

ROTTERDAM RESILIENCE STRATEGY.

**READY FOR THE
21ST CENTURY**

CONSULTATION DOCUMENT
EXTENDED VERSION



Gemeente Rotterdam

PIONEERED BY THE
ROCKEFELLER FOUNDATION

100



CITIES

**ROTTERDAM.
MAKE IT
HAPPEN.**

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CONTENTS.

OUR VISION IN BRIEF. 06

LETTER FROM MAYOR ABOUTALEB	08
LETTER FROM MICHAEL BERKOWITZ	10
LETTER FROM ARNOUD MOLENAAR	11

1. RESILIENT CITIES ARE PREPARED FOR THE FUTURE. 12

1.1. ON THE ROAD TO A RESILIENT ROTTERDAM.	14
1.2. ROTTERDAM AND THE 100 RESILIENT CITIES PROGRAMME.	16
1.3. WHAT IS RESILIENCE?	18
1.4. A RESILIENCE STRATEGY – LINKED TO THE STORY OF THE CITY.	20

2. 'SELFIES' OF ROTTERDAM. 22

2.1. ROTTERDAM THEN: 12 TH -21 ST -CENTURY TRANSITIONS.	24
2.2. ROTTERDAM NOW: THE 21 ST -CENTURY TRANSITIONS.	28
2.3. ROTTERDAM THEN: A RESILIENT FUTURE SCENARIO.	30
2.4. THE RESILIENCE STRATEGY – MOVEMENT TOWARDS A FUTURE-PROOF CITY.	34



3. VISION AND GOALS. 38

3.1. VISION.	40
3.2. ROTTERDAM: A BALANCED SOCIETY.	44
3.3. A WORLD PORT CITY BUILT ON CLEAN AND RELIABLE ENERGY.	58
3.4. ROTTERDAM CYBER PORT CITY.	70
3.5. CLIMATE RESILIENT ROTTERDAM TO A NEW LEVEL.	86
3.6. INFRASTRUCTURE READY FOR THE 21 ST CENTURY.	98
3.7. ROTTERDAM NETWORKCITY: TRULY OUR CITY.	112
3.8. ANCHORING RESILIENCE IN THE CITY.	122
3.9. LET'S TRAVEL TOGETHER: JOIN IN!	126

4. RESILIENCE LAB: ACTIONS. 128

HIERARCHY.	130
1. ROTTERDAM: A BALANCED SOCIETY.	132
2. WORLD PORT CITY BUILT ON CLEAN AND RELIABLE ENERGY.	146
3. ROTTERDAM CYBER PORT CITY.	154
4. CLIMATE ADAPTIVE ROTTERDAM TO A NEW LEVEL.	160
5. INFRASTRUCTURE READY FOR THE 21 ST CENTURY.	170
6. ROTTERDAM NETWORKCITY.	178
7. ANCHORING RESILIENCE IN THE CITY.	188

FACTSHEET RESILIENCE STRATEGY.	204
ACKNOWLEDGEMENTS	205



OUR VISION IN BRIEF.

ROTTERDAM IS WORKING TO BECOME A RESILIENT CITY – A CITY THAT IS PREPARED TO ENGAGE WITH THE OPPORTUNITIES AND CHALLENGES OF THE FUTURE. THE ROTTERDAM RESILIENCE STRATEGY PRESENTS OUR VISION OF A FUTURE-PROOF CITY.

OUR VISION FOR ROTTERDAM IN 2030 IS A CITY WHERE:

- strong citizens respect each other and are continuously developing themselves
- the energy infrastructure provides for an efficient and sustainable energy supply in port and city
- climate adaptation has penetrated into mainstream of city operations and water has added value for the city and our watermanagement system is cyberproof
- the underground is being used in such a way that it supports the growth and development of the city
- we have embraced digitization without making us dependant, and we have ensured a best practice level of cyber security
- self organization in the city gets enough room and a flexible local government supports if really needed
- resilience is part of our daily thinking and acting.

RESILIENCE GOALS:

- Rotterdam: a balanced society
- A world port city built on clean and reliable energy
- Rotterdam Cyber Port City
- Climate resilient Rotterdam to the next level
- Infrastructure ready for the 21st century
- Rotterdam Networkcity: truly our city
- Anchoring reliance in the city



LETTER FROM MAYOR ABOUTALEB

Rotterdam is a city to be proud of – and I am extremely proud of Rotterdam! The tiny settlement of ‘Rotta’ at the Rotte river bank has, over the course of centuries, grown into the major city of today. Rotterdam has its citizens to thank for that, from the early settlers to the current residents. The people of Rotterdam utilized the city’s location and its potential to the fullest, turning the water of the Rotterdam delta from its biggest threat into its greatest opportunity. They seized opportunities presented by trade and fishery. They embraced plans by visionaries such as Pieter Caland, whose ‘Nieuwe Waterweg’ (New Waterway) established the city’s direct connection to the North Sea.

Rotterdam’s history is marked by its residents’ resilience. Challenges were overcome, in water management, trade, fighting cholera epidemics, and in literally re-constructing the city after a devastating bombardment at the start of the Second World War left much of the city in ruins. Rotterdam has always faced difficult situations by looking to the future and finding opportunities for city improvement; ‘stronger through struggle’ is our motto. In May 2013 I met Judith Rodin, the Rockefeller Foundation’s CEO, in New York City. The great importance of resilience, in relation to the economic structure and livability of cities was recognized by her organization. Global developments, such as urbanization, climate change and the increasing complexity of urban society tell us we must look ahead and be prepared. The 100 Resilient Cities initiative was born.

She encouraged me to join the cities at the forefront, exploring the meaning of resilience for Rotterdam, and discovering the ways in which we can continue to build on our historical accomplishments. I embraced the invitation with conviction. Rotterdam has always shown

resilience, but innovative cities remain successful by being future-driven, rather than coasting on past successes. The people of Rotterdam are the key to the resiliency of their city. Their agility and resilience are crucial when disaster strikes. The memories of Paris and Brussels are still fresh. Continuing work on an inclusive Rotterdam society will further increase its resilience and provide balance. Developments in technology and society continue to challenge our resilience as well. The knowledge and skills necessary to deal with these new challenges are essential in order to keep moving ahead. The urgency of resilience is displayed in many areas. An example that stresses the urgency, in my opinion, is the growth, interconnectivity of and dependencies on ICT systems. This calls for ‘cyber resilience’: the ability of Rotterdam’s city and port area to keep functioning, despite disruptions that will surely occur.

I am very proud to present to you Rotterdam’s resilience strategy. This is only the beginning, not a blueprint. The strategy provides a new way of thinking, with new insights on how to further expand Rotterdam’s robustness, flexibility and inclusivity.

I invite you to view your daily activities and your passions through the ‘resilience lens’ this strategy offers. How do your activities contribute to Rotterdam’s resilience? Share your views and experiences with us as city officials, with your colleagues and your fellow-citizens. For only by joining forces, can we make our city even stronger and more beautiful.

AHMED ABOUTALEB
MAYOR OF ROTTERDAM



**“THE CITIZENS OF
ROTTERDAM ARE
THE KEY TO OUR
RESILIENT CITY.”**

LETTER FROM MICHAEL BERKOWITZ

The release of Rotterdam’s first-ever comprehensive Resilience Strategy is an evolutionary step forward for a city with a rich history of innovation and leadership. From its recovery after the destruction of World War II, to its globally recognized work on climate adaptation and water management, Rotterdam has time and again shown that it never shies away from confronting the most pressing challenges of the day head-on. The release of this strategy builds on this storied legacy. Through this strategy, Rotterdam is taking an honest and proactive view of its resilience challenges and opportunities, while laying the groundwork for important work ahead. It recognizes that Rotterdam must become resilient not just by fortifying its defenses to a changing climate and rising seas, but also by building a more cohesive and inclusive society. This is especially evident in the Strategy’s cross-cutting initiatives, which focus on finding multi-benefit solutions to climate, technological,



and socioeconomic risks that can achieve a resilience dividend for the city. Rotterdam has moved well beyond climate adaptation expertise to be at the cutting-edge of resilience topics such as building cyber resilience, and upgrading the landmark Peperklip Building. Specifically, renovating the Peperklip provides an opportunity to establish a link between the municipality of Rotterdam, to jobs and social cohesion programs for its residents. The aspiration is for the Peperklip to become an example, not only in physical infrastructure, but for building social resilience. If completed under current plans, the project has the potential to house one of Europe’s largest roof gardens. Of course, none of this could have been possible without the strong support and vision of Mayor Aboutaleb. As one of the first members of 100 Resilient Cities, Mayor Aboutaleb established Rotterdam as a leader in our global network early in our engagement. His keen interest in our partnership catalyzed the energy and political will necessary to turn Rotterdam’s challenges into opportunities. A special thanks should also be extended to Rotterdam’s CRO, Arnoud Molenaar, who hosted 100 Resilient Cities’ first ever Network Exchange and led an extensive process of research, analysis, and stakeholder engagement over the past few years that resulted in the fantastic work we see today. Though this strategy represents the end of the strategic planning process in Rotterdam, it is only the beginning of the exciting work to come in the months and years ahead. And 100 Resilient Cities’ partnership with the City of Rotterdam is also just beginning. It is now that we can collectively begin implementing the actions and initiatives contained in the following pages, which will positively impact the lives of all of those who call Rotterdam home. From its willingness to engage with world-class service providers through the 100RC Platform of Partners like Microsoft, to its ability to export best practices across the globe, Rotterdam is well positioned to continue leading the global urban resilience revolution. We at 100 Resilient Cities could not be more pleased to be a partner in these efforts.

BEST REGARDS,
MICHAEL BERKOWITZ
PRESIDENT, 100 RESILIENT CITIES

LETTER FROM ARNOUD MOLENAAR

Very few ‘Rotterdamers’ (citizens of Rotterdam) know, but Rotterdam is world-renowned for its adaptation to climate change. International delegations visit the city every week, to see for themselves how we handle management of dykes and levees, water management, rain and use of ground- and drinking water. Their tours include visits to our water squares, underground parking garages with a built-in water storage facilities and a rowing course that doubles as a water buffer, combining sports, recreation and water management. They may also stop to look at multifunctional dykes, experimental floating constructions or the internet system that allows us to monitor the entire city’s groundwater levels. Rotterdam’s leading position in climate adaptation helped local businesses to receive millions of dollars in commissions in the aftermath of the disastrous hurricanes Katrina in New Orleans and Sandy in New York. Rotterdam may proudly state: we make cities climate proof.

The climate change adaptation program we have been working on for more than a decade, is a good example of how to sustainably handle risks and threats. Of course, we have a long history of Dutch craftsmanship to build upon. Our approach is to keep threats at bay, even using them to Rotterdam’s advantage, increasing quality of life in our city and efficiency in our port. We do so because it is essential that the continuity of our city is preserved. Our efforts on climate change adaptation were a reason for the Rockefeller Foundation to invite us to join their resilience challenge, so that we could share our experiences, expand our horizons and learn from other cities – on climate change, and all the other challenges facing cities today.

This document is Rotterdam’s first Resilience Strategy. Our primary goal is to make resilience common practice in our city and part of our DNA. We do so for you and with you. Six themes and a wide range of inspiring initiatives, both new and operational, will help increase our city’s resilience.

100 Resilient Cities helped us in our journey to develop this Resilience Strategy and we are very grateful for this support. Participation in the 100 Resilient Cities Network



**“ROTTERDAM IS AN
INNOVATIVE CITY
THAT IS PREPARED
FOR THE FUTURE.”**

has further strengthened and expanded Rotterdam’s image as a well-prepared, innovative delta city. We look forward to contribute to – and benefitting from – the 100 Resilient Cities network in the forthcoming years. And as Chief Resilience Officer (CRO) I am very much looking forward to continuing the exchange on key resilience topics with my fellow CRO’s within the network.

ARNOUD MOLENAAR
CHIEF RESILIENCE OFFICER ROTTERDAM

1. RESILIENT CITIES ARE PREPARED FOR THE FUTURE.

ROTTERDAM IS WORKING TO BECOME A RESILIENT CITY – A CITY THAT IS PREPARED TO ENGAGE WITH THE OPPORTUNITIES AND CHALLENGES OF THE FUTURE. HOW AND WHY DID THE ROTTERDAM RESILIENCE STRATEGY COME INTO BEING? READ ALL ABOUT THE 100 RESILIENT CITIES PROJECT AND HOW IT TIES IN WITH ROTTERDAM’S ‘STORY OF THE CITY’.

1.1 ON THE ROAD TO A RESILIENT ROTTERDAM.

Cities are increasingly important to the functioning of society and form part of an increasingly complex world. Today, urban environments are more diverse, more dynamic, more connected and less predictable than they were in the past.

And this complexity is increasing relentlessly. The lifetime of the average company has declined steadily over the past twenty years. Traditional forms of economic activity are making way for new ones, and the number of self-employed people is rising consistently. New technologies are now becoming adopted more quickly than ever, particularly in the field of ICT (the telephone took thirty years to become established; the mobile phone took just six years). As a result, people and organizations are expected to adapt constantly to changing circumstances. The economy experiences more ups and downs than ever

before, and income inequality is increasing all around the world. Our ecosystem is feeling the strain: biodiversity is decreasing and the climate is changing in all areas of the world. Unexpected events, such as environmental disasters, flooding, power outages or cyberattacks, can have a significant and highly disruptive effect on the functioning of a city.

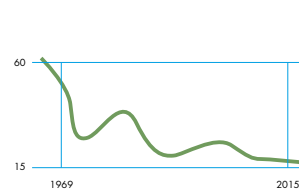
The cities that are able to respond to these new dynamics are able not only to survive, but also to continue to develop and grow. In the event of a crisis, they will be able to absorb the impact, recover quickly and bounce back to become even stronger than before. These are the cities that we call 'resilient' cities.

Resilience is an essential aspect of the strength of Rotterdam, both now and in the future. Our delta city

1A. INCREASING DYNAMICS IN URBAN ENVIRONMENTS

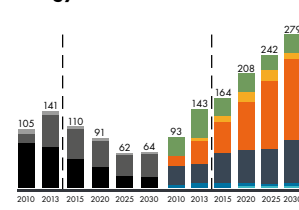
In de stad komen veel disruptieve ontwikkelingen bij elkaar.

Average lifespan of companies in the S&P Index



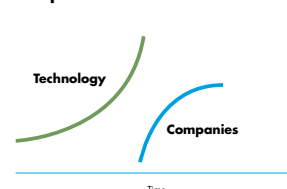
Average lifespan of companies is decreasing

Energy Transition



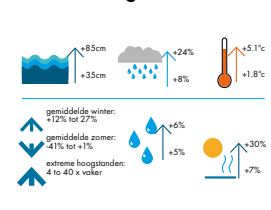
The energy transition is already happening: global investments in sustainable energy since 2014 now exceeds that in fossil energy

Technology changes faster than companies



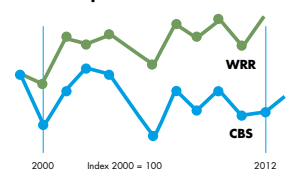
Technology changes exponentially; companies change logarithmically

Climate change: 1990 to 2100



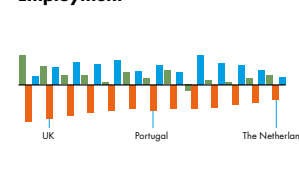
Climate change causes structural stress in Netherlands

Rich and poor



Power unequal in Netherlands is growing : the richest 2 percent owns a third of all assets in Netherlands

Employment



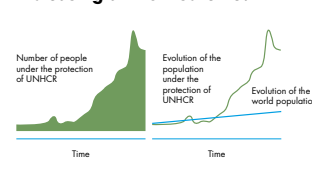
Technology has the greatest negative impact on middle groups, undermining social stability

Open Economy



The Netherlands has a very open economy, with Rotterdam being even more open; it is quickly exposed to global changes

Increasing air flow scheme?



Global dynamics leads to ever greater numbers of refugees, which also leads to increased tensions between cultures



includes an enormous port and industrial area within its municipal boundaries; it has a diverse and growing population, and is part of one of the most open economies in the world. Rotterdam is therefore exposed to a variety of global, regional and local transition processes, which means that resilience is particularly important to Rotterdam.

By looking at the city through the lens of resilience, we can ensure that Rotterdam is ready for the risks and opportunities of the future. And that the city will not be overwhelmed by major events. If the worst were to happen, Rotterdam could continue to function, recover rapidly and ultimately become stronger. At the same time, Rotterdam knows how to use this strength in the right way to ensure the development of the city, its citizens and its businesses.

The future belongs to those cities that learn to develop their resilience. And that applies to Rotterdam too!

“CITIES THAT HAVE CONSIDERED THEIR RESILIENCE IN A HOLISTIC WAY WILL BE BETTER PREPARED FOR THE FUTURE.”

1.2 ROTTERDAM AND THE 100 RESILIENT CITIES PROGRAMME.

Since 2014, Rotterdam has been a participant in the prestigious 100 Resilient Cities programme (100RC), initiated by the Rockefeller Foundation (RFF). The programme helps hundreds of cities around the world to become more resilient. The RFF has already set aside more than \$170 million for this purpose.

as an innovative delta city that is ready for the future. Additionally, Rotterdam's participation in 100RC strengthens the Cleantech economic cluster. Partners from Rotterdam have come together to form the Rotterdam Centre for Resilient Delta Cities (RDC). The RDC is already working on resilience issues in all kinds of world cities. Companies such as Deltares, Arcadis and TNO

The member cities of the 100 Resilient Cities Network receive various forms of support in order to promote their resilience.

1. Financial and practical assistance for appointing a Chief Resilience Officer;
2. Expertise in the process of achieving a solid strategy on resilience. Rotterdam has received support with the development of its strategy from 100RC partner AECOM and 100RC advisers.
3. Access to solutions, service providers, partners and NGOs. Rotterdam is supported by Microsoft. We have also been working with TNO, which will soon become a 100RC partner.
4. Being part of a network of world cities that learn from one another and support one another. Rotterdam's strategy has been reinforced by various forms of knowledge sharing, including a city exchange organized by the City of Rotterdam.

The ambition of 100RC is not only to make cities more resilient, but also to bring this approach to the attention of civil society organizations, businesses and citizens in the participating countries. In this way, the programme could eventually reach hundreds more cities, thus contributing to resilience at the global level.

So far, Rotterdam is the only Dutch city in the 100RC programme. We are already working with other cities in the field of resilience at the regional, national and even European levels.

Participation in the 100RC programme provides support for Rotterdam as it develops an effective resilience strategy. Membership also reinforces Rotterdam's image

are involved as 100RC partners in cities in Denmark, India and the United States. Finally, thanks to 100RC, Rotterdam is expanding its knowledge base in the field of resilient cities. We have already secured two European grants worth over €3 million in order to work on new projects that will help to improve the resilience of our city.

100 Resilient Cities – Pioneered by the Rockefeller Foundation (100RC) is dedicated to helping cities around the world become more resilient to the physical, social and economic challenges that are a growing part of the 21st century. 100RC supports the adoption and incorporation of a view of resilience that includes not just the shocks – earthquakes, fires, floods, etc. – but also the stresses that weaken the fabric of a city on a day to day or cyclical basis.



1.3 WHAT IS RESILIENCE?

The notion of resilience refers to the characteristic of being able to withstand shocks or setbacks. Within 100RC, resilience is defined as the ability of people, communities, organizations, businesses and systems to survive, adapt and grow, regardless of long-term tensions and crises of all kinds and varying magnitudes. Rotterdam’s strategy is based on both of these views of resilience.

We aim to build resilience by working consistently on seven essential aspects of the urban environment: people, communities, organizations, neighbourhoods, projects and systems.

Looking at Rotterdam in terms of these seven aspects, it seems that in many ways the city is already building up its resilience. But it is also clear that more work is needed. At the physical, social and organizational levels, our city is robust: we are already pretty strong. But resilience also involves a city that is flexible and agile, and this requires a more integrated approach to the issues that we face and an increased capacity for learning.

“ROTTERDAM IS ROBUST: WE CAN HANDLE ADVERSITY.”

1B. SEVEN QUALITIES OF RESILIENCE



REFLECTIVE
using past experience to inform future decisions



RESOURCEFUL
recognizing alternative ways to use resources



ROBUST
well-conceived, constructed, and managed systems



REDUNDANT
spare capacity purposively created to accommodate disruption



FLEXIBLE
willingness and ability to adopt alternative strategies in response to changing circumstances



INCLUSIVE
prioritize broad consultation to create a sense of shared ownership in decision making



INTEGRATED
bring together a range of distinct systems and institutions



1.4 A RESILIENCE STRATEGY – LINKED TO THE STORY OF THE CITY.

The city of Rotterdam is only too aware of the impact that traumatic international or social events can have on urban transition. This is why that the city is already engaged in a number of strategic projects with urban and regional partners that look at how we can best respond to this reality, where we want to go as a city, and which strategy and which challenges this is likely to throw up.

