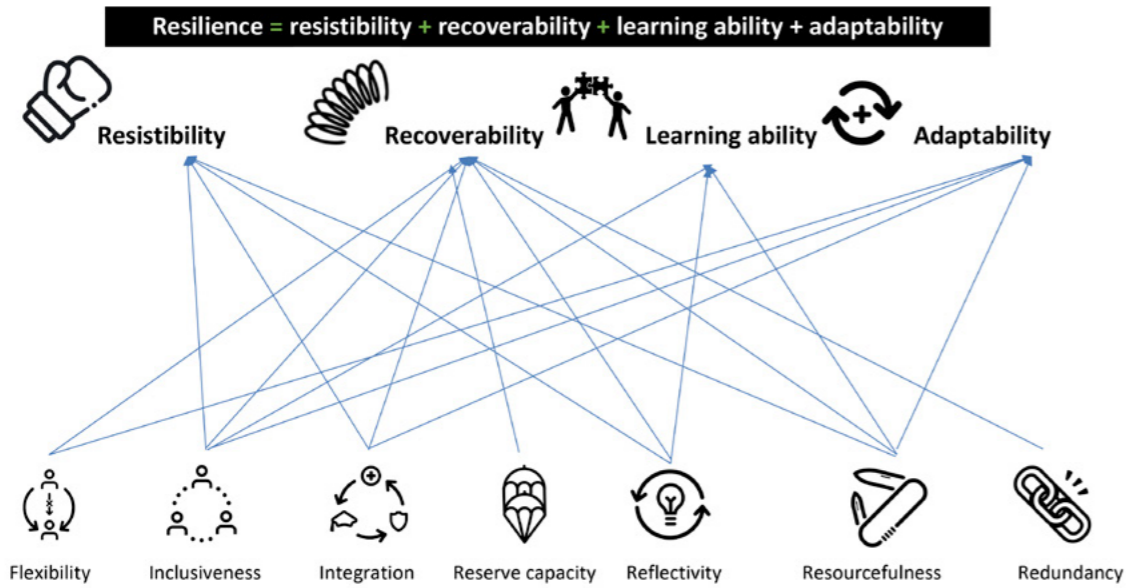


Figure 2.7b: How the resilience qualities support the four basic capabilities.

6. Specifically: GGD 3.0. The GGD (Municipal Health Service) is working on a more resilient organisation, partly as a result of the pandemic. Resilient Rotterdam supports this process.
7. Specifically: 'Risk management 3.0'. Develop a two-yearly analysis with the Risk Management department, specifically focussing on shocks and stresses and translation into scenarios for Rotterdam.
8. Specifically: New 2023-2027 Rotterdam Safety Strategy. The Safety Department and Resilient Rotterdam will jointly explore how resilience can enrich the new safety strategy (focussing on repression, prevention and resilience).
9. Specifically: Environment. In view of the relationship with, for example, health, we will further elaborate on how the Environment and Resilience policy areas can reinforce each other.

reached by researchers from the Institute for Physical Safety (IPS), the knowledge institute which supports regional safety authorities and other emergency services with disaster and crisis management. "The ability to improvise flexibly and wisely is extremely important with other and possibly bigger crises ahead (climate!) and the lesson that we may have lost that ability somewhat." In short, a plea for more flexibility and ingenuity!

A resilient organisation

McKinsey's 7 S's model has been combined with the resilience lens consisting of the seven resilience qualities for the purpose of a more resilient organisation (municipality). This has resulted in seven recommendations.

1. Pay explicit attention to diversity, inclusiveness.
2. Increase the ability to reflect by emphatically organising and embedding it.
3. Manage flexibility and change capacity (based on reflection).
4. Manage out of the box thinking and working, creativity and networking.
5. Reinforce the long-term focus, explicitly work with scenarios (see intervention 5).
6. Facilitate integrated working even more effectively, including integrated budgeting and working integrated at all levels.
7. Create trust, safety, openness and space.

Team Resilient Rotterdam

The further development, facilitation of implementation and monitoring of the approach require a strong and compact Resilience team. The team should collaborate with all parts of the municipality, stakeholders and communities in the city. The Resilience team is part of the municipal organisation and is led by the Chief Resilience Officer (CRO). This Resilience team is also known as the CRO Office. Team Resilient Rotterdam enriches existing policies by embedding the resilience principles, connecting with the various resilience themes, jointly initiating pilots where necessary and addressing knowledge questions. The driver team itself is rarely the actual initiator. This is the only way to create ownership where it belongs, to start a movement and to work on a Resilient Rotterdam on a structural and programmatic basis.

The Resilient Rotterdam team:

- identifies and analyses – which crises and disruptions are evident and which ones are (probably) imminent?
- assesses and chooses – how will these disruptions affect people and the city and what should we respond to? What has priority?
- devises and initiates interventions where necessary – how do we design and realise systemic and transformative interventions? Where are the gaps and is it relevant to start a pilot?
- sometimes supervises interventions – sometimes the team supervises the development and implementation of an intervention, but always with the intention of quickly transferring and securing;
- monitors and learns – how do we ensure that we continue to develop and safeguard knowledge and don't keep making the same mistakes?
- steers towards change – working towards a resilient Rotterdam is a transition in itself. The team is focussing on changes needed to be increasingly better organised to meet the following challenges;
- advises and is a driver – the team advises the board, provides solicited and unsolicited advice, is an ambassador and a driver of the resilience philosophy.

We will determine which resources are required for this in the further elaboration of this strategy and the associated implementation agenda. The aim is to allow the Resilient Rotterdam team to work from a strategic position within the municipal organisation with a group-wide booster budget.

Knowledge agenda

Knowledge agenda:
See chapter 3.1.

Institute for disaster relief and public crisis management (IPS):

"One of the lessons learned from the corona crisis is that the Netherlands shouldn't primarily seek refuge in even more scripts and scenarios, but should learn to improvise more effectively." This is the conclusion

Strategic partners:

- External: including Team Resilient The Hague, knowledge institutions, Resilient Delta Initiative, Resilient Cities Network, etc.;
- Internal (municipality of Rotterdam): all departments.



3. Knowledge – practice – spin-off

3.1 Knowledge agenda

Specific knowledge questions have been formulated for each resilience theme, based on current insights (chapter 2). It's crucial that there is, and continues to be, room for additional and new research, innovations, experiments and upscaling. The ability to learn is one of the core principles of resilience. Developing and sharing knowledge is also part of the resilience approach. Lessons learned, new knowledge and the learning curve form the basis for possible system or organisational adjustments to become increasingly resilient. Learning, knowledge development and knowledge sharing require a significant amount of effort. It requires the focus of an internal and external organisation, as well as collaboration with (knowledge) partners. This is the only way Rotterdam will be able to continue to anticipate on new developments and insights.

We're working towards a multi-year knowledge agenda together with knowledge partners, in order to focus on knowledge development, knowledge sharing and strengthening the ability to learn. This is aimed both at the major complex substantive issues (the 'what') and the methodical issues (the 'how'). The former underlines that we're far from ready for all the expected disruptions, let alone the potential disruptions. The latter is also the reason for investing in method development: how do you generate overall resilience, how do you embed this in projects and programmes (guarantee) and how do you increase the learning capacity of, for example, the municipal organisation?

The aim of the multi-year knowledge agenda is to develop substantive and methodical knowledge and tools together with knowledge partners, in order to support and accelerate the reinforcement of the city's strength and resilience.

Knowledge development and sharing at all scale levels

The major resilience issues don't stop at our municipal borders. That's why we attach a great deal of value to regional collaborations. We do this, for example, with the regional universities in the RDI context and The Hague.