- In the social domain, the social and economic position of Rotterdam and its inhabitants are key;
- The Next Economy Road Map involves looking at the regional business case from the perspective of the third industrial revolution;
- The Map of the City project takes a spatial-economic perspective;

- In the Investment Capital project, the city focuses on the (financing of the) investment that is needed.

The Story of the City is about bringing all these projects and aspects together and helping us to focus on our shared goals. The Story provides an integrated perspective for the long-term future, helping to identify and make sense of the changes and developments that are affecting our city. It is also an expression of the type of city that Rotterdam aspires to be and how our ambitions can be achieved. The Story of the City is a compact, flexible and adaptable resource, which is periodically updated so that we can respond quickly to new developments.¹

The Story of the City (in development) argues that resilience is one of the main qualities of Rotterdam 'as a city where the future is being created'.

The better and more quickly the various projects are able to anticipate and respond to developments in our environment, the stronger and more sustainable our city becomes, and the more opportunities the city can create for its inhabitants. It is vital to strengthen and build on the four future strategies on the basis of this view of resilience; this is an essential aspect of how we can achieve these ambitions.

In order to promote the desired ways of working and thinking, we have developed a resiliency strategy. The resilience strategy is not intended as a blueprint or final product, but as an initial starting point from which we can move forward. The aim is:

- to specify which activities, projects and programmes contribute to urban resilience;
- to establish how we can connect and strengthen the existing instruments;
- to determine how we can continue to build on the resilience of Rotterdam through a limited number of new and additional activities.

Above all, it is about taking the concept of resilience forward using all the aspects of resilience that we have described, and incorporating this into the everyday activities of the city's residents – the people of Rotterdam, its organizations and businesses, and public bodies.

THE STORY OF THE CITY AND THE RESILIENCE STRATEGY ARE COMPLEMENTARY

This means that the seven aspects of resilience that we have described (the capacity for reflection, resourcefulness, robustness, responsiveness, flexibility, inclusivity and an integrated approach) make up part of this strategy and are crucial to putting the resilience strategy into practice. This process will occur within the structure of the six focus areas: social cohesion and education, energy, climate adaptation, cyber, vital infrastructure and governance.

The Story of the City (and the four strategic projects that we have mentioned) and the resilience strategy complement one another. The Story of the City is about what kind of city Rotterdam wishes to be in the future, so that we can take full advantage of the opportunities that present themselves. The Resilience Strategy describes the way in which we, as a city, plan to remain robust and resilient, with a view to achieving the objectives of the Story of the City and the related policy programmes.

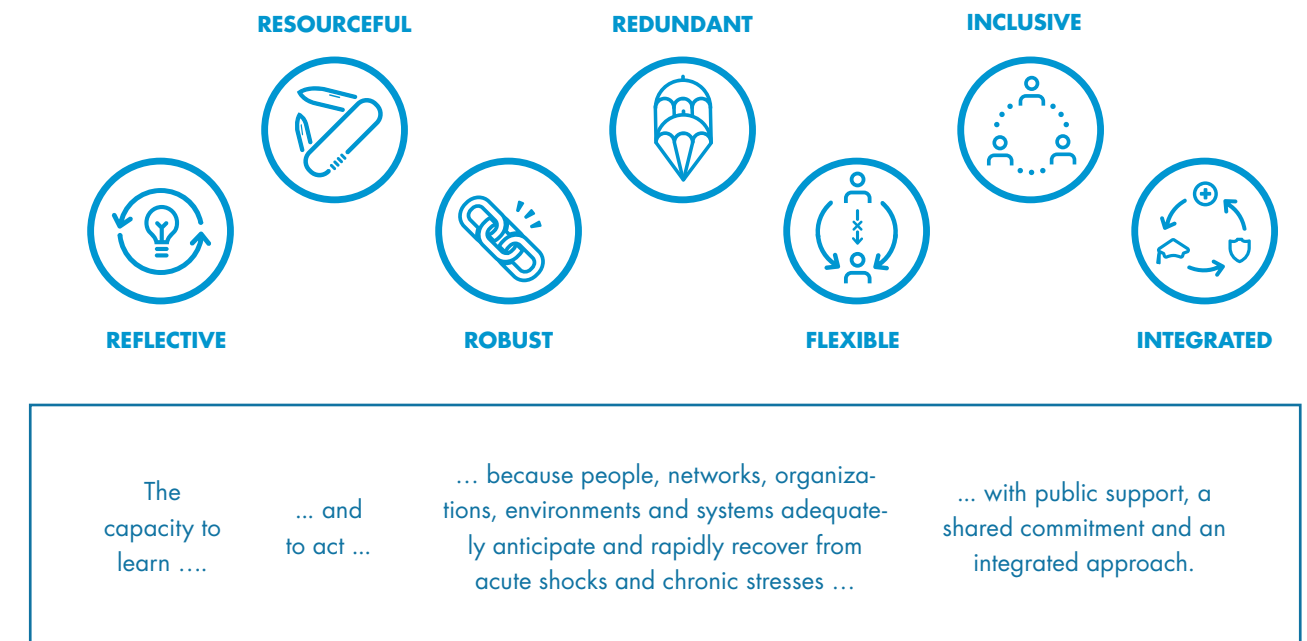


1C. THE STORY OF THE CITY



¹. When the resilience strategy was published, the Story of the City was still under development.

1D. ROTTERDAM'S RESILIENCE



2. 'SELFIES' OF ROTTERDAM.

RESILIENT CITIES NEED TO LOOK BACK TO THE PAST AS WELL AS FORWARD TO THE FUTURE. THIS DOUBLE PERSPECTIVE IS PART OF THEIR CAPACITY FOR LEARNING. THIS IS WHY ROTTERDAM IS LOOKING BACK TO ITS PAST TO LEARN FROM THE RESILIENCE THAT IS IN THE CITY'S DNA. WE WILL ALSO LOOK AT THE CHALLENGES AND DEVELOPMENTS OF THE PRESENT DAY. ADDITIONALLY, LOOKING FORWARDS TO WHERE WE WANT TO BE IN 2030 AND FROM THERE BACK TO THE PRESENT REVEALS HOW WE HAVE TACKLED THE PRESENT CHALLENGES AND DEVELOPMENTS, HOW WE HAVE RESPONDED TO THEM, AND HOW ROTTERDAM HAS DEVELOPED IN THE INTERIM YEARS.

- The population of Rotterdam includes over 175 different nationalities.
- The Port of Rotterdam is world-famous as Europe's largest port. Some 30,000 ships use the port every year.
- The Netherlands' four tallest buildings are all located in Rotterdam.
- Rotterdam is a pioneer in the Dutch urban farming. Green building façades and roofs already cover a total area of 185,000m² in the city.

2.1 ROTTERDAM THEN: 12TH-21ST CENTURY.



ROTTERDAM 12TH-21ST CENTURY

Around the year 1200, the first settlers built a dam over the river Rotte. Eight centuries later, the largest container ships in the world sail into the Rotterdam port with its entirely man-made complex of docks.

In large areas of the Netherlands, the land does not stay dry of its own accord. The Schieland District Water Board was first founded as early as 1273. From that moment onwards, the task of the water board was to manage water on behalf of the people who lived in the area: this makes it one of the world's oldest democratic institutions. Keeping the water at bay and removing excess water are clearly fundamental to the public interest because these activities have a major impact on all other aspects of society. The people who lived on the polders of thirteenth-century Holland did not have any choice about whether they worked together – they had to. In Dutch, this way of working even has its own

verb: 'polderen'. 'Polderen' means solving problems in an inclusive way: everyone gets to have a say, and it is not always the majority that automatically gets to decide. Minorities also have a voice, and their interests are also part of the decision-making process.

This historical context is what characterizes Rotterdam as a city – resourcefulness and innovation have enabled Rotterdam to become a unique place to live and work in a dynamic delta environment, where you are never far from water. Rotterdam is a city that has had to fight a battle against water every day of its existence; it has endured several severe flood events and it has successfully created ever more robust flood defences. And at the same time, the city has demonstrated its resourcefulness by managing to make water the basis of its primary economic activity. We have done this by creating a port of world stature, which serves as our city's primary economic motor. But another factor has been the endeavour to constantly find innovative ways to increase our redundancy by – literally – allowing more water into the city. And this is something that has also made the city more beautiful. The Port of Rotterdam has grown to become the largest transfer and storage point for fossil fuels in the world. But at the same time, the city is world famous as a specialist in climate change adaptation (climate resilience). The Netherlands has the third most developed infrastructure in the world (after the city states of Singapore and Hong Kong).

The growth of the port and the city is, not least, the result of a huge influx of people from all over the world to Rotterdam. At present, Rotterdam is home to residents from 175 different nationalities. What started with an influx of commuters from the surrounding villages was followed by migrants from Brabant, Belgium, Spain and North America, Eastern Europe, Eastern Asia and Southern Africa. Many came initially simply to work in the city, with the intention of returning home eventually, but many of them stayed and made the city their home.

They came because of work, but also because of the bonds of friendship or love. Rotterdam has thus shown itself to be a very flexible and inclusive city: there is a place for everyone. But the city has also had its share of sudden disruptions

and tensions in recent decades, and these have tested the city's resolve and resilience. How has Rotterdam responded? What has our city learned from these incidents, and how has this affected our resilience as an urban community?



ROTTERDAM AFTER THE SECOND WORLD WAR: THE RECONSTRUCTION IS IN FULL SWING

Perhaps the greatest sudden setback that ever to hit the City of Rotterdam was the hail of bombs that devastated the centre of Rotterdam on 14 May 1940. The bombing reduced 24,000 homes to ashes, killed 900 people and left 80,000 of the city's people without a home. The capacity of the Netherlands' military defences was reduced to zero at a stroke – within one day, the bombing led to the capitulation of the Netherlands, and the whole country was quickly occupied by the Germans. The buildings of central Rotterdam had not been built to withstand the bombs of the 20th century. But the people of Rotterdam and the Netherlands demonstrated their resilience and dealt with the cruel setbacks that were meted out to them: even as the German forces were moving in to take the city, work started on clearing the debris and plans were drawn up for reconstruction as early as 1940. Even under the difficult circumstances of the occupation, the people of Rotterdam never gave up, surviving as well as they could and even starting to rebuild their future.

The city's reconstruction – a process which is actually still going on today – has been characterized by flexibility and resourcefulness, creating an innovative new city centre,

the first in the Netherlands that is fully pedestrianized. A selection of innovative modern architects was invited to design and construct attractive and appealing new buildings and neighbourhoods in the city. What was, for a while, a cold and empty space at the heart of the city has now been transformed into an inclusive 'City Lounge'. In 2015, Rotterdam was voted the best city centre of the Netherlands! Rotterdam's philosophy has always been 'Actions speak louder than words'. Perhaps, at times, this has symbolized a certain lack of reflection and intellectual capital. Somehow, inclusiveness and integrity were overlooked, because over the course of time a sharp division was allowed to develop within the city. There was Rotterdam Noord to the north of the river, home to the city's well-to-do bourgeoisie; and there was Rotterdam Zuid, to the south of the river, with a large population of recent immigrants and working class communities.

The City set up the National Programme for Rotterdam Zuid to ensure that all the city's stakeholders would be included. As a result, Rotterdam Zuid has gradually been catching up with the rest of the city.

2. 'SELFIES' OF ROTTERDAM



ROTTERDAM AND WATER: FROM THREAT TO OPPORTUNITY.

Rotterdam lies largely below sea level, right at the heart of the river delta around which the Netherlands is based. The city is directly connected with three major rivers and is located right on the coast. It receives an above average amount of rainfall and also suffers from subsidence issues. Rotterdam has had no choice – it has had to learn to cope with and manage water out of necessity. Since the year 2000, Rotterdam has been working on this continuously through the Rotterdam Climate-Proof Programme (RCP). This programme has carried out its work in conjunction with the national Delta Programme.

Rotterdam's ever-abundant rainfall means that there is very little redundancy to accommodate any additional water. More and more frequently, we see flooding in Rotterdam's streets, open spaces and tunnels after heavy downpours. It is these same West European changing rainfall patterns that have also led to the prospect of our flood dikes being flooded more frequently. Both of these issues have been tackled in a resourceful manner. Buildings are being

equipped with water collection facilities, and open areas are being designed more flexibly so that, depending on the weather conditions, they can serve either as playgrounds for children or as water collection points. Together with neighbouring countries, the 'Space for the River' programme has been launched, helping to cope with fluctuations in the water discharge by the rivers and accommodate these more effectively. The functions of water technology have also been approached in a more integrated manner. For example, head dikes have been reinforced and combined with shopping malls, parks and parking garages. The innovative way in which ground water levels are now subject to constant monitoring demonstrates a capacity for reflection, as does the scenario planning for climate change that is currently underway. Increasingly, the inclusion of citizens, companies, universities and schools is being used to help us think about and take action on improving Rotterdam's approach to climate adaptation, which is already internationally renowned.

THE PORT AND THE CITY ARE WORKING TO ACCELERATE THE ENERGY TRANSITION.

The Port of Rotterdam is still one of the biggest fossil fuel hubs in the world. It also remains Europe's largest logistics centre by far. Indeed, in recent decades the port has formed one of the most robust motors for the regional economy and for the Dutch economy as a whole. However, this situation cannot be taken for granted, because it is rapidly changing. In December 2015, all the countries in the world unanimously agreed the Treaty of Paris, which states that climate change requires an accelerated transition to renewable forms of energy. This represents a significant challenge for the redundancy for the Port of Rotterdam: the activities of most of its current major customers are based on fossil fuels, and they continue to invest in this field. If we are to learn lessons from other cities that have been overly dependent on one particular type of industry, we will see that we must look seriously at the need for a transition

process.

As such, the Port Authority, the Metropolitan Region of Rotterdam and The Hague, and the national government are seeking to take advantage of new market opportunities in a flexible and resourceful manner (as part of the Next Economy Road Map). We are determined to maintain a strong competitive position in both energy production and energy transshipment.

Although the Port of Rotterdam is owned 70% by the City of Rotterdam and 30% by the national government, we must continue to look at the whole system in an integrated way: the port, city and region all need each other. Essential elements in this view are the development of the port area as a district for innovation and the transition to a sustainable energy mix in both Rotterdam and its port.



2.2 ROTTERDAM NOW: THE 21ST-CENTURY TRANSITIONS.



ROTTERDAM 21ST CENTURY

The 21st century is an era of change, but it is also a change of era, says Herman Verhagen in 'The Sustainability Revolution'. In his recent book 'Change of Era - the Netherlands at the Tipping Point', Rotterdam Professor Jan Rotmans explains that this change has three primary characteristics:

- **Society** is undergoing a transition away from a vertically organized, centrally managed, top-down society towards a horizontal, decentralized, bottom-up structure. Existing institutions and organizations are being replaced by communities, cooperatives and social and physical networks.
- **The economy** is shifting from a centralized, linear, analogue structure to a decentralized, networked, circular, sustainable and digital model. New technologies can be applied in a decentralized manner to provide the products and services that our societies need.
- **Power structures** are also shifting. Power can be defined as the ability to mobilize resources for a particular purpose. The new bottom-up order is, slowly but surely, leading to new structures, because

an abundance of knowledge and information is becoming available to networks and communities. That means a transfer of power away from large bureaucratic organizations and towards people who are able to organize themselves from the bottom up in the form of networks and communities.

Rotterdam is an extremely open city in all senses – physically, economically and socially. The city is open to all forms of water (rain, rivers and the sea, all of which are affected by climatic change); it is open to all kinds economic developments (global trade and commodity flows, energy, and financial shocks); it is open to many different social dynamics (all kinds of people live and work here, changing forms of social interaction, different cultures and religions); and it is open to changes in power structures, because it is located within an open and free democratic system (changing voting patterns that reflect the popular mood, concerns and aspirations).

All of this means that our city is right at the heart of the dynamic process of an entirely new industrial revolution: two simultaneous and fundamental shifts are underway in how we, as a society, manage our energy requirements (the transition from fossil fuels to sustainable energy sources) and manage information (the transition from analogue to digital). People, companies and governments are searching for new economic models, new models for cooperation, new patterns of behaving and responding. This type of transition process may take place over an extended period of time and become the cause of stresses that progressively become more intense (such as climate change, or cyber threats). It is also conceivable that abrupt events may occur unexpectedly and create disruption in (sections of) society or the urban community ('shocks' such as flood events or cyber-attacks). It is also possible that 'stress' may ultimately degenerate into a 'shock' (for example, the drying out of soil can cause a dike to break).

Working with a wide range of stakeholder partners, Rotterdam has analysed which of these transitions, which

are often global in nature, are essential to our city and are also occurring simultaneously and in an interconnected manner:

1. The economy of the 21st century ('next economy')

Simultaneous transitions from fossil fuels to renewable forms of energy, from analogue to digital, and from a linear extractive economic model to a circular sustainable model.

2. Climate change

Rising sea levels, more frequent and more intense rainfall, unpredictable river flow volumes, subsidence and heat stress.

3. Digitization

Technological progress and development are now occurring at an exponential rate, characterized by the Internet of Things, the Smart City, and big data. This presents us with plenty of opportunities, but also increasing levels of dependency and vulnerability in the field of security and privacy.

4. New democracy

Individualization, assertive citizens and consumers, an increasing degree of self-organization, the emergence of the 'prosumer' (people who are simultaneously consumers and producers), better information, new roles for government and utility services.

5. Unknown developments

However much we try to prepare for the future, often the unexpected happens and things turn out quite differently to what was anticipated. The ability to deal with the unexpected requires the ultimate form of resilience.

Recent events in Paris and Brussels are still fresh in our memory. How to handle threats of this nature is also an aspect of resilience, and we will discuss this more fully in section 3.2. under the theme of the WE-Society.

Resilience includes the ability to deal with both known and unknown threats and transitions, as well as the ability to turn stress and shocks into opportunities that Rotterdam can prepare for.

2A. ROTTERDAMS' TRANSITIONS



2.3 ROTTERDAM TOMORROW: A RESILIENT FUTURE SCENARIO.



ROTTERDAM 2030?

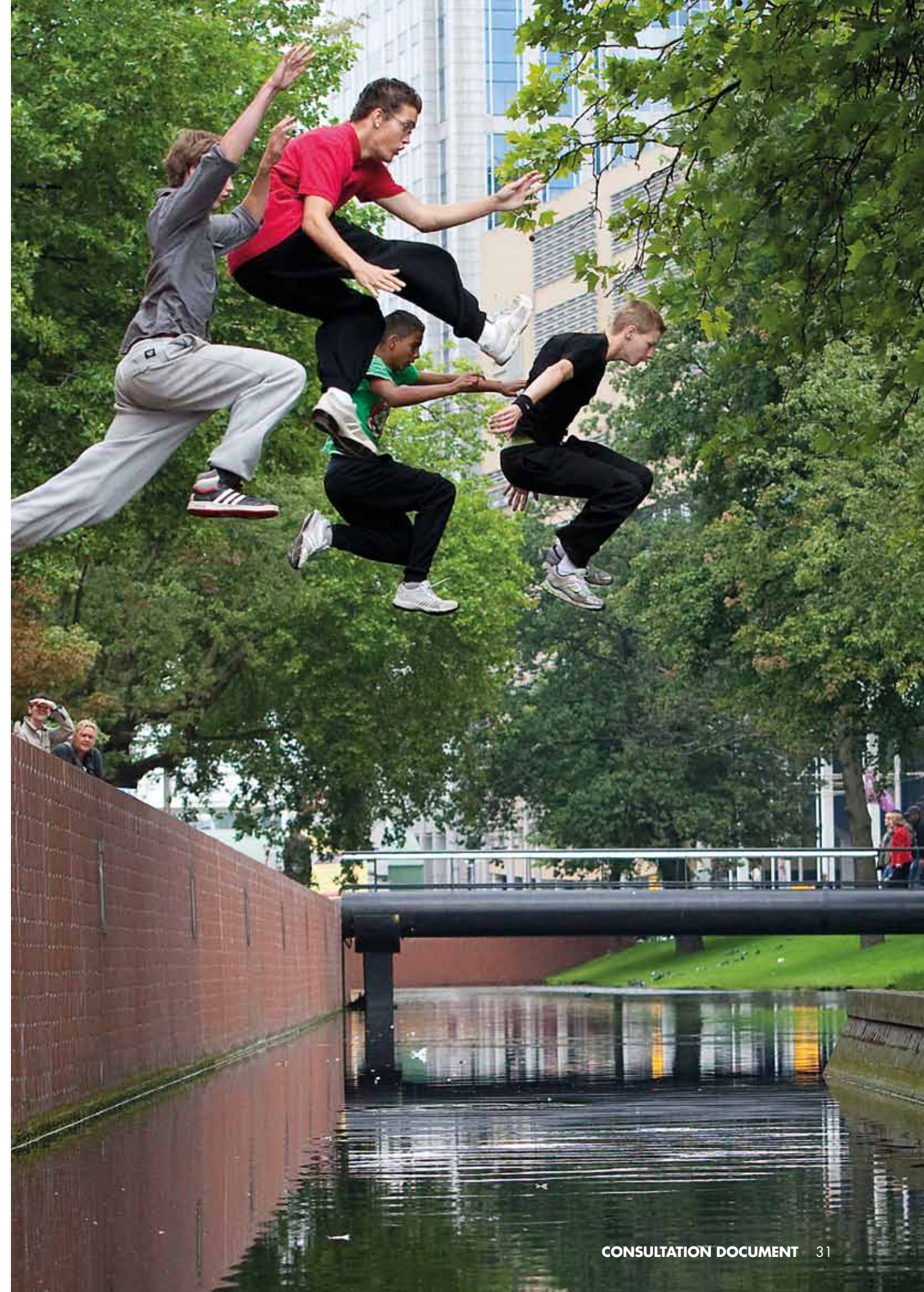
Where should we begin telling the story of our city, now in 2030? There have been so many changes, and so much turbulence. It is fairly easy to conclude that – just like during the total period from 1200 until the 21st century – people, climate, water, energy and logistics have all played a crucial role in the changes that have occurred. But of course, their roles have been very different to the roles that they played in the 21st century. The exponential nature of technological developments has radically changed the way in which we deal with change.