Rotterdam collaborates with various knowledge partners on various different levels:

- local – with residents, neighbourhood councils, Veldacademie, Rotterdam University of Applied Sciences (HRO), Erasmus University Rotterdam (EUR), Codarts, Venture Cafe, Thrive Institute;

- regional – with Resilient Delta Initiative (RDI – EUR/ TU-Delft/Leiden University), Resilient The Hague, Pandemic & Disaster Preparedness Centre;
- national – with VNG, 4TU Resilient Engineering, Scientific Council for Government Policy (WRR);
- international – with Resilient Cities Network (RCN); Global Center on Adaptation (GCA); Cooperation Rotterdam and Paris; Collaboration Rotterdam and Surat (India); EU Joint Research Centre.

Potential actions:

- Resilient Delta Initiative (RDI): the RDI is the ultimate partnership for Resilient Rotterdam to structurally work towards an integrated multi-year knowledge agenda, focussed on the major complex societal resilience issues in the city and region (delta). It's therefore relevant to jointly generate the required resources (deployment and co-financing).
- Knowledge Workshop Resilience: explore with external knowledge partners and the municipal RBI (Research and Business Intelligence) to what extent the establishment of a Knowledge Workshop Resilience can facilitate the process of locally and regionally determining and elaborating on the right knowledge questions. A knowledge workshop is a specific format aimed at collaboration and innovation.
- Rotterdam University of Applied Sciences (HRO): Resilient Rotterdam will continue the collaboration with the HRO, aimed at strengthening and implementing the Resilient Cities minor and strengthening the city's resilience.
- Resilient The Hague: we will continue to focus on collaboration to further strengthen each other's and regional resilience with the Resilient The Hague team. Topics for collaboration include: joint pilots, knowledge agenda, lobby and European subsidies. At local and regional level (metropolis).
- Resilient Cities Network (RCN): continue to work on the resilience of our cities together by investing in peer to peer knowledge exchange, Rotterdam's administrative and official representation in the RCN organisation and specific collaboration with the RCN EME Office in Rotterdam.
- Global Center on Adaptation (GCA): elaborate how we can further strengthen each other in the field of knowledge sharing and development together with the GCA, with the CRO as liaison partner.



The Resilient Cities Network connects global knowledge, practice, partnerships and financing to help cities within the network to strengthen their future-proofing, in which safety, sustainability and equality for all inhabitants are central. Our mission is to reduce vulnerability and improve the quality of life for 220 million urban dwellers worldwide. Rotterdam's resilience journey has been an inspiration for many cities in the network. Rotterdam has shared knowledge and practical experiences throughout all these years, which have subsequently been adopted by other cities in different regions. At the same time, as one of the pioneers within the network, Rotterdam has contributed

to the set-up and further development of the Resilient Cities Network, by actively participating in various parts of the organisation from the start. Rotterdam has also become the host city for the European office from 2021, once again confirming Rotterdam's commitment to our city network.

Lina Liakou
(Global Director for City Engagement and Knowledge, Head for Europe and the Middle East at Resilient Cities Network)

Rotterdam and Surat (India)

The Indian city of Surat is also a RCN member. 'Climate Resilience' is high on Surat's agenda. The city of 5 million inhabitants is still at the start of the process of becoming more climate-proof. Surat would like to collaborate with Rotterdam on this. The long-term, programmatic and more holistic approach in Rotterdam appeals to the imagination. Both cities have successfully applied for a subsidy through the EU International Urban and Regional Cooperation (IURC) programme. Experts are actively involved on both sides. The result is that Surat will be constructing seven water squares, of course translated in line with the local situation. EU support was exceptionally extended in 2021, allowing the collaboration to continue.



We introduced the concept of resilience more or less for the first time in the urban context and on the Rotterdam agenda seven years ago. At that time, it was mainly about what resilience is and why it's important. We have worked hard on further knowledge development and the implementation of pilots and actions after years of pioneering. Now it's mainly a question of how we're going to structurally work on Rotterdam's resilience and how we can use lessons learned to scale up to more of the city's neighbourhoods.

The years 2020 and 2021 (and probably 2022 too) will end up in the history books as the 'corona years'. But let's not forget that we were already in the middle of a crisis and still are: the climate crisis. And so there are

increasingly more large, complex challenges. The thematic resilience interventions, strengthening our resilience capabilities and the multi-year resilience knowledge agenda should help us on our way to a more resilient Rotterdam.

A resilient Rotterdam requires a joint effort. We do it for, with and by the city. I would hereby like to invite anyone who has ideas for this to contact us via resilient@rotterdam.nl.

Arnoud Molenaar
Rotterdam's Chief Resilience Officer



Resilient Delta Institute (RDI)

The RDI is an institute in the making as a pillar in the so-called 'Convergence Agenda'. The Convergence Agenda is a multi-year partnership between the three top universities in the region: TU Delft, EUR and Leiden. The RDI, for now referred to as the Resilient Delta Initiative, will be the partnership in which the major complex resilience issues will be addressed and translated into programmes and projects. All theme-specific knowledge questions listed in Chapter 2 and

future knowledge development arising from this strategy must be addressed in conjunction with the RDI agenda.

This joint multi-year agenda requires serious commitment on both the scientific and municipal side in terms of resources and long-term programming of at least ten years. Only in this way, continuity will be guaranteed, which is crucial to structurally and systemically work on the overall resilience of the economy and society.

Examples of important knowledge questions for the next five years:

- 1. How does Good Growth also become Resilient Growth?**
- 3. What are realistic spatial scenarios linked to accelerated sea level rises, what does the road travelling there look like and how will this affect short-term choices?**
- 4. How do we structurally work on a resilient municipal organisation?**
- 5. How can we use Rotterdam's Spatial Planning & Environmental Strategy for a more resilient Rotterdam?**

3.2 Resilience in practice

Working on resilience in and with the city

We explained which thematic interventions are needed for a resilient Rotterdam in the previous chapters. Linked to this, we're also working on a multi-year knowledge agenda, with the Resilient Delta Initiative as a carrier (see chapter 3.1). A third part of the package of interventions, linked to the same themes, is working on resilience in and with the city, at different scale levels and with different partners: resilience in practice.

Objective: to accelerate and scale up resilience at different levels with partners, using the lessons learned over the past five years.

We'll be working on all facets of system change by applying it in the city: sectors, policy, processes and awareness. According to the transition theory, the 'tilt' often starts with so-called 'niches'. Examples of 'niches' in the city which have accelerated resilience are the water square, the Floating Pavilion and the Resilient BoTu2028 programme. We will continue to build on these visible pilots and projects in the city via two tracks:

- A. in the city, resilient living environment: neighbourhood (A1), built environment/ infrastructure (A2);
- B. with the city: social organisations (B1), the business community (B2).

This will result in the following potential interventions:

A1. Resilient living environment: neighbourhood level

- Continuation of Resilient BoTu 2028 (Resilience Officer in new programme council);
- Field Academy (Veldacademie): monitoring at neighbourhood level;
- Explore how district-oriented scaling up of the BoTu2028 experiences can take place and draw attention to the results together with, for example, 'Working in City and District' (Werken in Stad en Wijk).



A2. Resilient living environment: physical built environment including urban systems

- Structurally work on Rotterdam's strength and resilience by embedding resilience in policy and projects linked to the implementation of Rotterdam's Spatial Planning & Environmental Strategy;
- Increase awareness, develop resilience scan built environment, organise Resilience Coaches;
- Submit knowledge question 'How does Good Growth also become Resilient Growth?' to RDI;
- Multifunctional Roofs (MFR): Resilience Team continues to support MFR, aimed at strengthening the city's resilience;
- Floating Building (1): participation in the consortium for the National Floating Future Research Initiative;
- Floating Building (2): contributing to further policy development (such as the Rotterdam Water Atlas) within the municipality in relation to the optimal use of water in the city.

B1. Social organisations

- Working together on a 'Strong and Warm Rotterdam' (coalition of, among others, Dona Daria, Rotary, NVO-NCW): explore how we can work with this coalition to strengthen social resilience;
- Junior Chamber International (JCI) for Resilient Rotterdam: JCI wants to make capacity available for a more resilient Rotterdam.