In 2016, Rotterdam was already, in a way, the water capital of the world. It's just that we did not see that at the time. But it is actually embedded in the genes of the people of Rotterdam. The irony is that the climate crises actually turned out to be tremendous opportunities

for Rotterdam. Precisely because they posed a really fundamental challenge to our city. Rotterdam's centuries old capacity for reflection and knowledge about living in a river delta was a vital survival tool during the period when the sea level began to rise steadily, rain and river flow patterns became more extreme, and the ground began to sink ever deeper. Rotterdam's climate adaptation strategy proved to be a unique tool that has grown into a fully-fledged and robust sector of the city's economy in recent decades. Whereas Rotterdam once flourished as a centre for offshore activities, it is now the epicentre of the 'water-shore' sector. We can take pride in a rich ecosystem of companies, institutions, events, infrastructure, maker spaces, institutions and public resilience programmes, and the city's resourcefulness and integrated approach mean that the city stands out from the rest. Rotterdam receives consultancy projects from cities and countries around the world who need support with the introduction of customized local and regional water-shoring and water adaptation programmes. And all because we have developed and applied so many new techniques and methods successfully ourselves, in order to ensure that our own city continues to thrive.

What started with floating pavilions, water plazas, water storage in car parks, green roofs, tidal parks and floating forests has developed into floating streets, underwater cycle lanes, water-based energy storage and energy generation from waste water, urban ecosystems that respond automatically to rainfall, and much more. It was the World Expo in 2025 that put Rotterdam well and truly on the map.

In the field of energy, too, Rotterdam has really made a difference. The city's new energy strategy meant that it said farewell to its previous dependence on fossil fuels and opted for innovations based entirely on clean fuels and the circular economy. Between 2016 and 2030, Rotterdam made steady progress on implementing a networked, fully efficient and sustainable energy



2. 'SELFIES' OF ROTTERDAM

infrastructure with optimum redundancy and flexibility built using a plethora of innovative techniques and technologies. This includes the large-scale energy storage of energy in salt in the port area and in the batteries of permanently self-driving vehicles, which have also become a new layer of transportation for the city's residents. This new infrastructure ensures that each local source of energy and each local energy surplus can be used to optimum benefit. We have created an inclusive and integrated city. The port has successfully abandoned its reliance on the supply, storage and processing of fossil fuels. In its place, it has set out along a new path – converting, storing and using a variety of renewable energy forms (such as geothermal energy, residual heat, wind power, solar power, biomass and hydrogen) for the benefit of a wide range of customers. The essence of the robustness of Rotterdam's energy network lies in its networked structure: the large-scale loss of energy is virtually impossible, and any localized outages can quickly be compensated using local power nodes. The logistics activities that once involved bulk liquids (oil), bulk solids (mainly coal) and general cargo have been rendered largely obsolete by the rapid development of 3D printing; these activities have been superseded by the much more efficient circular materials infrastructure that is known as micro-infomufacturing. Each residential unit is now a small production unit where, using advanced 3D printing, people can be self-sufficient in terms of food, medicines and complex technological products. The supply of basic materials needed for these techniques has been innovatively arranged using sections of the old but optimally networked sewerage network. This network, and the associated multi-channel infrastructure, is used to transport the materials required to and from where they need to be. This has been developed in parallel with the Internet of Things, creating a physical logistics network through which specific materials are transported and exchanged. The production of hydrogen fuel for use in aircraft, among other things, takes place in the port area using wind energy. Residual heat is distributed for use in industry, horticulture and the built environment. The long-term coordination and security of supply for all the city's infrastructure networks are achieved through smart and integrated combinations of engineering, mathematics, algorithms, economics, regulation, legislation and prosumer activity. But possibly the most important factor has been inclusivity: the networked structures that make up much of the city's infrastructure have found their counterpart in civil society organizations. The number of cooperatives in Rotterdam now doubles every three years. These civic initiatives focus on all the

ROTTERDAM AIMS TO BECOME EUROPE'S MOST INNOVATIVE LEARNING CITY.

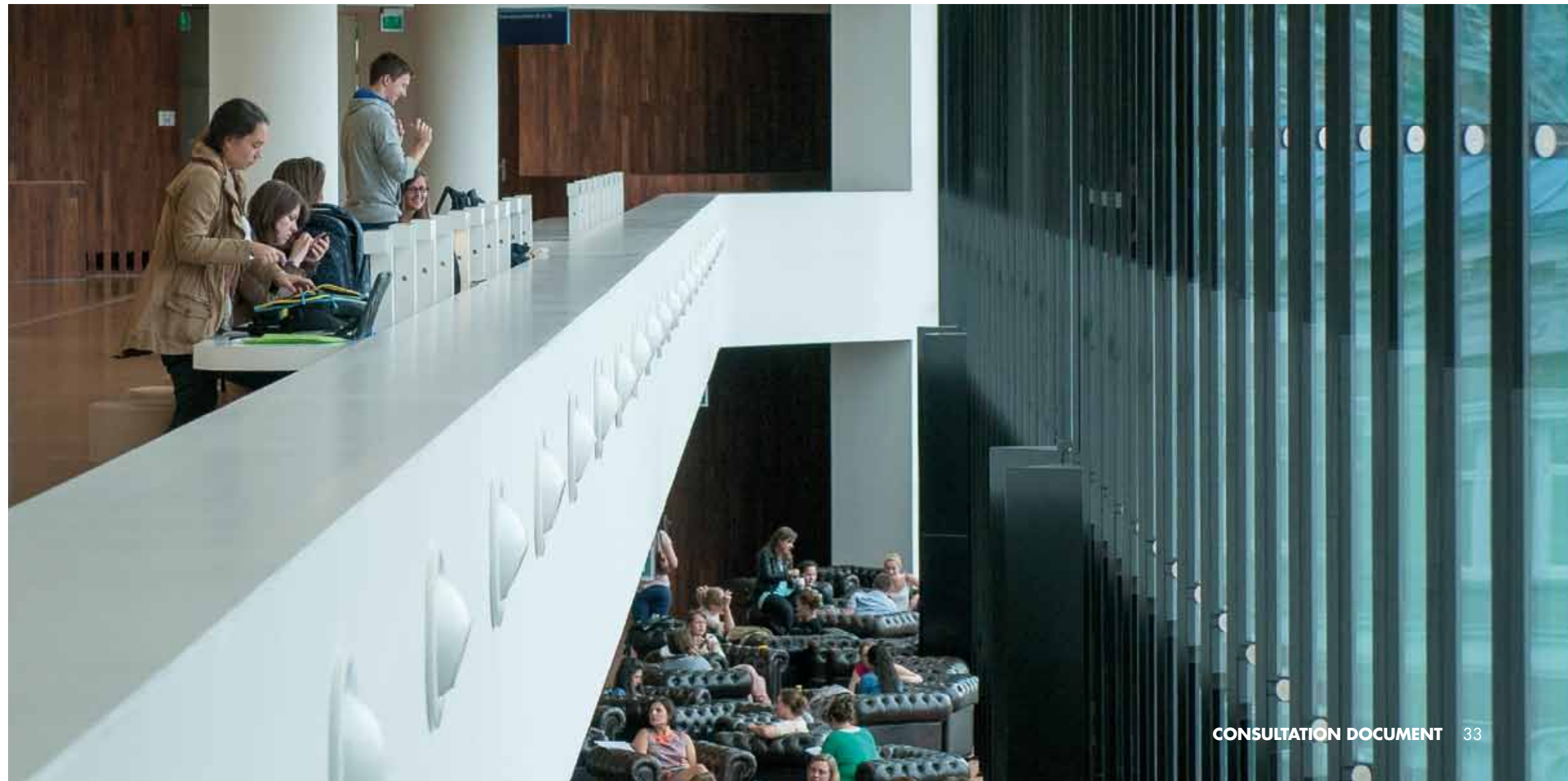
activities that create social value: the production of protein from the by-products of all kinds of processes, energy, water cycles, healthcare, sports, and education. There has also been a fundamental change in providing the investment needed for large-scale centralized infrastructure projects, such as pumping stations, sewage systems and lighting systems. This is because large-scale investment projects take a long time to pay for themselves, but technological progress is now so fast that any new technology becomes obsolete within five years. Although large-scale investment remains necessary

at times, many more tailored service contracts are now drawn up with suppliers. For example, suppliers provide lighting on the basis of a Service Level Agreement that promotes circularity and innovation rather than on the basis of bulbs and fittings that need replacing after a certain number of hours of usage. This incentivizes suppliers to provide lighting in the most efficient and economical way possible. It also helps the city's cash flow because it receives annual subscription fees for these services, reducing the need for asset investment. All this has led to enormous savings on the costs of materials and energy.

In 2030, Rotterdam is a vital city with visibly vital and healthy citizens. It's still a city where you can grow up healthy and happy, and where you can live, work and grow old. It is, above all, a dynamic city where talent, initiative and entrepreneurship are important for everyone, of all ages. People who do work for their neighbourhood in the informal economy are valued and help make the city resilient. Healthcare is managed

locally: the city's districts manage their own health affairs. Residents and professionals know what is important to each another when it comes to health, and the things they want to achieve together. A healthy lifestyle is the obvious choice. Healthcare has penetrated the digital sphere and vice versa. The neighbourhood is attractive, mobility-friendly and full of green spaces and inviting meeting places. The air is clean. People look after each other and find their own ways to care for and support one another. The residents of Rotterdam are resilient and are able to count on receiving the care that they need – from each other and from the municipality. There is a social safety net, where that is needed. But the dividing lines between the healthcare, welfare and social support have disappeared. Preventative care is now an integral aspect of welfare and healthcare services.

Finally, in 2030, Rotterdam was named as the most innovative learning city in Europe. The city's motto for this programme is: 'Live like it's your last day. Learn as if you still have a whole life ahead of you'.



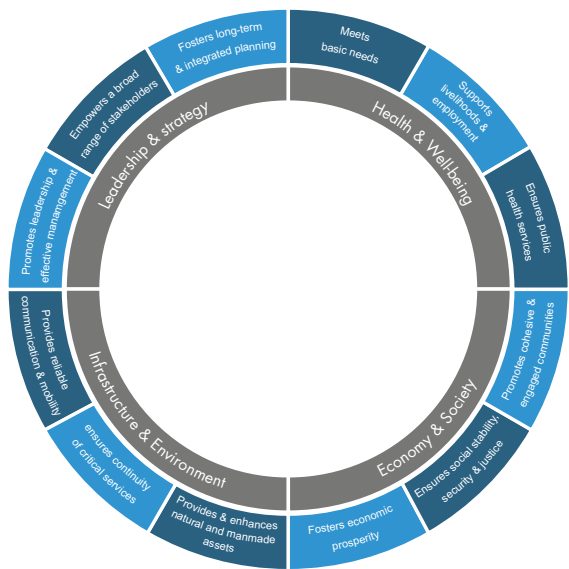
2.4 THE RESILIENCE STRATEGY – MOVEMENT TOWARDS A FUTURE-PROOF CITY.

Prior to establishing a resilience strategy, a number of steps need to be taken according to the methodology developed by the 100RC programme. These steps are outlined below, the first three of which are set out in the Preliminary Resilience Assessment (PRA).

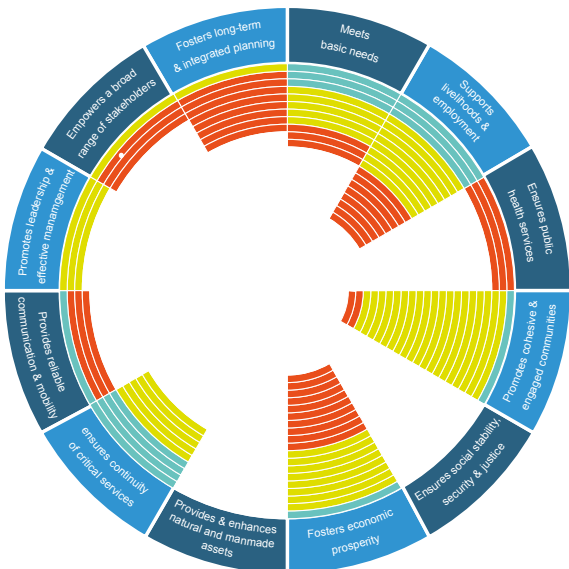
1. An assessment of the current situation, using a list of the main fields of activity in the city as a framework, as shown in the City Resilience Framework wheel.

2B. METHODOLOGY: THE CITY RESILIENCE FRAMEWORK

City Resilience Framework (figure A).

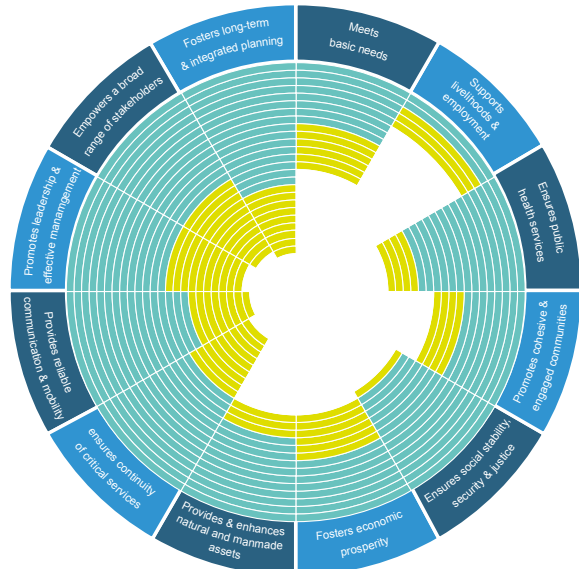


Resilience status perception (figure B).



● Area of strength
● Doing well, but can improve
● Need to do better

General inventory of actions contributing to resilience (figure C).



● Actions' primary impact
● Actions' secondary impact

An assessment of the current situation, using the overview of the 12 most important aspects of the city as a system, as shown in the City Resilience Framework wheel (fig A). A first rough inventory of actions and programs contributing to these aspects showed us the richness of initiatives in Rotterdam contributing to resilience (fig B). Yet, this does not match the professional's perception on the state of resilience (fig C.)



2. 'SELFIES' OF ROTTERDAM

2. Review the main developments

- (see section 2.2).
- The economy of the 21st century (next economy)
 - Climate change
 - Digitization
 - New democracy
 - Unknown developments

3. Defining the focus areas.

- Social cohesion and education
- Energy
- Climate adaptation
- Cyber
- Vital infrastructure
- Governance

4. Define the resilience goals.

On the basis of the seven aspects of resilience (the resilience lens, see section 1.3), these focus areas have been translated into resilience goals that represent what resilience means in each area.

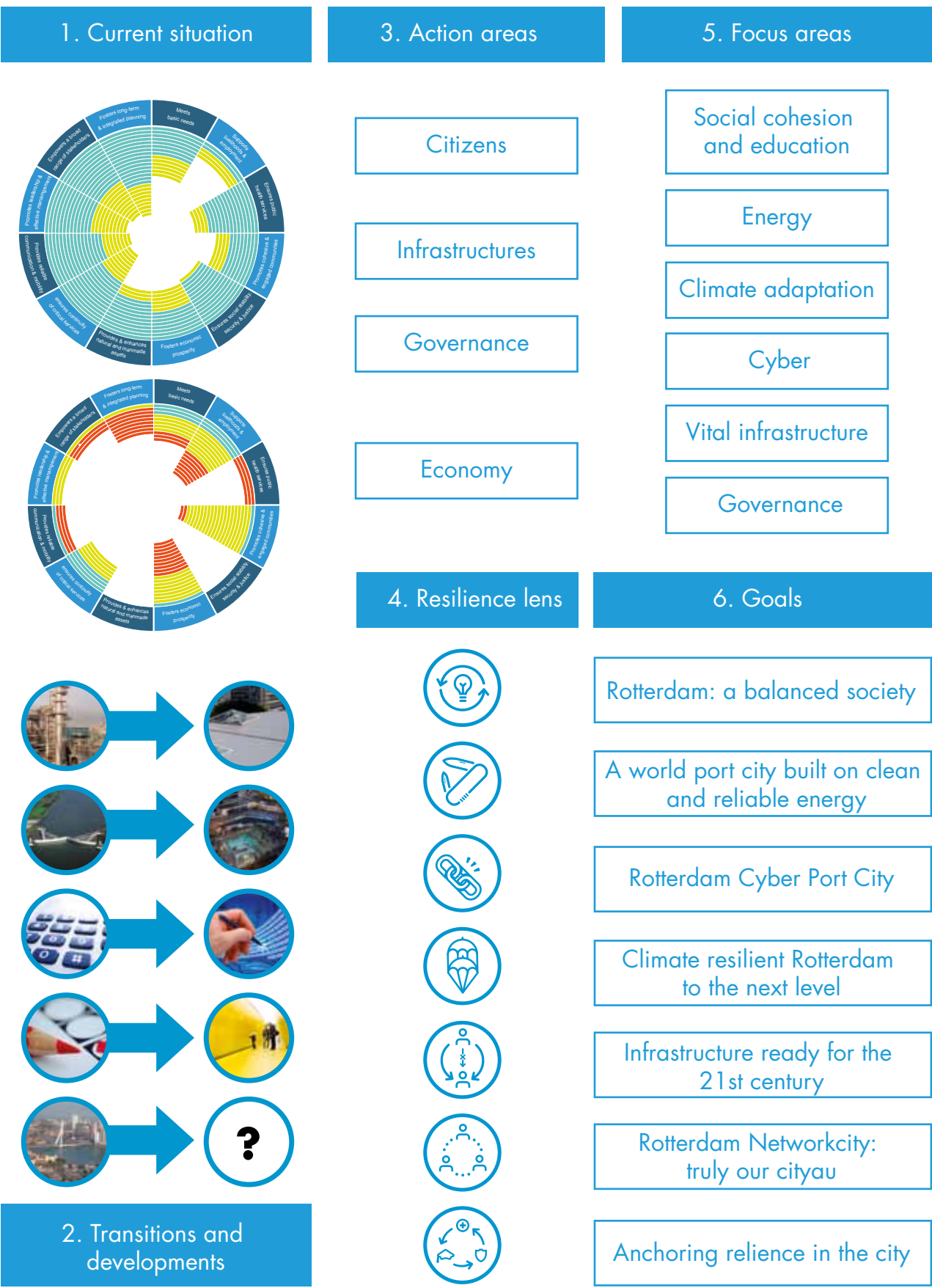
5. Identifying actions

The challenge is to apply resilience thinking in practice. We have identified a number of case projects (flywheel actions and related actions) that will contribute significantly to the resilience of our city. On the one hand, these cases can help to prevent the changes that we are undergoing from leading to a crisis over time. On the other hand, they create opportunities by responding appropriately to developments. A good example of this is the increasing amount of excess water that the city has to cope with, which was once seen as a nuisance and a threat (in terms of urban development), while today this is seen as an opportunity to make the city more attractive.

THE STRATEGY IN BRIEF: FROM ROBUST TO RESILIENT.



2C. THE RESILIENCE PROCESS



3. VISION AND GOALS.

ROTTERDAM WANTS ITS RESILIENCE STRATEGY TO EMBED THE RESILIENCE PHILOSOPHY MORE FIRMLY AND SYSTEMATICALLY IN ALL ITS WORDS AND DEEDS. IN ORDER TO SET THIS CHANGE IN MOTION, CHALLENGES, OPPORTUNITIES AND ACTION HAVE BEEN IDENTIFIED FOR EACH OF THE SEVEN RESILIENCE AMBITIONS.



3.1 VISION.

Everything's going swimmingly in Rotterdam! After many years of wrong turns and dead ends (for example, in the field of security and social cohesion), progress is now evident. Seventy-five years after the bombing of Rotterdam, the city is celebrating its election as the best city centre in the Netherlands. The city is much safer than it once was, and according to European research its residents are happier than those of other major cities. The city is now home to even more architecturally iconic buildings and rates highly in international travel guides. Rotterdam is the place to be!

Although we have made real progress, the effects of the socio-economic crisis are still being felt. The number of residents receiving social support continues to grow, even though the economy is picking up. And new challenges are emerging. As an international city with a world famous port, Rotterdam has more economic connections with the rest of the world than any other Dutch city, and is therefore more vulnerable to global changes and shocks. But the city, its people and its urban community are continuing to develop. More and more new initiatives are now underway and people are buzzing with ideas. They see opportunities and they want to take those opportunities, whether they are in the field of generating energy, including solar energy, making the city's streets greener or organizing social activities. Rotterdam is blessed with a very energetic community!

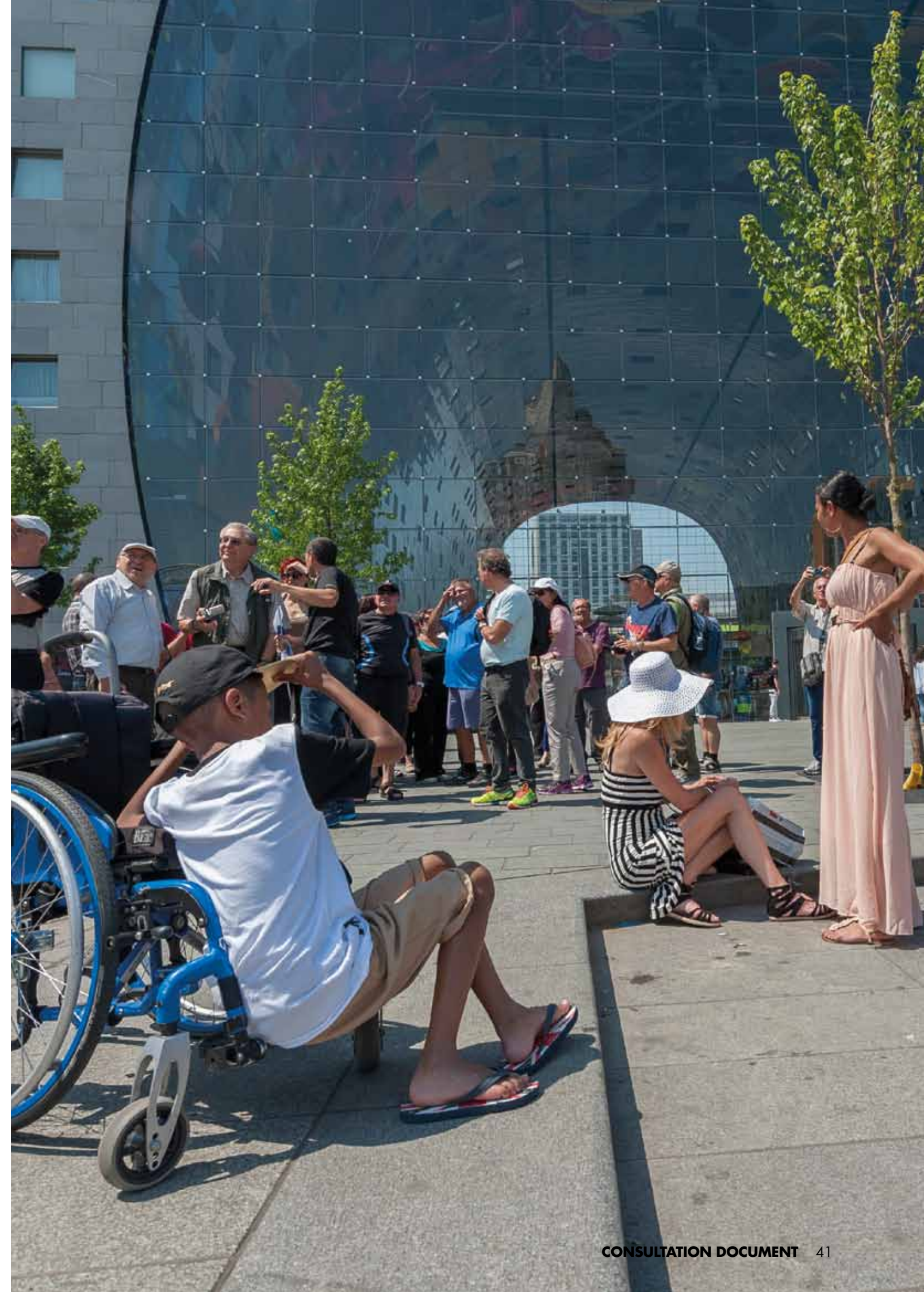
In the past, the development of the city was characterized mainly by large-scale interventions such as the development of the port area, the expansion of residential and employment districts, and the creation and strengthening of robust flood defences. Well-organized government and public institutions have ensured a reliable supply of energy, housing, water and public services. The city, its community and facilities have all grown up under the welfare state. This way of doing things has brought Rotterdam and the Netherlands a long way. Our strength is based primarily on being robust, well-organized and efficient.

But now, at the beginning of the 21st century, we are seeing a number of long-term trends, some of which are occurring at an exponential rate. Many transitions and changes are underway, such as the digitization of society and climate change. And changes are also occurring in the fundamental social and democratic relationships between citizens, businesses and governments. The risk of further crises is real, even if we cannot predict when or if they will happen. True to character, Rotterdam stands ready to deal with whatever the world might throw at it – to roll up its sleeves and do what needs to be done.

The reconstruction of our city and our climate adaptation strategy make this clear for the world to see, as do programmes such as the National Programme for Rotterdam Zuid (NPRZ). This is why we are confident that Rotterdam can adapt to these changing circumstances. We will do this not only by building up our defences, by becoming stronger and making our plans even smarter – but also by becoming more flexible, by building in additional capacity, and by drawing on our reserves of creativity and resourcefulness. But above all, we can do it by working together, applying the knowledge and energy of the community, allowing new ideas to emerge, allowing space for people with initiative, and ensuring that the city's networks are interconnected. This will be our new source of strength: resilience!

Building a resilient city will demand an open mind and new ways of thinking. We will need the courage to think in terms of alternatives and fall-back scenarios – to make connections and balance short-term results against longer-term goals. Building a resilient city means built-in flexibility, freeing up funds, thinking beyond our own interests, and looking at the real questions that we face as a city, rather than just settling for the solutions that are already available.

This is no easy way of working, and at times it may be difficult to see its value, especially when we are already so well-organized, efficient and – apparently – in control



3. VISION AND GOALS


of everything. It will be a learning process; it will involve trial and error.

In Rotterdam, we have always had the courage to experiment, and making mistakes is fine, provided that we learn from them. That is how we can build the future of our city. At the end of the previous section, we identified a number of domains in which Rotterdam needs to build its resilience.


On the basis of these challenges, we have formulated the following vision by way of a summary. Our vision for Rotterdam in 2030 is a city where:

- strong citizens respect each other and are continuously developing themselves
- the energy infrastructure provides for an efficient and sustainable energy supply in port and city
- climate adaptation has penetrated into mainstream of city operations and water has added value for the city and our watermanagement system is cyberproof
- the underground is being used in such a way that it supports the growth and development of the city
- we have embraced digitization without making us dependant, and we have ensured a best practice level of cyber security
- self organization in the city gets enough room and a flexible local government supports if really needed
- resilience is part of our daily thinking and acting.


The above vision has been translated into the following goals for urban resilience:




1. Rotterdam: a balanced society




2. A world port city built on clean and reliable energy




3. Rotterdam Cyber Port City




4. Climate resilient Rotterdam to the next level



5. Infrastructure ready for the 21st century



6. Rotterdam Networkcity: truly our city



7. Anchoring resilience in the city

This also illustrates how these goals fit together and how it is possible to integrate them into the city as a whole and at the level of neighbourhoods, streets and individual buildings. Many questions remain that we would like to talk about with the city's stakeholders.

ROTTERDAM HAS THE COURAGE TO EXPERIMENT.

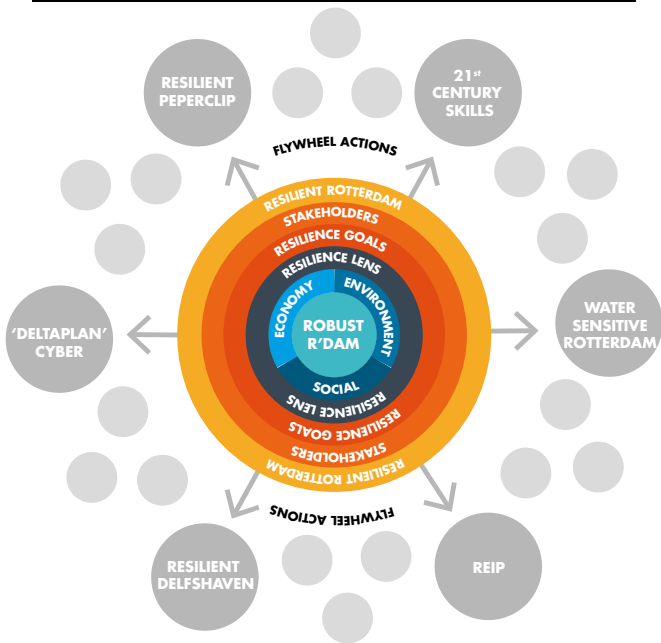
But, as we have explained, a great deal is already happening. The number of residents' initiatives is growing, and several strategic municipal projects are underway that will contribute to the city's resilience and its capacity to face the future. These ambitions, including our resilience ambitions, form the basis of the Story of the City.

The resilience philosophy relates to how we can achieve our goals and the approach that is needed. The goal of

our resilience strategy is to integrate the seven aspects of resilience into our thinking and actions in a more focused and systematic manner. We will now discuss how we can set this process in motion – connecting, facilitating and, where necessary, launching initiatives in relation to each resilience goal. Our actions are distinguished into two types: flywheel actions and additional actions. The flywheel actions are the headline actions that deliver the greatest resilience benefit for Rotterdam or which serve as an umbrella for a cluster of supporting actions. The supporting actions are considered to have less impact individually.

¹. The municipal decisionmaking process regarding some of the flywheel actions and supporting actions that are described in this document will be taking place in the near future. The elaboration, execution and financing of the actions are dependent on the results of this process.

3A. RESILIENCE COMPASS



3.2 ROTTERDAM: A BALANCED SOCIETY.



“Skilled and healthy citizens in a balanced society”

VISION

Making Rotterdam a resilient city and enhancing the resilience of its citizens will require action in several areas. These actions focus on both the urban community as a whole and on individual citizens. Good health and working consistently on maintaining the right skills are both requirements for resilient citizens. Societal cohesion and balance between population groups – in particular cohesion between the higher-skilled and lower-skilled – are also essential to creating a resilient urban community in Rotterdam. These aspects are therefore both focus areas within the wider social resilience strategy for Rotterdam:

- Working on the development of 21st-century skills and leadership among young people in Rotterdam
- Improving the health of the citizens of Rotterdam
- Working on the WE-Society in Rotterdam
- Working to attract more highly-educated people to settle in Rotterdam

This choice forms a link with the Social Domain of Future Exploration, on which Rotterdam is also currently working. The City of Rotterdam will review developments in this area and – on that basis and in consultation with the city – formulate a robust policy. This means a policy that takes account of the trends described and that will remain relevant in all conceivable future scenarios, and a policy that can be adapted as and when circumstances require, i.e. policy that is both robust and flexible. The four chosen themes will undoubtedly be elements of this robust policy, but other areas of action are bound to be identified as we travel the road to a more resilient Rotterdam.

For the four selected focus areas of the resilience programme, the current situation in Rotterdam is of course essential, since this is the baseline from which



we will work. On the other hand, a number of important developments will also affect the resilience of Rotterdam’s urban community and citizens.

DEVELOPMENTS

We have identified the following baseline and key developments in Rotterdam’s urban community and among its citizens:

- the impact of economic, technological and societal developments will lead to new demands on our education system. In addition to the function of disseminating knowledge, there will need to be a greater emphasis on personal development and the acquisition of social skills. Familiarity with ICT (digital skills) already plays a crucial role, and this will of course remain the case going forwards. 21st-century skills will play a vital role in education.
- Changes in the nature of the labour market, such as

greater flexibility (e.g. as a result of globalization), will magnify differences among our working population. Some jobs and professions will disappear, and new ones will emerge. New employment opportunities will involve ‘head work’ more often than manual work; there will be fewer opportunities for lower-skilled workers, while the opportunities for those with higher levels of education will grow. Job security will decrease. There will be less work for the middle segments of society. Employees will become more responsible for adapting and updating their skills to meet the rapidly changing demands of the labour market.

- An increase in international migration will lead to greater diversity in values and customs in society. Cultural diversity confirms Rotterdam’s international character.
- Events on the world stage (including the war in Syria and successive terrorist attacks) have left their mark in Rotterdam, fostering feelings of fear, anger, distress and



incredulity. These feelings involve the risk that events like these could lead people in the city to harden their points of view. Fortunately, at the same time we can see that the people of Rotterdam remain resilient and continue to work hard to ensure that the tensions manifesting themselves elsewhere in the world will not take hold in Rotterdam.

- Polarizing forces in society are increasing. Citizens can easily become angered or daunted by the contrasts created by modern life. But despite these contrasts, some citizens have taken the initiative to consciously look beyond these divisions and work for the good of the community and society.
- The definition of health is changing. It is no longer simply the presence or absence of disease or infirmity that defines health, but what people are (still) able to do. This represents an entirely new mind set, which corresponds closely with the increased self-reliance that citizens are being required to develop. For example, more and more young people are living at

home with their parents for a longer period of time. This requires increased health awareness, but this tends to be less well-developed in people with lower socio-economic status. In addition, the demands made on care services are increasing as a result of these developments.

- Shifts are occurring in health issues due to factors such as demographic change and scientific progress. Rotterdam has a relatively young population, but even here the proportion of elderly people is rising too. Among the elderly, there are often issues with mobility, and the elderly are more vulnerable in a general sense. Due to medical progress, once fatal diseases have now become chronic conditions. But global mobility and climate change are leading to new kinds of epidemics and antibiotic-resistant organisms.
- Rotterdam has a substantial proportion of housing classed as vulnerable, which is generally occupied by citizens with little or no work, living on low incomes, with unhealthy lifestyles and limited levels of

education. These groups are concentrated in certain neighbourhoods, particularly in Rotterdam Zuid.

Addressing the four topic areas of the social domain that we have described will enable us to enhance the resilience of individual citizens as well as Rotterdam's urban community as a whole. That resilience is reflected in qualities that are significant both at the individual level and the societal level: flexibility (are we able to adapt quickly?), capacity for learning (do we learn from events?), robustness (can we deal with setbacks?), inclusiveness (do we involve those around us enough?), resourcefulness (are we easily able to find new ways of doing things?), redundancy (are alternatives available?) and an integrated approach (do we look at the way in which things relate to one another?).

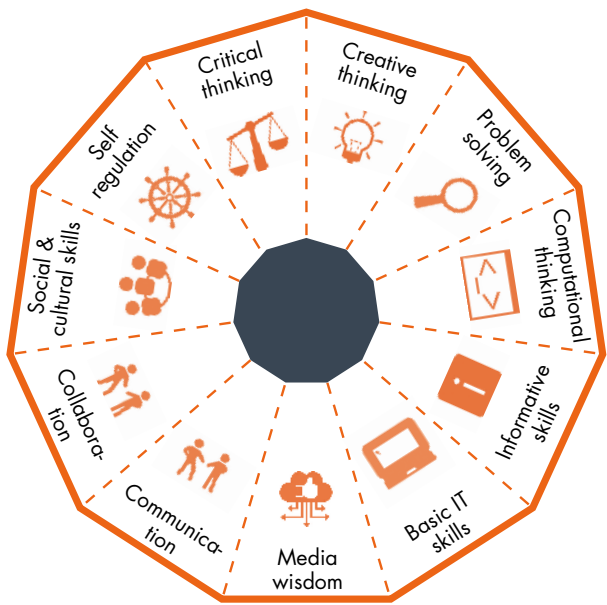
These four topic areas include several activities that can contribute to resilience. For each spearhead, one specific action is highlighted.

**FORTUNATELY,
THE PEOPLE OF
ROTTERDAM ARE
RESILIENT TO ENSURE
THAT THE TENSIONS
MANIFESTING
THEMSELVES
ELSEWHERE WILL
NOT TAKE HOLD IN
ROTTERDAM.**

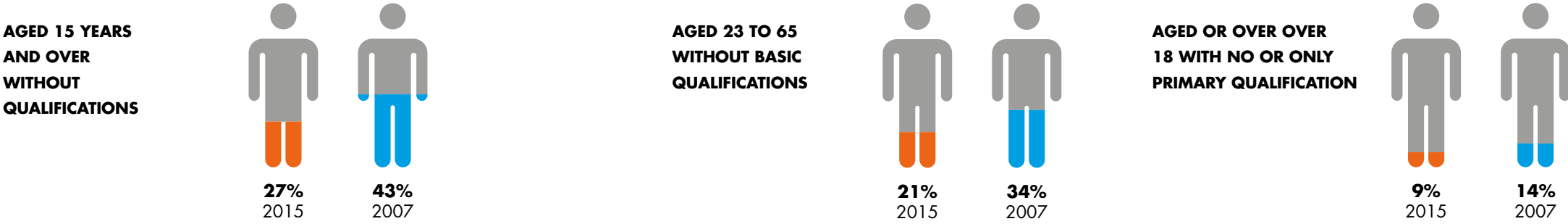
1 WORKING ON THE DEVELOPMENT OF 21ST-CENTURY SKILLS AND LEADERSHIP, PARTICULARLY AMONG YOUNG PEOPLE IN ROTTERDAM.

The level of education of the Rotterdam population is rising (see figure 3C). At the same time, we are witnessing changes in society due to the effect of wider developments, such as increasing digitization, automation and newly emerging economic markets. Relationships are changing within our economy and society. For example, we are increasingly working in a project-based manner with colleagues that are constantly changing; the dividing line between work and private life is becoming less clear; and the notion of property and security is taking on a new meaning. All this is affecting our social relationships, the way we work, and the nature of employment and work opportunities. In this new economy, success is more dependent than ever on who you are and your market value in relation to others.

3B. 21ST-CENTURY SKILLS



3C. ROTTERDAM'S EDUCATIONAL LEVEL



We also see that flows of information are now so rapid that the world outside and all the stresses that are occurring there can very rapidly impact on our urban community. Maintaining the quality of life in the city requires flexibility, mutual understanding and the skills to cope with the news coming in from all around the world.

Such developments demand new knowledge and skills in order to ensure that everyone can participate in and contribute to our changing society. This affects all citizens, whether they are working or not working, but particularly the younger generations. Our strategy places a particular emphasis on this latter aspect. In the world of education, a transition is needed in order to prepare young people for a future that is still uncertain and very unpredictable. That means that 21st-century skills must be consistently integrated into educational curricula. These new skills are about more than just preparing students for the employment market of tomorrow and beyond. Crucially, they also involve preparing young people for life in a more complex society. These '21st-century skills' can be categorized into three main groups:

- Intra-personal skills, such as flexibility, initiative, self-reliance, listening and coming up with creative solutions;
- Interpersonal skills, such as working with others, negotiating skills and communication skills;
- Digital and media skills, such as presenting, media literacy, working with ICT and understanding the basic principles of programming.

Underlying all of these are personal leadership skills. The ability of young people to determine their own future and take responsibility for their own choices. And the capacity to believe that they can control their lives, develop strategies, set goals, take care of their own well-being in a positive way and cope with set-backs or stress. If young people feel confident that they can influence the world around them, they will be better prepared for

the challenges of the future, the outcome of which is still uncertain.