B2. Business community

- R100 Challenge 2022: collaborating with Thrive Institute to deploy one hundred talented students for resilience issues provided by the business community in Rotterdam;
- Rotterdam Running Ambassadors (RRA): 'Running for Resilience', to increase awareness of the entrepreneurs involved;
- Actions to be determined with the business community.



Resilient built environment: Resilience by Design

Sustainability in the built environment is well underway, however, being sustainable doesn't automatically result in the environment becoming resilient. The slowness of the built environment is a blessing, but also a concern. The task is to anchor the resilience philosophy in this process. It is clear that, these changes do not happen over night; the built environment is indeed very adaptable, but its use requires a long-term view and strategic management. It's about utilising linking opportunities, creating work-with-work and finding synergy. We must focus on four tracks in order to work on a resilient built environment:

1. using the existing differently;
2. adapting the existing;
3. removing what doesn't work or is no longer desirable/useful;
4. build new parts.

Awareness of usefulness and necessity is necessary to create real impact and to realise scale. Resilience in the built environment is therefore not a matter of completely changing course, it's more of a question of making it explicit, visible, putting it on the agenda more clearly, becoming more aware and expanding our integrated approach. Not building resiliently now is a missed opportunity and can entail higher costs at a later stage as a result of repairs or adjustments. At the same time, we need to become even more proficient in the way we contribute to strengthening Rotterdam's resilience with every intervention we introduce in the city. For example, it became apparent during the pandemic that extra greenery and flexible public space are desirable, in other words Resilience by Design!

District-oriented approach

The municipality has decided that Rotterdam will have 39 district councils. This gives residents more control of the plans in their neighbourhood, how municipal money is spent and which initiatives are carried out by fellow residents. Resilient Rotterdam will also commit to using the experiences gained in BoTu2028 in this neighbourhood-oriented approach.

Multifunctional roofs

Recently, the Multifunctional Roofs Programme focussed on defining what can be done on roofs, resulting in, e.g., a Rooftop Catalogue. The forthcoming period – just like the renewed Resilience Strategy – will be dominated by the ‘how’. More emphasis will be laid on how we can develop multifunctional roofs and work towards new, appropriate structures and systems. With this renewed approach, we are consciously competent and this will ultimately lead to the realisation of upscaling. Resilient Rotterdam will continue to participate in the Multifunctional Roofs Programme and the development of a roof vision, to contribute to resilience at building level and to the resilience of the city as a whole.

Floating buildings

Floating buildings automatically adapt when the sea level rises and are therefore by definition climate-proof. In addition, floating constructions offer a high degree of flexibility. For example, the Floating Pavilion has now been moved to a different harbour basin and will be given a second destination at RDM as an innovative breeding ground for students, start-ups and sustainable technology. The largest floating office in the world has recently been completed as accommodation for the Global Center on Adaptation. Floating constructions also offer opportunities for the energy transition (floating solar panels) and can contribute to Rotterdam’s housing task. In addition to the fact that floating constructions can contribute to a resilient Rotterdam, this concept also offers export opportunities for the Rotterdam business community, given the application possibilities in other delta cities. The big challenge now is to scale up, because only then this type of construction can make a substantial contribution to a resilient Rotterdam.



3.3 Spin-off

Resilient Rotterdam is primarily aimed at increasing the city’s strength and resilience, including the municipal organisation. In the previous chapters, we outlined how we want to work on this during the forthcoming years. Furthering the strength and resilience of the city and the municipality is something that will be done together. This will be done on a thematic level, as well as a general level with the aim of knowledge development and starting practical examples. Experience has shown that this can also directly or indirectly lead to interesting ‘spin-off’s’. These spin-offs could be seen as a mere bycatch. However, the significance of the spin-offs in

size and impact is such, that we see them as an essential part of the Resilient Rotterdam programming. This is how we’ll be ‘exploiting’ Resilient Rotterdam. The basis for this was laid by the reputation Rotterdam acquired with the water and adaptation approach (Climate Resilience). Rotterdam is still reaping the benefits from this, which has now led to a genuine Resilient Rotterdam ‘Ecosystem’: a chain of knowledge development, policy making, innovation, pilots, knowledge exchange and branding, which in turn leads to more knowledge, and so on. This is a self-reinforcing process; for example, the arrival of the Global Center on Adaptation will lead to new conferences, delegations and institutes (see appendix 2).

“The ‘Resilient Rotterdam’ brand and specifically the leading position in the field of climate adaptation, will lead to a growing ecosystem of companies, programmes and conferences.”

*Wilbert Lek
Rotterdam Partners Director*

Rotterdam, together with Rotterdam Partners, among others, will continue to make use of the ‘Resilient Rotterdam brand’, making sure it continues to contribute to further growth of the corresponding ecosystem and strengthening Rotterdam’s international profile. This should lead to more conferences, more students and more employment.

Business climate for international institutions

The international profile built up over fifteen years makes Rotterdam attractive for (international) institutions. Here are a few examples:

1. The Global Center on Adaptation (GCA). The Adaptation Future conference in Rotterdam resulted in the establishment of the Global Center on Adaptation, which is led by a board chaired by the 8th Secretary General of the UN, Ban Ki-moon. The Mayor of Rotterdam has now also joined the board. On 6 September 2021, the first “high level dialogue” took place. At the same time, the floating office, headquarters GCA, opened its doors. The GCA offers a platform to global cities and countries, and thereby, enables Rotterdam and partners to increasingly export their valuable expertise abroad.
2. Resilient Cities Network. Recently, the Resilient Cities Network’s EME (Europe Middle East) office moved from London to Rotterdam. This is a wonderful asset for Rotterdam.
3. Resilient Delta Institute. The aim is to develop the Resilient Delta Initiative (as part of the convergence agenda) into the Resilient Delta Institute. The Rotterdam AMS. Linked to this, the Pandemic and Disaster Preparedness Centre was also established.

Resilient Rotterdam will substantively contribute and steer towards good connections between these various initiatives and will continue to work on attracting institutes.

Exposure and image on the world stage

Directly and indirectly the Resilient Rotterdam dossier leads to interesting international platforms for Rotterdam representatives. Think of Rotterdam's participation in the U20 (Urban20), in preparation for the G20 summit. The Mayor of Rotterdam was invited to the U20 in 2019, where the central theme was urban resilience.

Generate additional resources

The resilience dossier has directly and indirectly led to additional resources, both internally and externally. Rotterdam is participating in two EU programmes with Climate Resilience (Life Urban Adapt and Life@Urbanroofs). Recent 'calls' from Brussels are even aimed directly at Resilient EU and Cities. The structural commitment to resilience is even an advantage for the EU Green Deal. It's certainly no coincidence that Rotterdam finished in the top 5 for the I-Capital Award. The necessary additional internal resources have been made available for specific programmes like Resilient BoTo2028.