The concept of personal leadership is the opposite of victimhood. In a large city, leadership has an extra dimension. Uncertainty about one's identity or victimhood can make people feel insecure about the world. Some youngsters move daily between the worlds of their family home, their school and the street – completely different worlds where they are required to apply fundamentally different standards. Many of them struggle to find their identity when they have roots in two or more cultures. The challenge is to turn this into a strength rather than a source of self-doubt or victimhood. And this requires personal leadership.

Many professionals who work with children and young people acknowledge the importance of 21st-century

skills. Youth workers and sports coaches often focus on leadership skills too. Discussions with teachers have revealed that they understand the urgency of addressing this need, but have little experience to draw on in order to get started. But the tide is turning: at a number of schools across the city, we are seeing individual – often modest – initiatives that address the teaching of 21st-century skills. At the national level too, we are seeing a move in this direction, including the recent report entitled 'Education 2032'. What matters now is that we take steps towards renewal in education, working from the current situation.

A FLYWHEEL ACTION 21st-century skills programme (including the Leadership Institute)



2 IMPROVING THE HEALTH OF THE CITIZENS OF ROTTERDAM.

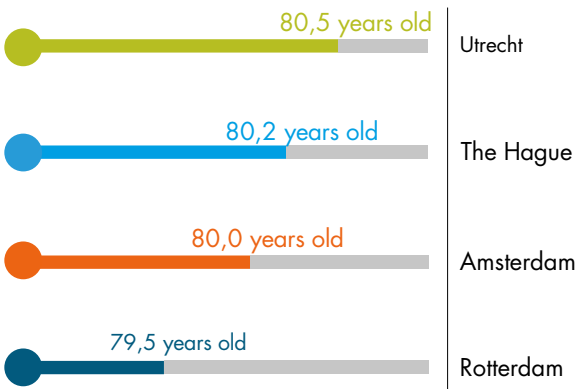
Psychological problems, obesity (among youths as well as adults), smoking, and the effects of particulate matter in the air are all major health problems in the city. Particularly those with lower educational levels and those living on lower incomes tend to live shorter lives and experience more health problems, often earlier on in life. They are more likely to be affected by stress, financial difficulties, unemployment and housing issues. One in five Rotterdammers has low literacy and a limited knowledge of health matters. This represents a significant risk to their personal resilience.

A city’s overall level of health is easy to gauge on the basis of average life expectancy. As in the Netherlands and its other major cities, life expectancy is increasing in Rotterdam, but it remains lower than in the Netherlands’ other major cities and the national average.

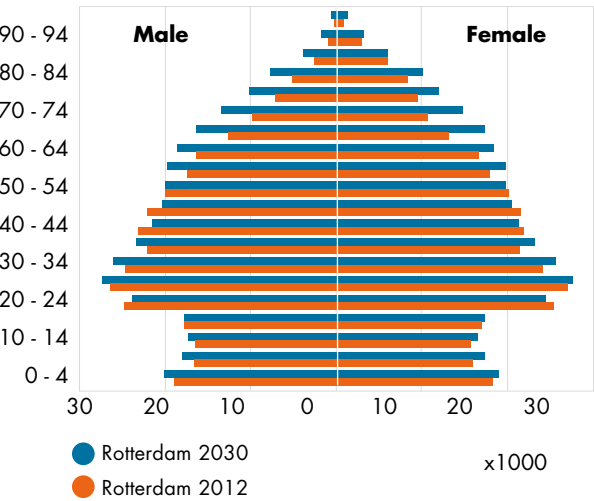
In the future, Rotterdam will be home to a relatively young population, but also to relatively large numbers of elderly people, and to many people from a migrant background. These trends will take place against a backdrop of a differentiated economic growth and rapid developments in technology.

The concept of ‘health’ itself is changing too. It is not only illness or disabilities that determine how healthy you are, but also your personal resilience and your ability

3D. LIFE EXPECTANCY AT BIRTH



3E. ROTTERDAM’S POPULATION PYRAMID



3. VISION AND GOALS



to continue to shape your own life wherever possible, no matter what life may bring your way. One crucial aspect is doing what you can to stay as fit and active as possible.

The challenge of tackling specific health problems in the neighbourhoods of Rotterdam remains relevant, even if we adopt this new, more realistic notion of ‘health’. In areas of the city that experience more health issues, the aspects of loneliness, depression and anxiety disorders, obesity (among both young people and adults) and air quality (particulate matter) are the main challenges.

Table showing the state of health of citizens aged 19 and older in the Netherlands’ four largest cities and in the Netherlands as a whole (%), taken from data from the G4 Health Monitor 2012, revised version dating from December 2014

Rotterdam’s mental and physical health are below the national average and vary significantly between different

HEALTH OF CITIZENS AGED 19 AND OLDER IN G4 (%)

	ROTTERDAM	AMSTERDAM	THE HAGUE	UTRECHT	THE NETHERLANDS
Perceived health (very good or good)	70.9	74.9	72.5	77.6	76.5
At least 1 chronic condition (receiving treatment from a GP or specialist) in the last 12 months	44.2	42.0	43.9	39.9	45.8
At least 2 chronic conditions (receiving treatment (or not receiving treatment) from a GP or specialist) in the last 12 months	31.2	32.0	32.8	28.9	32.2
Diabetes (receiving treatment from a GP or specialist) in the last 12 months	6.8	6.2	6.5	5.7	5.9
Asthma or COPD (receiving treatment from a GP or specialist) in the last 12 months	6.2	5.4	7.0	6.6	5.9
Hearing difficulties	5.3	3.7	5.0	3.6	4.2
Overweight persons BMI >= 25	49.1	39.7	48.5	38.4	48.3
Moderate and high risk of depression or anxiety disorder	48.6	46.4	48.6	39.8	39.8

populations in different areas of the city. Health outcomes are also strongly related to socio-economic disadvantage. The question is whether people will be able to keep pace with developments such as digitization and automation, and adapt themselves quickly enough to develop higher levels of self-reliance and resilience. Socio-economic health disparities are expected to increase. The growing power of the market may lead to inadequate access to essential healthcare for people with less money, due to the need for personal contributions to healthcare costs, for example.

The proportion of elderly people in the city is growing. There are ever more elderly people and they are living longer. This will lead not only to a higher incidence of chronic diseases, but also to more issues with mobility and independence. One special group is the – fast growing – group of older people from an ethnic minority background. These people suffer from more health problems than over-65s of Dutch origin.

TOWARDS A VITAL CITY WITH HEALTHY CITIZENS

The people of Rotterdam are primarily responsible for their own well-being, but the role of the municipality is to ensure that they are enabled and empowered to do this effectively. We are investing in a safe and mobility-friendly environment and in accessible facilities that invite people to get to know each other and care for one another, in order to ensure that this can happen. Together with other partners in the city, the municipality is exploring how we can facilitate healthier behaviour (‘nudging’).

A healthier lifestyle can help to prevent 20% to 30% of all major diseases. This involves eating a healthier diet, exercising regularly, stopping with smoking, reducing alcohol consumption, and practicing safer sexual behaviour. Much of our behaviour is simply the result of habit, and is less deliberate than we might think. Better knowledge about healthy living is vital, especially where there are gaps in people’s knowledge, but it is not always the whole solution. Having fun, helping to get people moving and implementing environmental interventions that make it easier and more attractive to choose a healthy lifestyle often have a greater impact and are more cost-effective.

New digital techniques, direct monitoring and social communication are all consistent with activities to

reinforce people’s self-reliance, using home technology for instance. The City of Rotterdam wishes to take full advantage of these opportunities, working with creative partners. At the same time, we must not lose sight of those residents that these kinds of initiatives may fail to reach.

Not everyone is equally able to live a healthy life and make their own healthcare arrangements. For those people who cannot do this, for whatever reason, it is important that care remains accessible and that care professionals spot potential health and social problems early and help these citizens to take care of themselves. For this reason, the municipality is strengthening its arrangements and agreements in the field of frontline healthcare and social care. Prevention must play a prominent role in care and welfare.

Health protection is, due to its collective nature, primarily the responsibility of the municipality. The residents of Rotterdam should be able to rely every day on a municipality that is alert to the changing health threats that may affect a major port city and stands ready to take appropriate action. Our city is a leader in the field of dealing with (new) infectious diseases, surveillance and crisis management, and is working to achieve better air quality and sustainable mobility.

B

FLYWHEEL ACTION

Building on the Public Health act 2016-2019



3. VISION AND GOALS

3 WORKING ON THE WE-SOCIETY.

Recent events in Paris and Brussels are still fresh in our memory. How we should handle threats of this nature is one aspect of urban resilience. Communication lines to the National Coordinator for Counterterrorism and Security (NCTV) are short. Recently, all planning at the national, regional and local levels has been reassessed and updated, in partnership with all the other actors involved, such as the emergency services. There are also frequent meetings to review the current threat level at the national and regional levels.

In addition, it is seen as crucial for the municipality to invest in identifying social tensions and potential issues, and to ensure that investments are made in social cohesion and resilience within Rotterdam. The long-term investment that is required is an important aspect of our resilience strategy.

Social and cultural differences between different population groups are inevitable in all cities. This creates opportunities – the opportunity to diversify networks, for example. But when these differences become excessive, they can pose a threat to social cohesion. The WRR (Scientific Advisoryboard for the Government) and SCP (Social Cultural Planning Bureau) argue that social and cultural aspects are dividing the Netherlands. The consequence of this is that groups can end up living in their own separate world. This increases the risk of tensions between groups, while reducing connectedness and accessibility. Particularly in a society where these worlds are characterized by differences in educational level, income and ethnicity, it is believed that growing divisions undermine the resilience of society as a whole and disempower citizens.

We are working on this issue, both by tackling radicalization and through the WE-Society programme. The WE-Society programme is seen as an important model and may be given flywheel action status. The WE-Society meetings held as part of the Future

Exploration of the Social Domain showed that the residents of Rotterdam themselves have noticed growing divisions. They confirmed that city dwellers from different ethnic backgrounds are, to a significant extent, living alongside one another and to a much lesser extent with one another. A growing number of young Muslims, for instance, feel that they have to answer for what a small number of radicals are doing in the name of their religion. Residents of vulnerable neighbourhoods frequently express the opinion that their local areas have been forgotten about.

The implication of Rotterdam's WE-society, by contrast, is that there is a place for everyone, regardless of ethnic origin, religion or lifestyle. It is a place where people actively want to meet one another and demonstrate understanding and respect for each other. The WE-society in Rotterdam is a place where there are opportunities and where everyone can be approached without inhibitions. Mutual dialogue and connection enable and facilitate the discussion of any perceived issues. Rotterdam's WE-society is a resilient society that is able to cope with negative and subversive influences,

whether from outside or from within.

The WE-Society programme was initiated to make Rotterdam more resilient and resistant to such potentially harmful influences. Its most important goals are as follows:

- Strengthen connectedness in a sustainable way. This can be achieved by strengthening the networks that are already in place in the city as well as by creating new connections.
- Create space for citizens to express issues and misgivings, both through dialogue and in daily life in the city.

Rotterdam is working on expanding and strengthening the interconnectedness of the city – among city dwellers, between population groups with different cultural backgrounds, between a variety of social organizations and with municipal government. Connectedness within the city will result in a sustainable dialogue between the various groups that are represented in the city. This will help to promote Rotterdam's urban resilience because:

- Population groups can learn to accept one another, understand each other's value and take action to reduce tensions (integration).
- It will help to reduce the large variations in the opportunities available to different population groups (participation).
- The cultural diversity of Rotterdam's population can contribute to quality of life in the city (capacity for adaptation).
- Our society can become strong and assertive enough to avoid the potentially negative consequences of world events (resourcefulness and robustness).
- Communication channels between the various population groups will already be open in times of crisis (redundancy).
- Society can accommodate population groups that are facing difficulties (flexibility).

For individuals, a resilient society means that everyone, regardless of cultural, ethnic or religious background, is valued and respected, can participate in society and is not excluded (participation). Difference and diversity will always be there, but mutual respect and understanding are on the increase (integration).

3F. ETHNICITY IN ROTTERDAM



FLYWHEEL ACTION

WE-Society programme

3. VISION AND GOALS

4 WORKING TO ATTRACT MORE HIGHLY EDUCATED PEOPLE TO SETTLE IN ROTTERDAM.

In demographic terms, a resilient city will have sufficient capacity to allow the local economy to grow and maintain the city's facilities at the city-wide and local levels to the required standards. Decades of economic dependence on the city's port mean that Rotterdam is home to many people of lower socio-economic status. Rotterdam has a substantial proportion of housing classed as vulnerable, which is generally occupied by citizens with little or no work, living on low incomes, with unhealthy lifestyles and limited levels of education. These groups are concentrated in certain neighbourhoods,

particularly in Rotterdam Zuid. The average educational level of Rotterdam is below average, although it is continuing to rise slowly. The performance of the city's schools is improving, the number of those leaving school early is falling, and more highly educated people are moving to the city. Nevertheless, the number of highly educated people still lags far behind other major cities in the Netherlands. This is an aspect of Rotterdam's urban community where we need more balance.

Highly educated people have a greater chance of employment and earning a higher income. Because they earn more, they are more likely to own their own home and therefore to feel more committed to the area in which they live, and to do more volunteer work in that area. And because they earn more, they spend more, so the standard of local amenities (such as shops and museums) is higher, which attracts more tourists. Highly educated

people also create more diversity in the city. This also attracts more tourists and companies (who like to locate where they can find suitable staff).

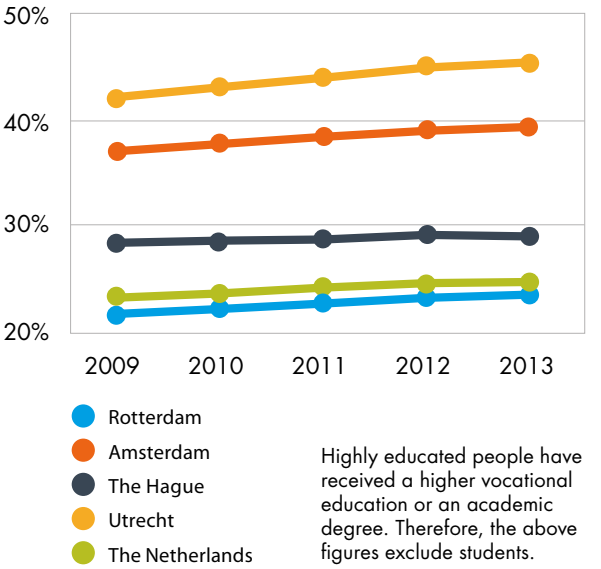
Rotterdam already represents an attractive place for highly educated people to settle. But improvements could be made by making the city greener, more child-friendly and safer (especially at night). Highly educated people attach a great deal of importance to inviting and accessible outdoor areas with a lot of greenery, where people can spend time playing, walking and cycling. They often find Rotterdam to be a surprising attractive city: the city does not need to do a great deal more, but it does need to take action in the form of new creative or experimental initiatives, following international, 'out-of-the-box' models. The city needs to become more flexible and offer more opportunities that are free of obligations. Highly educated people combine their busy work and

household schedule with a lot of leisure time outside of the home. They also tend to prefer activities that they can engage in when it suits them, such as eating out, visiting museums and festivals, and sports such as hiking, biking, fitness, running and swimming. The Strong Shoulders, Strong City programme has been established to increase the proportion of highly educated people who make Rotterdam their home. This involves investing in the attractiveness of the city and its living environment. Partnerships between highly educated people and local government are central.

D FLYWHEEL ACTION Strong Shoulders, Strong City programme



3G. EDUCATED AS A PERCENTAGE OF THE LABOR FORCE (15 TO 75 YEARS)



3.3 A WORLD PORT CITY BUILT ON CLEAN AND RELIABLE ENERGY.



“Towards a flexible energy infrastructure for an efficient and sustainable energy mix in Port and City”

VISION

Rotterdam wants to capitalize on the energy transition to the maximum extent and to be a pioneer in this transition. The goal is to become a zero-carbon city by 2050 (as specified in the Next Economy Road Map). In addition to generating and using renewable energy, we will also support the development of a world-class technology and innovation cluster. This will enable Rotterdam to maintain its reputation as one of the world’s foremost port cities. Our energy transition process will be developed in consultation with stakeholders and backed by sound research and policy measures. The transition will be based on diversification and flexibility in the way that we meet the city’s energy requirements. This means making sure that our energy infrastructure remains among the best in the world and guarantees security of supply for businesses and citizens alike. Restructuring our energy infrastructure will also provide us with the opportunity to apply the principles of localized energy use, storage and conversion. The system will be designed to facilitate the energy transition, reduce consumption, ensure maximum reuse and use clean methods of generating energy. All this applies at both the regional and local levels.¹

CURRENT SITUATION

Energy is one of the basic building blocks of any urban infrastructure. A modern city without adequate energy

conversion and supply facilities (which together make up the main components of energy infrastructure) is unthinkable. What is special about Rotterdam’s energy system is that it is integrated with our port, which has developed primarily on the basis of activities that involve fossil fuels.

The existing energy system of the Port of Rotterdam includes the large-scale storage and supply of fossil fuels (coal, oil and gas), energy conversion facilities (coal, gas, biomass and waste incineration plants), processing facilities (refineries) and energy consumption (in the petrochemicals sector). The port also plays a role in supplying electricity and heat from the power plants to end users (businesses and citizens).

The city benefits from a robust power grid. Some 20% of the city’s heat is supplied by a collective heating network which is supplied with heat mainly from the waste processing plant. The remaining 80% comes from gas boilers. This latter form of heating involves high levels of CO₂ and NO_x emissions and means that the city remains reliant on fossil fuels for its daily energy needs.

Rotterdam forms part of the largest petroleum and chemicals cluster in Europe: The Antwerp-Rotterdam-Rhine-Ruhr area, which accounts for 20% of Europe’s oil refining capacity and 30% of its bulk chemicals production. In global terms, this cluster is comparable with the Houston Area, Singapore and Shanghai.

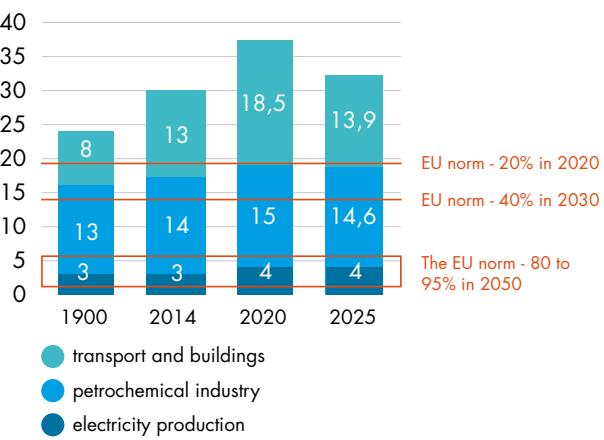
¹. But this is not just about sustainability, but also efficiency. Achieving the optimum energy mix will require a power grid that enables and facilitates flexibility and energy conversion. Resilience in the field of energy therefore requires a new system that allows for developments at both the local level and beyond. At the same time, it is important that this system enhances efficiency and maximizes the use of renewable and affordable sources of energy.



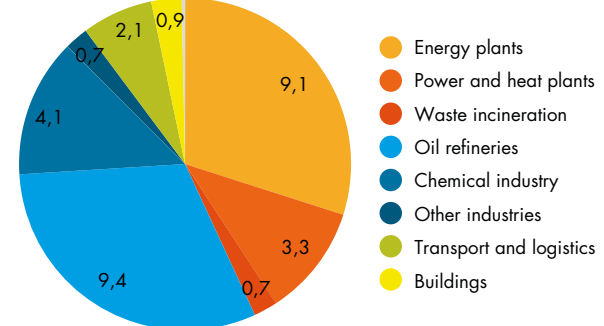
3H. ROTTERDAM’S INDUSTRIAL COMPLEX

	Million tonnes	Percentage in the NL
Overseas supplies		
Fossil energy: petrol, coal, gas	136	
Mineral oil products (100% fossil)	88	
Other (60% fossil, 40% bio)	31	
	255	75%
5 oil refineries		
with a capacity to destillate 58 million tonnes of crude oil		88%
30 chemical companies		
with a capacity to produce 17 million tonnes of commodity chemicals		40%
3 biofuel companies		
with a capacity to produce 2 million tonnes of biofuels		56%
4 vegetable oil refineries		
with a capacity to produce 2.6 million tonnes of vegetable oil		75%
Energy supply		
8 plants, 11 cogeneration plants, 1 waste incineration plant, 86 wind turbines, with a total capacity of 6.4 gigawatt (93% fossil)		20%

CO₂-emissions in Rotterdam versus Europe’s COP21 pledge



CO₂-emissions in Rotterdam: 30.4 million tonnes = 19% of the Dutch emissions



3. VISION AND GOALS

Within the Netherlands, the Rotterdam industrial cluster accounts for 88% of oil refining activities, 40% of bulk chemicals production and 20% of electricity generation. At the same time, Rotterdam is Europe’s largest bioport, with biofuel production and vegetable oil refineries.