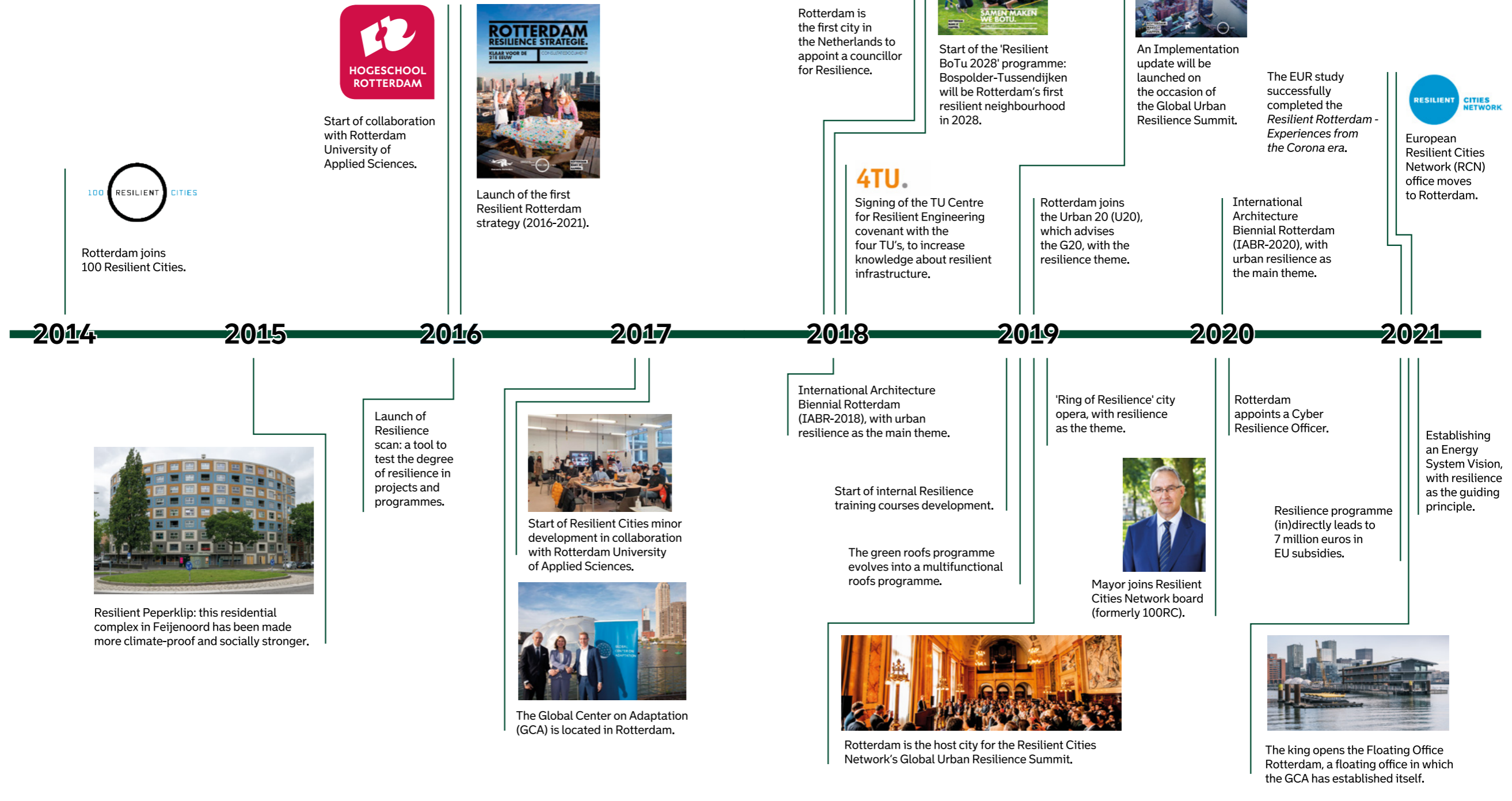
Attract conferences

Rotterdam was the first city in the world to host the 2010 Delta in Times of Climate Change conference- an important international conference in the field of climate adaptation. The Adaptation Future 2016 and the Urban Resilience Conference of 100 Resilient Cities (100RC) followed in the subsequent years. Due to the pandemic, the international conference Urban Future, has unfortunately been postponed to 2024. The Climate Adaptation Summit (CAS) in January 2021 eventually also became virtual. The Mayor of Rotterdam also argued for a global acceleration of adaptation in a setting with various world leaders. The resilience dossier is an important Unique Selling Point for attracting conferences for Rotterdam for the Event Bureau of Rotterdam Partners. This will lead to extra familiarity with the city and to overnight hotel stays and spending by visitors.