The energy consumption of the urban region accounts for only 10% of the total. The city’s CO₂ emissions reflect this situation: over 90% are accounted for by the power plants, processing plants and industrial consumption in Rotterdam’s port area. CO₂ emissions are rising in Rotterdam, but the port economy is undergoing even stronger growth. Over the past decade, the transit of goods has increased by 26%, the added value has increased by 11%, and employment has increased by 17% - all this while CO₂ emissions remained unchanged between 2005 and 2013. This is because the plants in the port area are becoming more efficient as a result of new technology and the replacement of old equipment. In 2014, CO₂ emissions rose again due to installation of new coal plants and increasing port traffic. The construction of these coal-fired plants was a national decision based on national energy requirements (i.e. the national demand for electricity).

The national share of energy from renewable sources in 2014 was 5%, and this is not rising quickly enough towards the target of 30% by 2030 (the target set in the Port Vision) and the 14% target for generating capacity by 2020 (the target set in the National Energy Accord). The urban energy system is based on a robust electricity and gas network and a heat distribution network. Every home in Rotterdam is connected to the electricity and gas supply networks. Many homes also are connected to the heat distribution network (this is compulsory for some homes).

WHAT IS ALREADY HAPPENING?

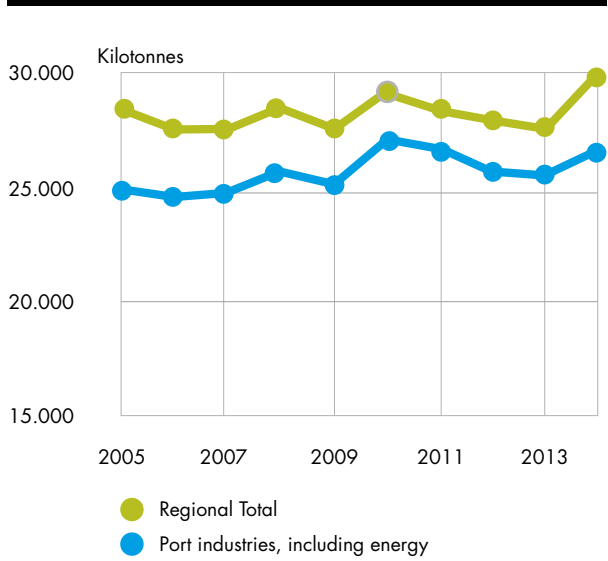
The City of Rotterdam’s Sustainability 2015-2018 programme has set out an ambitious implementation programme that aims to generate more renewable energy than the city’s residents consume by the year 2030. Its goals include:

- Energy savings for residents. The goal is to reduce the energy consumption of rented housing and 10,000 privately owned apartments and houses. This is to be combined with an increase in employment opportunities and apprenticeships.
- Energy savings for businesses. The municipality is encouraging the implementation of energy scans.

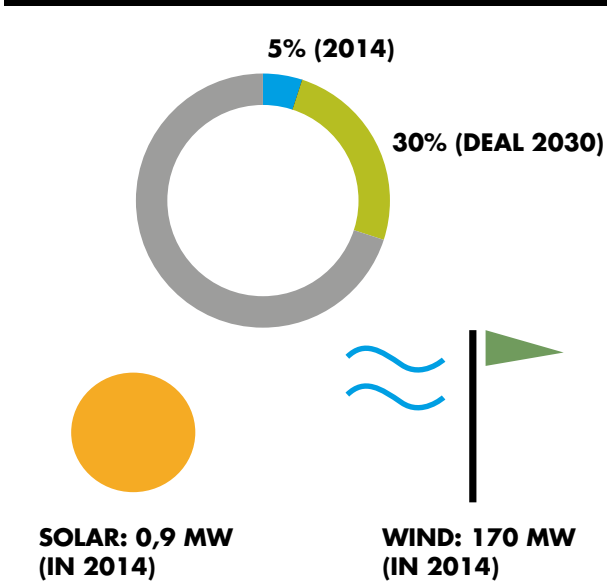
- Industry as a source of heat. The goal is to ensure that 150,000 more homes are connected to the municipal heating network by 2035.
- Wind revenue. The ambition is to generate 350 MW of wind power by 2025, which is enough to supply 200,000 households.
- The sun as a source of energy. The objective is to generate 20 GWh of solar energy by 2018. This will rise to 1,000 GWh by 2030.

The Rotterdam Climate Initiative brings together the City of Rotterdam and the Port of Rotterdam to work closely with the business community and the province of Zuid-Holland, with the support of the DCMR Environmental Protection Service. The goal is to make Rotterdam the largest port in Europe in the field of innovation and sustainability, serving as an inspiring example for other cities in the world.

3I. CO₂ EMISSIONS IN THE ROTTERDAM REGION



3J. SHARE OF ENERGY FROM RENEWABLE SOURCES]



3. VISION AND GOALS

Rotterdam wants to take its place among other major cities that are leading the way in solar energy. There is plenty of potential when it comes to solar power in Rotterdam. We have a total of 18.5 km² of flat roofs, which constitutes 70% of the total roof area of the city. On the basis of current solar panel technology, the city's solar potential (excluding industrial sites) is around 1,500 GWh. This means that solar power could meet approximately 60% of the city's current demand for electricity (based on 2013 figures).

The Port of Rotterdam is also organizing a number of major projects that are designed to contribute to this energy transition:

- Rotterdam BioPort (since 2010);
- Delta Plan for Energy Infrastructure (since 2013);
- Reinforcing the Rotterdam Moerdijk Industry Cluster (since 2015);
- SmartPort (since 2015);
- Energy Transition Arena (since 2015);
- Energy scenarios (2014) and Energy Trend Analysis (since 2015).

NEW DEVELOPMENTS AND CHALLENGES

A number of recent developments mean that reducing our dependence on fossil fuels and encouraging the use of clean energy forms is now a matter of increased urgency. Climate change and the agreements recently reached in Paris (COP 21), technological developments (ever cheaper and more energy-efficient renewable sources such as solar and wind) and lower levels of economic innovation all mean that the energy transition must be tackled without delay. Because Rotterdam's economy is heavily dependent on fossil fuels, it is particularly important for the city to take steps in this area. Its three major economic sectors (energy, refining and bulk chemicals production) are suffering from a major squeeze, particularly because of the relatively high cost of energy. This trend will be reinforced if Rotterdam also wants to assume a leading position as an innovative city based on the circular economy. These ambitions are in fact at odds with an economy based on fossil fuel processing and consumption.

FURTHERMORE:

- Gas production in Groningen is being scaled back.
- The national goal is to become less dependent on oil and gas from abroad.
- There is increasing pressure from society to make the transition to renewable energy and more efficient energy consumption.
- The number of 'prosumers' is growing: more and more households produce their own energy and make the surplus available to the power grid.
- This is also driving the development of a system for the exchange and storage of various flows of energy and smart grids.
- There is a greater focus on lowering energy bills.²
- The demand for heating will fall due to improved efficiency and insulation, although it will remain high both in urban areas and in the greenhouse cultivation sector. In the future, residual heat will continue to be produced, however, as a by-product product of the production of hydrogen, for example.

TOWARDS THE NEXT PHASE IN THE ENERGY TRANSITION

The energy transition needed in the port and the city will require different approaches, but these are also interconnected.

An analysis carried out using the resilience lens shows that the Netherlands' current energy system – and that of Rotterdam too – is robust, but not flexible enough and insufficiently integrated. Enhancing its flexibility and making it more integrated will require work, both in the city and the port area. Increasing flexibility can be achieved by the creation of a heat node, which several heat sources can be connected to. Combining large-scale with small-scale and decentralized energy will be crucial. Increased flexibility will also be required due to the lack of synchronicity between the demand for and the supply of renewable forms of energy. It will be vital to develop our capacity for the storage, conversion and buffering of energy. In the context of Rotterdam, there may be opportunities to commission disused port basins for this purpose, as well as reservoirs and electric cars. These options are currently being explored.

3K. POTENTIAL SOLAR ENERGY



In all cases, the energy transition will require more than technical solutions alone. Public support and more sustainable patterns of behaviour on the part of individuals and businesses will also be essential. For example, it would be counterproductive if citizens and businesses start to use more hybrid vehicles but end up driving further because they assume that the effect is environmentally neutral. It is therefore necessary to increase our understanding of what motivates citizens and entrepreneurs; Rotterdam is currently carrying out research in this area (by means of social marketing).

Coherence between large-scale and small-scale energy facilities can also be achieved through an energy mix that is tailored to what is possible in the region, and which transitions will be taking place there. On the one hand, we urgently need to get started on the energy transition, but at the same time it will take time before we can start

¹. One important indicator in energy poverty is that residents are now having to use a high proportion of their income to pay for the cost of energy. In the Netherlands, this concept is still relatively new and there is still no official definition of energy poverty. In the UK, the definition used for energy poverty is when a household needs to spend over 10% of its income on energy costs. The number of Dutch people spending more than 10% of their income on energy has risen by 40% over the past three years.

3. VISION AND GOALS

ROTTERDAM WANTS TO BECOME A FRONTRUNNER AMONG OTHER MAJOR CITIES IN SOLAR ENERGY.

to make the changes that are required. The transition will involve issues such as which options become available in terms of technology, finance, employment and competitiveness.

The following general principles will be applied in order to promote the energy transition:

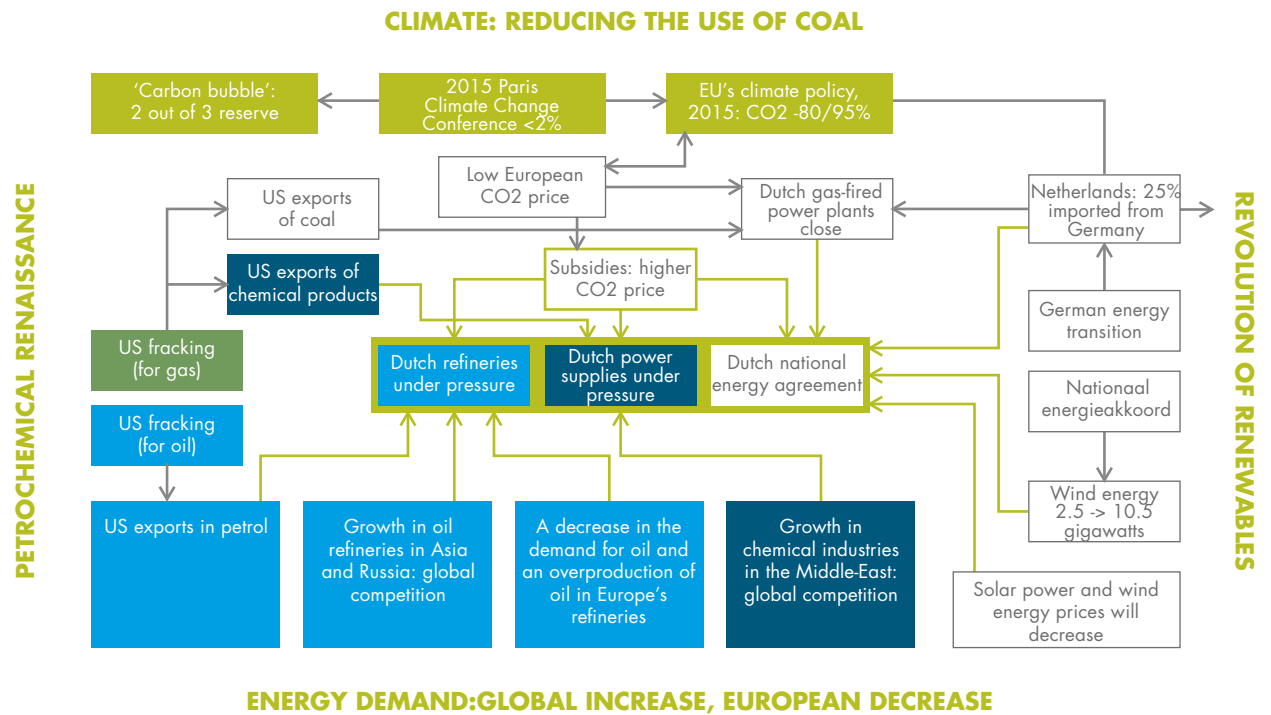
- The process of promoting sustainability will be approached by means of saving energy, utilizing residual energy, generating renewable energy and (only when necessary) generating clean power from fossil fuels. This approach is known as the Rotterdam energy approach (REAP), which is an extension of the trias energetica.
- The transition to a more sustainable energy system will require effort on all the primary means of

contributing to sustainability, i.e. saving energy, the use of (residual) heat, thermal storage, geothermal energy, wind energy, solar energy and biomass. Given the enormity of this challenge, we cannot afford to adopt an 'either-or' approach. And neither can we afford to gamble on major technological breakthroughs, which may or may not happen in the next decade. In reality, this is simply an elaboration of the precautionary principle.

- Energy sources are utilized as much as possible for the highest-grade applications (in other words, with the minimum possible energy loss). As long as we continue to use natural gas, for example, it is preferable to use this for the high-quality processing industry or for transportation, rather than for low-grade applications such as generating heat for buildings.
- The number of energy conversion processes in a single chain must be minimized because of the losses that occur (which are usually in the form of lost heat). Where necessary, and in cases where residual heat is of good quality, the conversion process should take place in the vicinity of the heat distribution network, so that the residual heat can be utilized and yields are increased. The heat distribution network can also play an active role. For example, where hydrogen fuel is produced using residual heat.



3L. A CHANGING GLOBAL ENERGY LANDSCAPE



3M. POTENTIAL GAINABLE EARTHWARMTH



1 UPDATING THE URBAN ENERGY INFRASTRUCTURE TO ENABLE THE ENERGY TRANSITION.

The transition to efficient and renewable energy will require – in addition to measures at the level of individual buildings – an energy infrastructure that can support this transition and proposals on how this transition can be implemented and overseen (road map). This will be an important step towards a 100% CO₂-free built environment by 2050. The municipality has decided to start this process using the Rotterdam Energy Infrastructure Plan (REIP). The reasons for this are:

- It is a strong and ambitious plan for achieving the energy transition. There is a lot that we can and want to achieve in areas such as solar energy, wind energy, insulation and heating. The Sustainability Programme includes these opportunities.
- The speed at which sustainable heating can be incorporated into our energy transition is less rapid than we had hoped for.
- Above all, the existing infrastructure and facilities are based on outdated ideas in relation to the supply of energy, and do not incorporate the concepts of emissions reduction and the finite extent of the earth's (fossil) resources. This infrastructure is therefore not capable of supporting the transition to the extent that is required.

The step from ambition to implementation is too great in terms of the existing energy infrastructure. An intermediate stage will be necessary in order to provide a better understanding of the ultimate goal, the implementation strategy, and the relevant parameters. The REIP represents such an intermediate stage. The challenge is to ensure that the city's energy management systems remain flexible, integrated and yet robust. The combination of energy storage and smart grids will play a key role.

The REIP is a collaborative project that includes Stedin, Eneco, and Nuon; the housing corporations of Woonstad, Havensteder, Vestia and Woonbron; the Urban Development clusters and the City Management Department of the City of Rotterdam; and central government (the Ministry of Economic Affairs, the Ministry of Infrastructure and the Environment and the Ministry of the Interior and Kingdom Relations).

The REIP will need to deliver the following intermediate results:

- Energy mix: What is possible in terms of our energy supply (and demand)? This includes plans relating

to the heat node and developments in the port area. This issue is viewed at the regional level.

- Infrastructure plan: What do we need to do and where? We are seeking to understand the optimum combination of energy solutions at the local level and the urban energy infrastructure that would be needed for this. This subproject focuses on the built environment of the City of Rotterdam.
- Road map: How do we get there? The road map provides us with an insight into who needs to do what – and which requirements need to be met – in order to make progress towards the energy transition.

assessments of projects at the project or company level do not exert sufficient influence over the ultimate decision-making process when it comes to the issue of sustainability. Encouraging the transition will therefore require a focus on regional level considerations, which can then be translated into solutions for each district of the city and decisions on which local infrastructure is required. This forms part of the REIP. The REIP approach involves a closer examination of which best combination of top-down and bottom-up measures will work the most effectively (including research into which combination of push and pull measures are required).

E FLYWHEEL ACTION
Rotterdam Energy Infrastructure Plan (REIP)

3N. ROTTERDAM'S ENERGY INFRASTRUCTURE PLAN (REIP)



3. VISION AND GOALS

2 THE CONVERSION OF ROTTERDAM’S PORT AND INDUSTRIAL COMPLEX INTO AN AREA BASED ON CLEAN AND SUSTAINABLE ENERGY SOURCES AND RAW MATERIALS, IN ORDER TO SECURE A STRONG COMPETITIVE POSITION FOR THE CITY IN THIS FIELD.

The challenge is to neutralize CO₂ emissions in the port and industrial complex by 2050. This is a shared task that requires commitment from private sector companies, the port authority and other public authorities, including central government and the European Union.

The Action Plan for Reinforcing the Industrial Cluster in Rotterdam Moerdijk was recently published. The Action Plan is based on the following vision. In 2030, the Industrial Cluster in Rotterdam Moerdijk will still be setting the pace in Europe. In addition to the large-scale production of chemicals and refining, the cluster can make a significant contribution to the energy transition in Western Europe through sustainable mobility and the production of bio-chemicals. Proactive management on the part of all stakeholders will enable the cluster to emerge from the consolidation of Europe’s fossil resource-based industries in a stronger

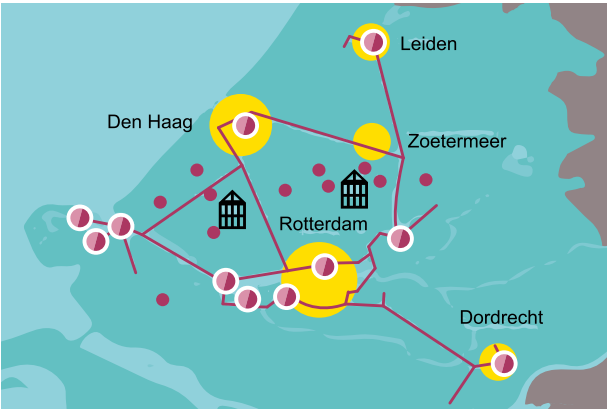
position. Additionally, the cluster can exploit the growth opportunities presented by technological progress and a wider social commitment to sustainability. Security is clearly a core value for all stakeholders in the cluster.

- The actions planned combine two tracks:
- an optimization track, which aims to further strengthen the competitiveness of existing companies in the cluster. Key elements in this track are business cooperation in the fields of utilities and infrastructure, the distribution of residual heat and CO₂ to third parties and the implementation of process innovations.
 - a renewal track, focusing on renewing the cluster itself, and its integration with the wider region. Key elements here are biomass conversion, the use of streams of recycled materials, renewable electricity, and the use of innovative technologies in the field of electrification and decarbonization.

A good example of how both optimization and innovation can be combined is the heat node, a network of pipes that can distribute heat to where it is needed in the city – particularly heat from renewable and energy-efficient (residual) heat sources. In recent years, the first steps have been taken in the construction of a total of 43 kilometres of heat transfer pipelines linking the Botlek area with Rotterdam’s municipal heat distribution network. In 2015, public and private partners undertook a feasibility study in relation to the westward extension of the heat distribution network, a project known as the Cluster West. It was found that residual

heat and geothermal energy amounting 40 to 60 PJ is available, which could be used to supply 50 to 75% of the demand for heat in the area of the cluster. The plan is to make the heat node – and the heat distribution network more generally – an integral part of the city’s wider energy system. Because the network would make it possible to convert energy between different forms (such as between electric power and heat) and allow energy storage, the entire energy system could be made more efficient and sustainable. This would allow all sources of energy (solar power, wind power, geothermal power, biomass, residual heat) to be used optimally.

3P. ENERGY IN THE MAJOR CITIES IN THE ROTTERDAM REGION

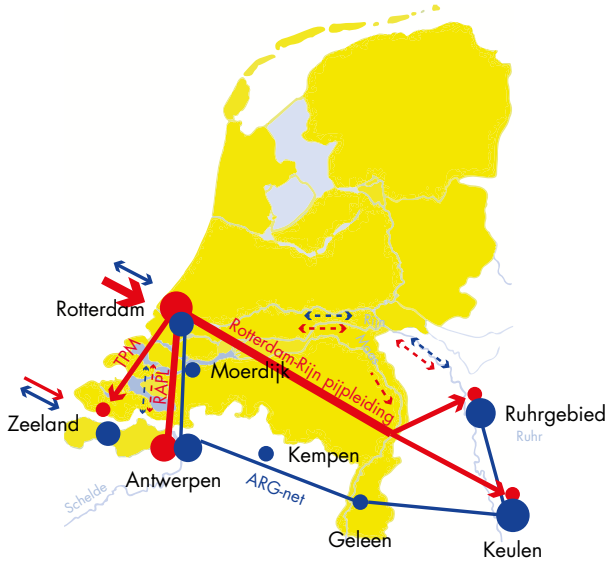


- F FLYWHEEL ACTION Reinforcing the Rotterdam Moerdijk Industry Cluster Action Plan
- G FLYWHEEL ACTION Paris Plus
- H FLYWHEEL ACTION Port Transition arena, focused on the bio-based economy

30. EUROPE’S LARGEST PETROCHEMICAL CLUSTER

Antwerp-Rotterdam-Rhine-Ruhr area

1. Major supplier of oil and chemical products:
 - 20% of Europe’s oil refining capacity;
 - 30% of Europe’s bulk chemicals production.
2. Unique infrastructure: seaports, rivers and pipelines.
3. Efficient logistics between seaports and mainland.
4. Integration of refineries and chemical plants.
5. Highly qualified staff and R&D, based on more than 100 years of regional development of chemical products.



3.4 ROTTERDAM CYBER PORT CITY.



“Rotterdam aims to be a cyber resilient city and port; an important condition required to attract new business and investment”

VISION

In five years time, the City of Rotterdam has implemented a cyber resilience strategy, thereby attaining an advanced level of cyber resilience.

The city's citizens, companies and organizations are able to respond quickly and flexibly to cyber incidents of any type. Cyber incidents do not lead to situations that are unmanageable, and the city is able to recover quickly. This is possible because there is good cooperation, because there is joint learning in relation to any incidents that occur, and because we are looking ahead to the future and focusing on the impact of digital developments. There is an awareness of cyber threats and the risks that they pose to citizens, businesses and institutions; those involved know how to act in a preventive, proactive and responsive manner. The actors involved are working together to make maximum use of our knowledge and experience of new technology and to ensure that this is used to increase the resilience of the city wherever possible, thus improving the welfare and prosperity of citizens, businesses and institutions in Rotterdam. This is leading to a permanent increase in our cyber adaptive capacity.

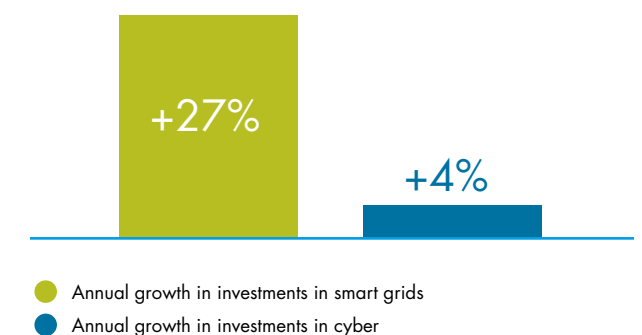
CURRENT SITUATION

The field of 'cyber' includes the application, use and organization of information and communication technology (ICT). This is an area that affects every society and every city. At the same time, our dependence on ICT for the functioning of contemporary urban society is significant and continues to grow exponentially. ICT applications are now involved in all urban functions.¹ Rapid technological developments and significant added value for users mean that the increasing importance of ICT is set to continue, according to research by Deloitte. The importance of developing capacity to respond to the risks associated with technological failures will therefore also grow. Failures can occur as a result of both human or technological shortcomings, or cybercrime. The primary question is not: can I be hacked? Rather the key question is: how long does it take before I notice that I have been hacked? The persistence and sophistication of cyber threats can be overwhelming for organizations of all sizes. A failure of the ICT infrastructure, which now plays such a vital role in services such as banking, energy and communication, could have a huge impact on the citizens of Rotterdam in the short term, and on the wider urban economy in the longer term. Society consists of countless chains – such as production chains, logistics chains and services chains – which often play an essential role in our lives. Many of these chains involve dependencies, both internal dependencies and mutual dependencies. A good standard of cyber security in relation to the individual components of a chain does not automatically mean that the chain as a whole is secure. What is more, experience shows us that the development of new technology does not always move in parallel with the development of better cyber security. A Smart City does not automatically mean a cyber resilient city...



The application of ICT has grown exponentially in recent decades. There are a myriad of opportunities for the use of ICT to improve the way in which our society functions. Rotterdam wishes to take full advantage of these opportunities. One of the ways in which this can be done is based on the concept of Smart City – this will enable the city to prepare for the economy of the future. Cyber resilience means being able to cope with cyber threats and risks, and utilizing the opportunities offered by ICT in a proactive manner. A cyber resilient city continues to function even if a part of its cyber infrastructure or systems fails for some reason. Not only that, but the city can also recover rapidly, and preferably bounce back even more strongly. Adaptation and innovation are the key. The ability to work on competencies, skills and abilities – between public and private organizations, and with and among citizens – is essential for the Rotterdam's cyber future.

3Q. ANNUAL GROWTH IN INVESTMENTS IN SMART GRIDS AND CYBER



¹. The following nine distinct urban functions can be defined as relevant to cyber resilience, both in the context of Rotterdam's cyber resilience strategy for the future, and more generally: economy, mobility, healthcare, governance, public services, housing, education, public order and security, and basic amenities. This list is not exhaustive, but includes the main urban functions in relation to cyber resilience.

HOW LONG DOES IT TAKE BEFORE I NOTICE THAT I HAVE BEEN HACKED?

The (new) opportunities offered by ICT are an integral part of a cyber resilient city and therefore form part of Rotterdam's Smart City initiatives. The use of open data by governments and automation in healthcare (e-health) are examples of such opportunities.²

URGENT ACTION FOR ROTTERDAM

As Europe's trusted gateway, Rotterdam cannot afford any disruptions. The digital sphere is one of the areas that involves risks to the functioning of the port and the city. Technical or human error and cybercrime could undermine the interests, security and reputation of both the city and its port. The Cyber Security Review of the Netherlands 2015 highlighted the fact that the availability of IT systems is becoming increasingly crucial, not least because the alternatives to those systems are disappearing. Essential societal processes could come to a halt if the IT systems on which they depend are unavailable for some reason and, crucially, the old analogue alternatives are no longer there.

This will become even more true as more and more devices and objects in the city become connected through the Internet of Things. This development will present opportunities, such as more effective usage, management and maintenance, but it will also introduce new vulnerabilities. Rotterdam's international port is the largest port in Europe and one of the main economic motors of the Netherlands and Europe. It is a major industrial complex, with hundreds of companies and businesses. Its large-scale infrastructure employs thousands of workers within a relatively small area. The area is home to complex industrial and logistics processes and chains, all of which are dependent to some extent on properly functioning ICT. Interdependence between companies (in the fields of logistics and production) is also increasing through the cross-linking of IT systems, including through the internet. All this means that an integrated approach to reducing

cyber risks is essential. After all, any chain is only as strong as its weakest link. An additional risk is the presence of the petrochemical industry, and especially the 'high-risk' companies. Any failure or tampering with cyber systems could lead to significant economic damage, but more than that, it could have an environmental impact throughout the region. Rotterdam is a delta city, built on low ground in the Rhine and Meuse delta. At least 80% of the city lies below mean sea level and excess water has to be pumped out through an extensive drainage system. The risk of flooding caused by the breach of a dike is small, but nevertheless it is always present. The city's water management system and other critical infrastructure are also dependent on ICT. The failure of ICT systems at a time when water-related infrastructure is most needed (such as when water levels are high and there is heavy precipitation) could also have very serious consequences for the functioning of the city of Rotterdam and the lives of its citizens. It is certainly not inconceivable that the city's water management infrastructure could be hacked by attackers. ³The fact that a section of the industrial port infrastructure in Rotterdam is located below sea level only serves to underline the seriousness of this potential threat. In 2014, the importance of ensuring a more cyber resilient Rotterdam was acknowledged by the members of the city's authorities: the mayor, the chief public prosecutor and the local police chief. They have prioritized cyber security in the Port of Rotterdam and developed a strategy and an action plan in this area (see section 3.4.3).

VULNERABILITIES AND CHALLENGES

The city's vulnerabilities in the field of cyber have a range of causes. These are all important for Rotterdam, but some are particularly urgent.

¹. Digital Delta is an initiative by the Delfland Water Board in the field of open data exchange. A good example in Rotterdam is the study recently launched by the Veldacademie to support home technology in the IJsselmonde area.

². In 2013, Iranians hacked the control system of a dam in New York state in the USA. It is not inconceivable that something similar could happen in the Netherlands, with its many locks, dams and pumping stations.

3R. CYBER INCIDENTS BY TYPE

ATTACKS BY TYPE



- Phishing
- Information Leakage
- Infection Attacks
- Malicious Code
- Ransomware/Cryptoware
- Denial of Service
- Botnets
- Cyberbionage
- Databreaches
- Hacking/Cracking
- Other

ATTACKS: GOVERNMENT



- Phishing
- Information Leakage
- Infection Attacks
- Malicious Code
- Ransomware/Cryptoware
- Denial of Service
- Botnets
- Cyberbionage
- Databreaches
- Hacking/Cracking
- Other

ATTACKS: PRIVATE



- Phishing
- Information Leakage
- Infection Attacks
- Malicious Code
- Ransomware/Cryptoware
- Denial of Service
- Botnets
- Cyberbionage
- Databreaches
- Hacking/Cracking
- Other



ROTTERDAM’S CYBER VULNERABILITIES AND CHALLENGES

CAUSE	EXPLANATION	POTENTIAL CONSEQUENCES FOR ROTTERDAM
Hyperconnected world	Within the cyber domain, everything is (potentially) connected to everything else, almost instantaneously, all around the globe. Data can be sent to the other side of the world in an instant – and then sent back again. Adverse situations require very rapid action, but this is rendered impossible by definition. Governments, businesses and citizens are always in the position of playing catch-up when it comes to the digital world. Hyper-connectivity brings great benefits, but also major vulnerabilities.	Rotterdam is part of this hyper-connected world, of course. The city’s extensive industrial complex, businesses and vital infrastructure such as bridges, locks, data centres, traffic management systems and hospitals (including the Erasmus MC, the largest university hospital in the Netherlands) are all connected to the internet. And the city’s level of connectivity will increase still further as we benefit from the new opportunities that added connectivity brings (the Smart City).
Physical location	The cyber infrastructure of delta cities is particularly vulnerable to the risk of flooding. The same applies to cities in densely populated, highly developed regions where internet connectivity is often very high.	More than 80% of Rotterdam is located on ground that is below sea level and the city has an extensive water management infrastructure. The Netherlands also has one of the most developed internet infrastructures in Europe.
Centralization of functions	Many functions are being centralized due to cost considerations. This offers undeniable benefits, but it can also have drawbacks when it comes to cyber security. One example is the plan for one integrated national monitoring centre.If no back-up option is available, a hacking incident or power failure could lead to the failure of the entire facility.	Rotterdam is also subject to the centralization of functions such as the emergency services control room and the water management system. Even though in this case there are back-up systems present, it will be essential to remain alert to effects of centralization of (other) important services.

AS EUROPE’S TRUSTED GATEWAY, ROTTERDAM CANNOT AFFORD ANY DISRUPTIONS.

CAUSE	EXPLANATION	POTENTIAL CONSEQUENCES FOR ROTTERDAM
Insufficient redundancy	Many cyber systems have insufficient (technical or organizational) redundancy. Redundancy can be achieved internally through the automatic acquisition of system components, or externally by ensuring that analogue systems are available to take over the tasks of the digital system if this becomes necessary. The Cyber Security Review of the Netherlands 2015 highlighted that the availability of ICT systems is becoming increasingly important, not least because the alternatives to those systems are disappearing. Vital societal processes could fall flat if the ICT systems on which they depend become unavailable for some reason and, more importantly, the old analogue alternatives are no longer in place. One example is the end of the old-fashioned ‘blue envelopes’ sent out by the Netherlands Tax Authority. In the future, everything will have to be processed digitally. But if the digital system were to fail for some reason, no analogue (paper-based) back-up will be available.	Redundancy in vital cyber systems is also very important for Rotterdam in the field of water management. In Rotterdam, we know that certain vital cyber systems (the emergency services control room and water management systems) already have back-up capacity in place. However, we still have no overall picture for all the vital cyber systems in the city.
Failure to keep cyber systems and knowledge up-to-date.	Due to reasons of cost or lack of knowledge and experience, old systems are still sometimes used, but fewer and fewer people know how these work. Sometimes there are some surprising gaps in security. Let us take, for example, the process operator in the petrochemicals installation who can log in from home, but does this using an outdated computer system. Or the failure to ensure that personnel have sufficient knowledge in the field of cyber skills and security awareness, which contributes to risks. Software vulnerabilities are also cited as the Achilles’ heel of digital security in the Cyber Security Review of the Netherlands 2015. If software is not designed sufficiently robustly to withstand cyber threats, the processes that support ICT systems will also be vulnerable to failure.	We do not currently have enough knowledge when it comes to outdated IT systems that are used for vital urban functions in Rotterdam, or of the level of knowledge of the employees who work with them. Further research is therefore needed.

ROTTERDAM’S CYBER VULNERABILITIES AND CHALLENGES

CAUSE	EXPLANATION	POTENTIAL CONSEQUENCES FOR ROTTERDAM
Internet ownership	The internet is not controlled centrally and has no ‘on/off’ button. The internet belongs to everyone – and therefore to no-one. It is formed by everyone who is connected to it and who contributes to it. It is a shared and integrated domain. This increases the vulnerability of its users.	As such, of course, Rotterdam is just one of the many players involved in the internet. The internet brings our city many benefits and opportunities, but at the same time the city is just another internet user: we are (increasingly) dependent on it, and therefore vulnerable.
Lack of cooperation and openness	An awareness of cyber threats and knowledge of incidents that have occurred in the past, and of the measures that can be taken to protect or restore internet-based infrastructure, are essential aspects of cyber resilience. However, the importance of limiting reputational damage and simple lack of knowledge means that this kind of knowledge is often not shared. Cyber awareness is frequently low (with the exception of specialists) , and the dependency on others within organizations and chains is frequently high. Limited cooperation and sharing of knowledge and experience increases our vulnerability to cyber threats as an urban community.	In Rotterdam as well, there is limited cooperation between different organizations in the field of protection against cyber threats. However, individual organizations do have knowledge and experience that they can draw on. Building trust and ensuring openness are essential in order to build a cyber resilient Rotterdam.
Shifting power relations	The exponential growth of the digital domain is leading to changes in power relations – and these are affecting our cities too. Companies like Google, Microsoft, Facebook and Apple have attained near-monopoly positions. This means that a shift in the power relationship between the public and private sectors is occurring, with the scales tipping in favour of the private sector. Cities are increasingly vulnerable because our freedom to use (new) ICT facilities is only relative. We are dependent on what these big companies choose to develop and offer us.	As a (relatively small) city in international terms, Rotterdam is only one of many cyber technology users. Our ambition to maximize the benefits of cyber technology (Smart City) must be accompanied by an awareness of the vulnerabilities created by these technologies. Solutions need to be devised in advance (using dual loops), and this will lead to redundancy.

In general, Rotterdam, like many other big cities in the Netherlands, is vulnerable to cyber disruptions and cyber threats, but there is a growing awareness of this vulnerability. It impossible to say exactly how vulnerable Rotterdam’s urban community really is. Would the city continue to function adequately in the event of coordinated cyber-attacks or the large-scale failure of the ICT systems that manage the city’s vital functions? Would it be able to recover quickly? And would it recover to the same level as before or – hopefully – to an even higher level?

What is needed is a better understanding of the extent to which citizens, companies and organizations are sufficiently aware of potential cyber threats and

vulnerabilities, and of the extent that they are equipped to cope with them. This knowledge is also needed to understand the many chain dependencies between companies and organizations. This is a virtually impossible task. For this reason, further research is needed.

Nevertheless, it is currently already possible to build up a more detailed picture of the cyber threats that Rotterdam may one day have to face. The National Cyber Security Centre (NCSC) has published its opinion in the Cyber Security Review 2015. It cites a number of potentially malicious parties who could pose a threat to organizations.



3S. CYBER THREATS MATRIX

Targets			
Source of the threat	Governments	Private organisations	Citizens
Professional criminals	Theft and publication or selling of information ↘	Theft and publication or selling of information	Theft and publication or selling of information
	Manipulation of information	Manipulation of information	Manipulation of information
	Disruption of IT	Disruption of IT	Disruption of IT
	IT takeover	IT takeover ↘	IT takeover
State actors	Digital espionage	Economic espionage	Digital espionage
	Offensive cyber capabilities	Offensive cyber capabilities ↗	
Terrorists	Disruption/takeover of IT	Disruption/takeover of IT	
Cyber vandals and script kiddies	Theft of information	Theft of information	Theft of information ↗
	Disruption of IT	Disruption of IT	
Hacktivists	Theft and publication of information obtained	Theft and publication of information obtained	↘
	Defacement	Defacement	
	Disruption of IT	Disruption of IT	
	IT takeover	IT takeover ↘	
Internal actors	Theft and publication or selling of information	Theft and publication or selling of information	
	Disruption of IT	Disruption of IT	
Cyber researchers	Receiving and publishing information	Receiving and publishing information	
Private organisations		Information theft (industrial espionage)	Information theft (industrial espionage)
No actor	IT failure	IT failure	IT failure

Low	Medium	High
No new trends or phenomena of threats have been observed. OR (Sufficient) measures are available to remove the threat. OR No incidents worth mentioning have occurred during the reporting period.	New trends or phenomena of threats have been observed. OR (Limited) measures are available to remove the threat. OR Incidents have occurred outside of the Netherlands, a few small ones in the Netherlands.	There are clear developments which make the threat expedient. OR Measures have a limited effect, so the threat remains substantial. OR Incidents have occurred in the Netherlands.

↘
↗
Change compared to CSAN-4

Cyber Security Assessment Netherlands. CSAN 2015

CYBER THREATS

SOURCE OF THREAT	INTENTIONS
Professional criminals	Financial gain
Foreign state actors	Enhance geopolitical (or internal) power
Terrorists	Bring about changes in society, spread fear and insecurity, influence political decision-making
Cyber Vandals and ‘script kiddies’	Expose security vulnerabilities; hacking as a challenge and an opportunity to show off their skills
‘Hacktivists’	Ideological motives
Internal actors	Revenge, financial gain or ideological motives
Cyber researchers	Expose weaknesses or make a name for themselves
Private organizations	Obtain valuable information (espionage)
Technical faults	

All these cyber threats are relevant to Rotterdam. There are many potential actors, and just as many potential reasons for cyber-attacks. It is true, however, that certain threats are likely to focus on specific ‘target groups’. Cyber espionage might seem a rather far-fetched notion to the average citizen of Rotterdam. But the city’s port and industrial complex is of genuine interest to some states, and cyber espionage represents a potential threat to companies based in the port area. Successful cyber espionage could also undermine the competitiveness of companies and therefore lead to a loss of employment. Internal actors may also be motivated to deliberately undermine companies. Careless mistakes and accidents also constitute a threat. Unfortunately, the vulnerability of the operational management of the City of Rotterdam was demonstrated recently when it was discovered that due to the actions of one staff member, personal

Every month, an estimated 10,000 targeted cyberattacks take place on the City of Rotterdam’s ICT environment. Most of these are automated attacks. The municipality is also the target of around a million other cyber-attacks per month, such as phishing and spam.

data relating to 25,000 Rotterdam residents had been temporarily accessible on the internet.

Cyber threats are a reality of contemporary life. Any modern urban society in which ICT is a basic provision will be inherently vulnerable. The challenges for Rotterdam lie in increasing awareness and improving knowledge of cyber threats, and in sharing the knowledge and experience of individual organizations about how cyber incidents can be minimized. In addition, Rotterdam wishes to work closely and learn from its partners. If we do this, hopefully we can reach an even higher level of resilience (permanent learning curve).

DEVELOPMENTS

The internet is a game changer: its emergence and expansion over recent decades represent a disruptive technological change.

Four major trends can be predicted for the next ten to fifteen years (see, for example, the Microsoft publication ‘Rotterdam 2025: Cyber Resilience, the Digital Dividend’) in the field of cyber technology: The Internet of Things, big data and machine learning, the cloud and mobile connections.