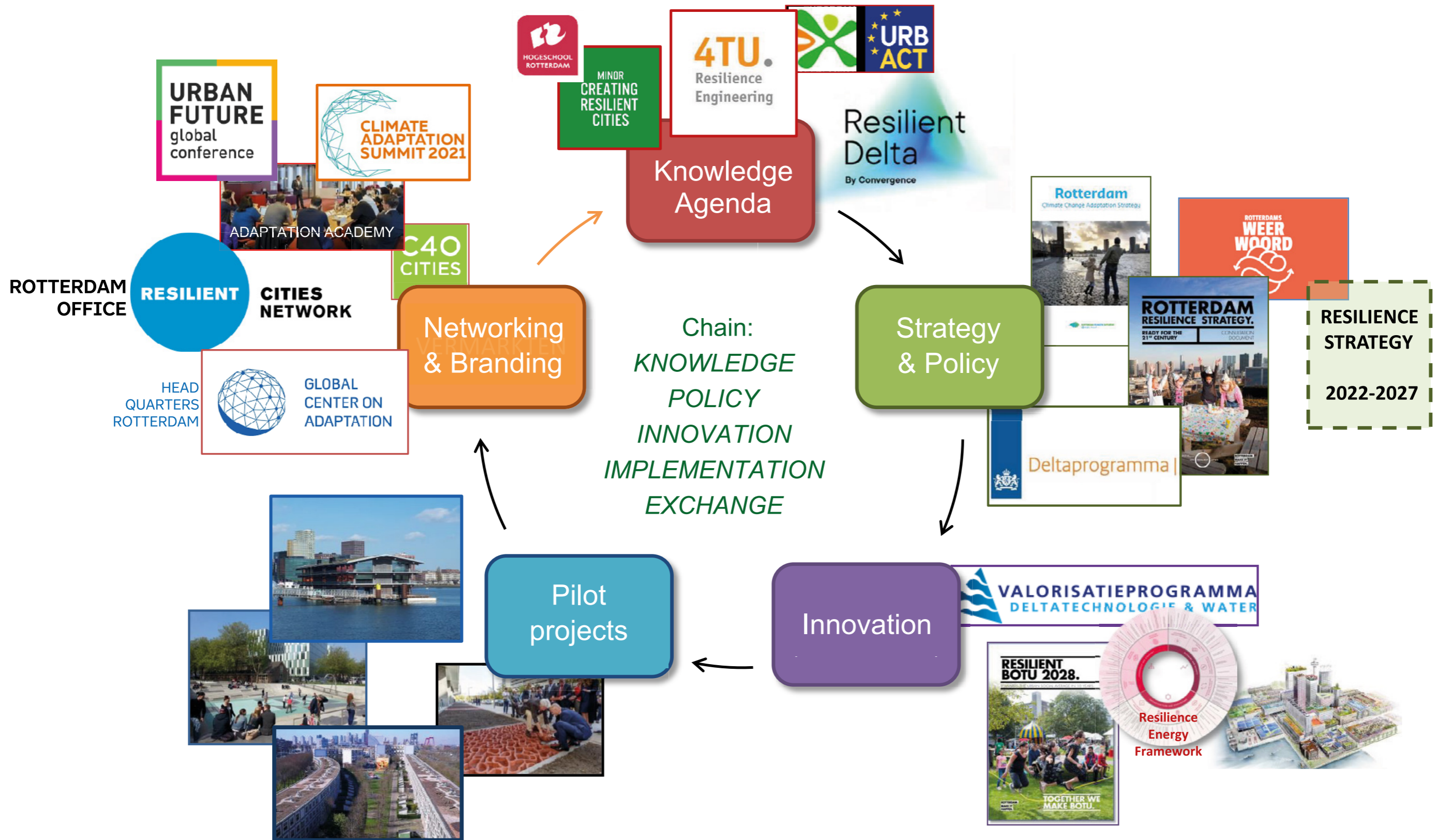


Appendix 1

Review and highlights 2014 - 2021



RESILIENT ROTTERDAM 'ECOSYSTEM'





Colophon

2022

The Municipality of Rotterdam

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City of
Rotterdam