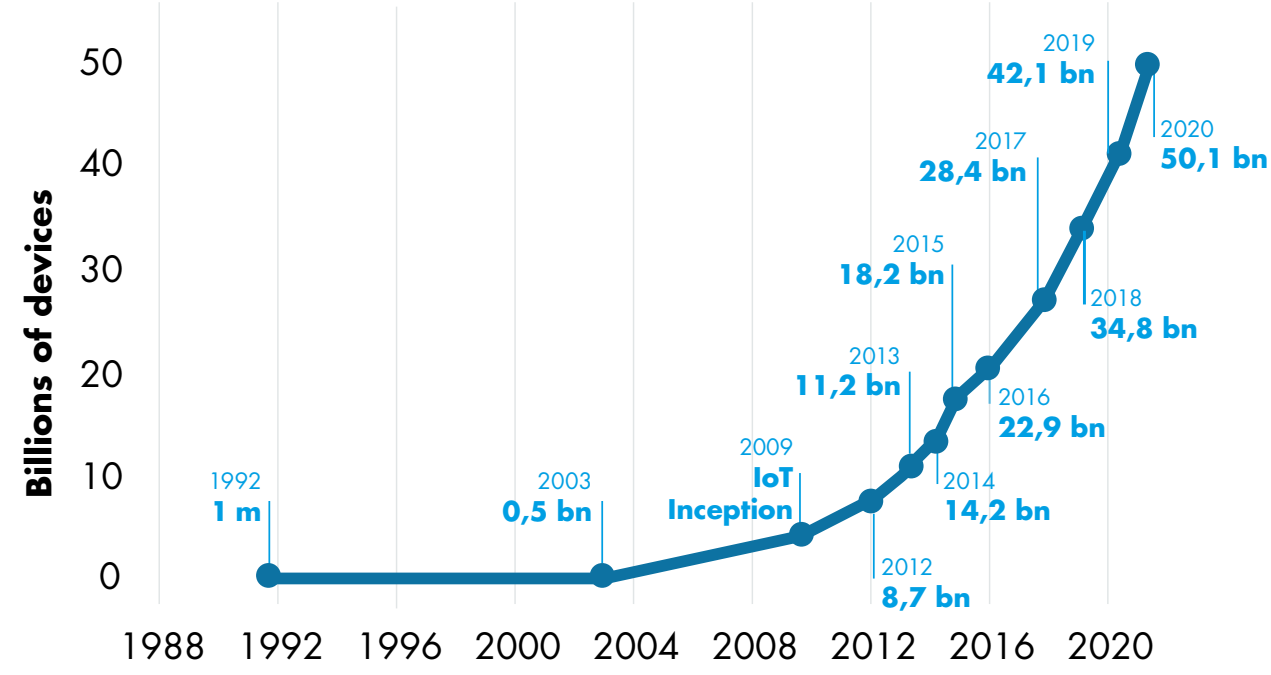
3. VISION AND GOALS

MAJOR CYBER TRENDS

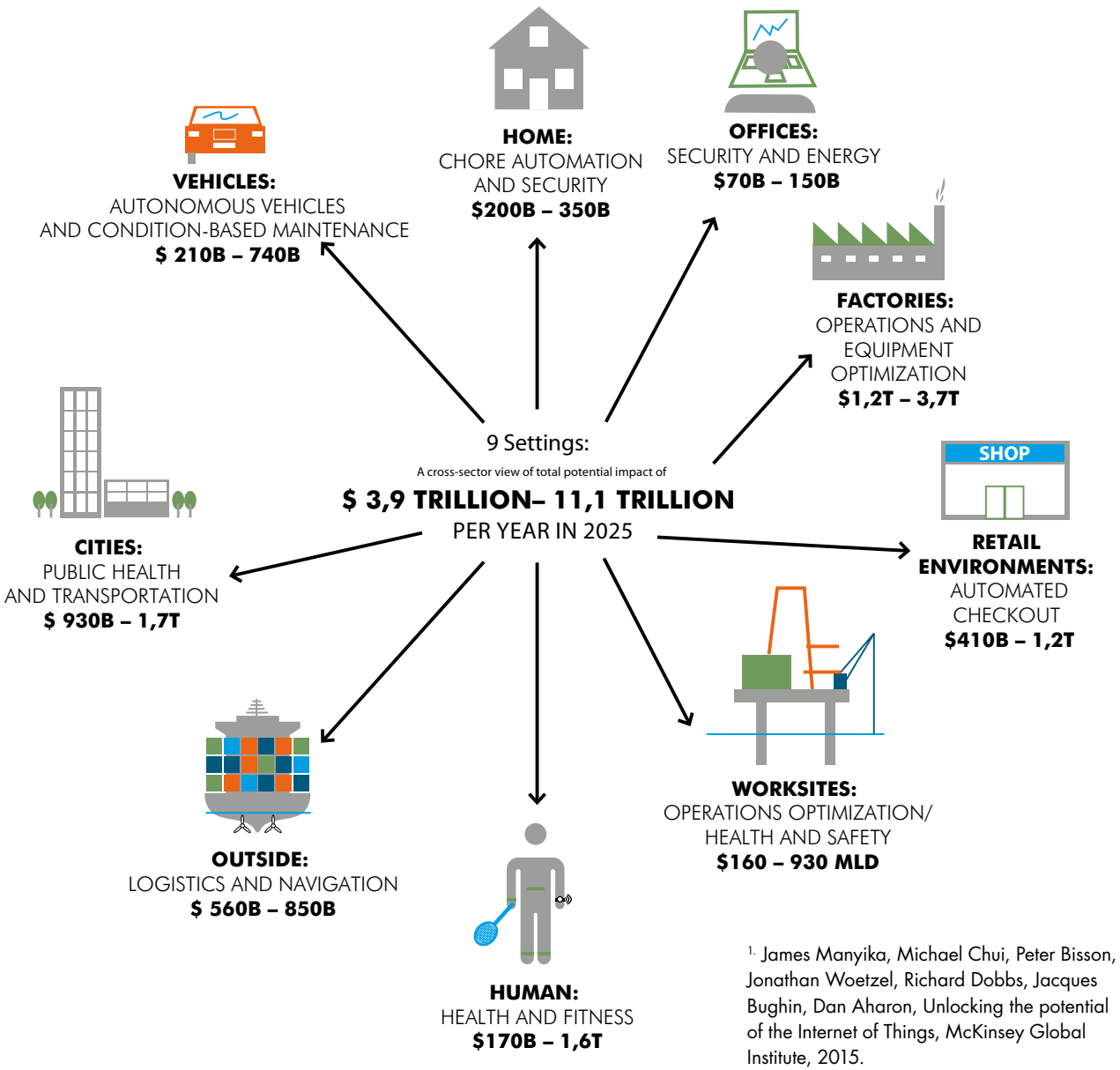
1. The Internet of Things	Microsoft expects that by around 2025, fifty billion devices will be connected to the internet. This will include both domestic devices and mobile objects (such as waste containers), as well as immobile items and infrastructure such as bridges, roads and outdoor furniture. The Internet of Things will provide real-time data that can be used to contribute to operational efficiency as well as predictive maintenance and predictive response to disruptive actions.
2. Big data and machine learning	Vast quantities of data ('big data') will become available, which can be used to make predictions and to market products. These vast quantities of data will require processing using analytical technology in order to distinguish 'the wood from the trees' (in digital terms). Big data will also be linked to machine learning technology: smart machines will be able to filter the data needed from the mass of irrelevant data with incredible speed.
3. The cloud	The cloud is increasingly being used to store data securely, but it is also enabling faster methods of data processing (cloud computing). Cloud storage reduces the vulnerability of individual data storage systems because copies are always available at multiple physical locations.
4. Mobile connections	By 2025, the most frequent method of accessing the internet is expected to be via a mobile connection, while the use of desk top PCs will have decreased.

3T. GROWTH IN THE INTERNET OF THINGS

The number of connected devices will exceed 50 billion by 2020



3U. POTENTIAL VALUE OF THE INTERNET OF THINGS IN 2025



These trends will have a major impact on the relationship between government and citizens, as well as on the way our economy functions. One of the objectives of the Rotterdam Next Economy Road Map is to identify these effects and determine the actions required for Rotterdam. Broadly speaking, the consequences of these trends will be as follows:

- Changes in the labour market. Innovative companies and (cyber) technologies will play a greater role in the new economy. This will require a different type of skills from employees, who will also need to update their skills more frequently and rapidly: the skills that are useful in today's labour market

may quickly become obsolete tomorrow. Many professions that existed one hundred years ago no longer exist today; in their place, we have new professions, with different skills sets. This phenomenon will accelerate. Certain (lower) middle-class occupations are expected to disappear. At the same time, we are already facing a shortage of trained IT staff at all levels and from all types of secondary and further education.

- The demand for 'digital skills' will become ever higher, and not just among company employees: citizens too will need digital skills to continue to participate in society. Where these skills are lacking,

3. VISION AND GOALS

- this could lead to a widening gap between ‘haves’ and ‘have-nots’ in the field of cyber, which will undermine social inclusiveness.
- Dependence on cyber technology for important urban functions will increase. Using robotics and automation may enable the elderly to live more independently in their own homes or allow remote diagnosis and medical advice (e-health, active aging). But these techniques will also play an increasing role in, for example, monitoring the state of repair of devices and objects in urban outdoor areas.
 - The relationship between government and citizens will change fundamentally. Direct interaction and dialogue between government and citizens will become more commonplace; citizens and government will have more equal positions when it comes to information; and government services will take more account of citizens. Citizens are just as good at staying up to date with certain subjects than the government; indeed, they are often able to do so more quickly and thoroughly. This is sometimes a cause of resistance, impatience and irritation – and citizens will (rightly) demand more input and consultation. Traditional systems of governance in an urban society will therefore be forced to move with the times. Developments in the domain of cyber technology will affect the governance of the city.

OUR HIGH-TECH URBAN SOCIETY REQUIRES CYBER RESILIENCE.

- New decision-making models will emerge. Society is looking for new decentralized forms of decision-making, and new technology will enable this to happen. This shift is leading to the creation of local energy cooperatives, maker spaces, business collectives and informal networks. Often these are independent of official decision-making channels and sometimes such initiatives are of a temporary nature. Digital platforms are enabling new business models to exist, such as Uber and maker spaces, for example. Urban governance is changing.
- Company business models are changing. Accelerating developments in ICT mean that existing business models are becoming outdated ever more

quickly. Companies are therefore required to figure out new business models within an ever shorter period of time. Just think of the market for mobile telephones or music, for example. This trend is reinforced by the fact that in an increasing number of areas, there is a trend towards zero marginal costs.

The exponential growth of cyber technology is undeniably affecting the cyber resilience of Rotterdam. In addition to the opportunities offered by new technology, our vulnerability to cyber threats is increasing. But with its major educational and technical capabilities, its growing start-up community, and its communication and data centres, Rotterdam undoubtedly has the potential to transform itself into a leader in the field of urban cyber resilience. Higher levels of resilience and innovation will, in turn, lead to higher economic growth. Our high-tech urban society requires cyber resilience!

WORLD ECONOMIC FORUM, CYBER PRINCIPLES

Working on the basis of an international, multi-stakeholder initiative supported by various sectors, the World Economic Forum (WEF) has developed a set of principles by which systematic resilience against cyber risks can be enhanced. Together with over 110 private and public organizations around the world, the City of Rotterdam has signed up to these principles. The WEF uses a maturity model to assess the degree of cyber resilience of participating organizations. The WEF’s model, which is described in the publication ‘Partnering for Cyber Resilience. Risk and Responsibility in a Hyper Connected World - Principles and Guidelines’, is also a useful method of assessing the extent of cyber resilience at the sectoral level (such as in healthcare, education and mobility) as well as the resilience of the city as a whole. Rotterdam is currently likely to be in the transition phase between the first and second phases.

TOWARDS A CYBER RESILIENCE STRATEGY

Rotterdam urgently needs to become a more cyber resilient city and port (see section 2.3.3). Cyber Resilience is therefore a high priority within Rotterdam’s wider resilience strategy. The aims are to reduce vulnerability to cyber threats and make cyber resilience a primary requirement for companies wishing to locate in Rotterdam. In addition, it is a way of maximizing the

3V. THE WORLD ECONOMIC FORUM’S MATURITY MODEL FOR ORGANIZATIONAL CYBER RESILIENCE



opportunities for the citizens of Rotterdam. This is another opportunity for Rotterdam to reinvent itself. By linking the current situation with a new generation of cyber expertise, companies, institutions and citizens alike can be made more resilient in the face of cyber incidents and threats. Developing cyber resilience skills will then have a significant trickle-down effect on the local start-up community and the general level of the expertise in Rotterdam and the surrounding region.

An action plan in this area has been developed by a partnership between the city's local authority troika (the mayor, the Chief Public Prosecutor and the Rotterdam-Rijnmond police commissioner), the Port Authority, the Public Prosecution Service, the municipal security department, the Port Police Authority and Deltalinqs (a group representing the interests of over 60% of the firms active in the Port of Rotterdam). This plan will be put into effect over the next few years. This process has served as a basis for the development of building blocks for the city-wide cyber resilience strategy.⁴

The strategy for enhancing Rotterdam's level of cyber resilience and reaching a higher level of maturity (to use the terms of the WEF model) has two tracks: one for the port and one for the city. For both these tracks, a total of fifteen building blocks have been identified. Of course, as much collaboration as possible will be involved when working on these two tracks. The building blocks for cyber resilience are included as action points in the resilience strategy, along with a few more general activities (see section 4.3 and 4.4). Four of these building blocks have flywheel action status because they will be decisive in achieving the cyber resilience strategy. The Cyber Resilient Port track has already been divided into seven building blocks, which have been approved by the Security Troika and port partners.

¹. At the request of the Seaport Police and Deltalinqs, TNO has implemented a 'challenge' to address the question of what it would take to make Rotterdam's port more cyber resilient. The premise on which this was carried out was that cyber incidents will, undoubtedly, occur at some point. The challenge identified how, using collaboration, the sharing of knowledge and experience, and increasing awareness, it is possible to handle cyber incidents and threats.

3W. THE 7 BUILDING BLOCKS OF THE PORT CYBER RESILIENCE STRATEGY



To identify cyber threats and define priority actions that can enhance Rotterdam’s cyber resilience, nine urban functions were used which together (largely) determine the functioning of the city.¹ Cyber threats

could undermine the cyber systems on which these urban functions are based. Measures (building blocks) that can withstand these threats are expected to increase the resilience of all these features and would enhance the opportunities for the city to the maximum extent. Analysis sessions with representatives from various urban functions have led to the identification of eight building blocks for cyber resilience. These will be operationalized in tandem with the port building blocks.

The operationalization of all these building blocks will greatly enhance Rotterdam’s cyber resilience within five years, and will enable the city to reach a more ‘mature’ level of cyber resilience. At the heart of this strategy are awareness, effective cooperation, continuous shared learning and looking ahead to the future.

¹ The functions were as follows: mobility, economy, healthcare, governance, public services, housing, education, public order and security, and basic amenities. These include port processes and processes within municipal bodies. Two workshops were held with over thirty representatives of these urban functions. The threats and opportunities were considered from the perspective of the City of Rotterdam’s wider cyber domain. Technological, social and economic developments were also detailed, and the trends and changes predicted by Microsoft by the year 2025 were also analysed. This enabled the potential for improvement to be identified in terms of making urban functions more resilient, flexible and adaptable.

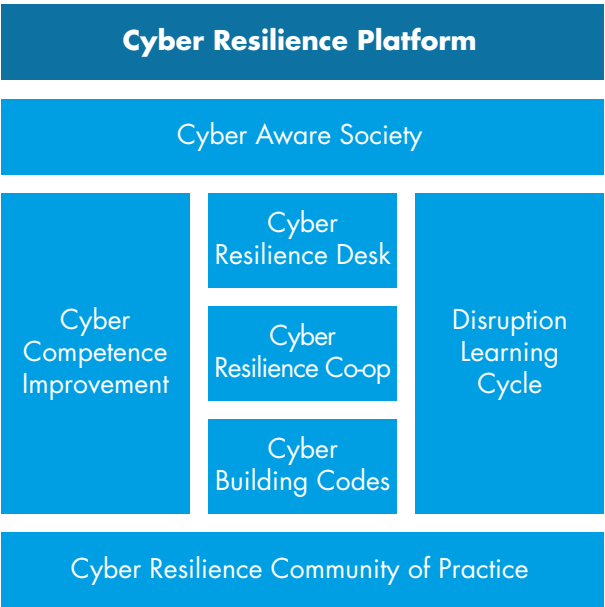
THE 7 BUILDING BLOCKS OF THE PORT CYBER RESILIENCE STRATEGY

STRATEGY BUILDING BLOCKS (PORT)	RESILIENCE GOAL
Port Resilience Officer (flywheel action)	Coordinating and monitoring the implementation of the building blocks of the cyber resilience strategy for the port
Cyber Notification Desk	Understanding the nature and number of cyber incidents as a basis for learning and improving
Cyber Threat Intelligence Watch	Monitoring cyber threats and trends
Community of Practice	Sharing knowledge and experience in relation to cyber incidents, security and the opportunities offered by new technology
Cyber Response Team	Rapid response in the event of (potential) incidents.
Cyber Co-Op	Acquiring high-quality cyber products and services that help to address security concerns
Cyber communication	PM

THE 8 BUILDING BLOCKS OF THE CITY CYBER RESILIENCE STRATEGY

BUILDING BLOCKS OF THE STRATEGY (CITY)	RESILIENCE GOAL
Cyber Resilience Platform (flywheel action)	Coordinating and monitoring the implementation of the building blocks of the cyber resilience strategy
Cyber Aware Society	Increasing the awareness in Rotterdam society of cyber threats and potentials for handling these (motto: taking responsibility for yourself)
Cyber Competence Improvement	Developing the skills of citizens, businesses and organizations, so that they become more skilled in the cyber domain (motto: life-long learning)
Cyber Resilience Desk (flywheel action)	Understanding the nature and number of cyber incidents as a basis for learning and improving (Motto: eyes and ears open)
Cyber Resilience Co-op (flywheel action)	Acquiring high-quality cyber products and services that will help to address security concerns (motto: you can travel faster on your own, but you can go further together)
Cyber Building Codes	Developing high-quality cyber products and services that can enable end users to move more quickly and increase ease of usage. (motto: resilience by design)
Cyber Disruption Learning Cycle	Structured learning in the event of cyber incidents (motto: incidents are an opportunity for learning)
Cyber Community of Practice	Sharing knowledge and experience in relation to cyber incidents, security and the opportunities offered by new technology (motto: communication brings us closer)

3X. THE 8 BUILDING BLOCKS OF THE CITY CYBER RESILIENCE STRATEGY



FLYWHEEL ACTION

From Smart City to Cyber Resilient
(‘Deltaplan Cyber’)

3.5 CLIMATE RESILIENT ROTTERDAM TO A NEW LEVEL.



“Climate proof plus cyber proof critical infrastructure”

VISION

By 2025, Rotterdam will be a resilient city that is able to withstand the effects of climate change, such as extremely heavy rainfall, rising temperatures and rising water levels. Climate adaptation measures will be integrated into all phases of spatial developments and a range of aspects of our urban infrastructure. Designing with water in mind will form the basis of this approach. Participatory processes will be used to identify smart combinations of initiatives and spatial planning measures that contribute to both climate resilience and the quality of our outdoor spaces, improve health and social cohesion, and help to safeguard property values. Citizens, businesses and institutions will work closely with the city’s municipal authorities and water management organizations. All parties will be aware of the need for innovative and flexible adaptation measures; they each will have their own responsibilities and perspective, and they will embrace the possibilities of co-creation. Rotterdam in 2025 will be in a position to share and market its knowledge and experience through local and (inter) national networks.

CLIMATE ADAPTATION MEASURES CAN CONTRIBUTE SIGNIFICANTLY TO A MORE ATTRACTIVE AND PROSPEROUS CITY.



3. VISION AND GOALS

CURRENT SITUATION

As an industrial port located in a low-lying delta region, Rotterdam is particularly vulnerable to the effects of climate change. Some 80% of our city is below sea level. In this delta city, water is all around us all the time. Rotterdam has to contend with an increasing risk of flood events due to rising sea levels, increasing fluctuations in the volumes of water flowing through our rivers, more frequent periods of heavy rainfall, and longer periods of drought and heat. Rotterdam has had a long history of adapting gradually to changing circumstances. Over the years, the city has developed a robust system of dams and flood defences, sewers, waterways and canals – all of which help to protect the city from being inundated from all sides – from rivers, the sea, the land or the air.

Our system of flood protection against the sea and the river consists of an extensive network of dunes, dikes and locks. The system is formed by robust but also flexible barriers around the city, which ensure that high water levels due to storm surges at sea cannot reach the city. This means that there is a very limited chance that the low-lying urban area behind these dams could be flooded. The former port areas that are located outside the outer dike are not protected by primary

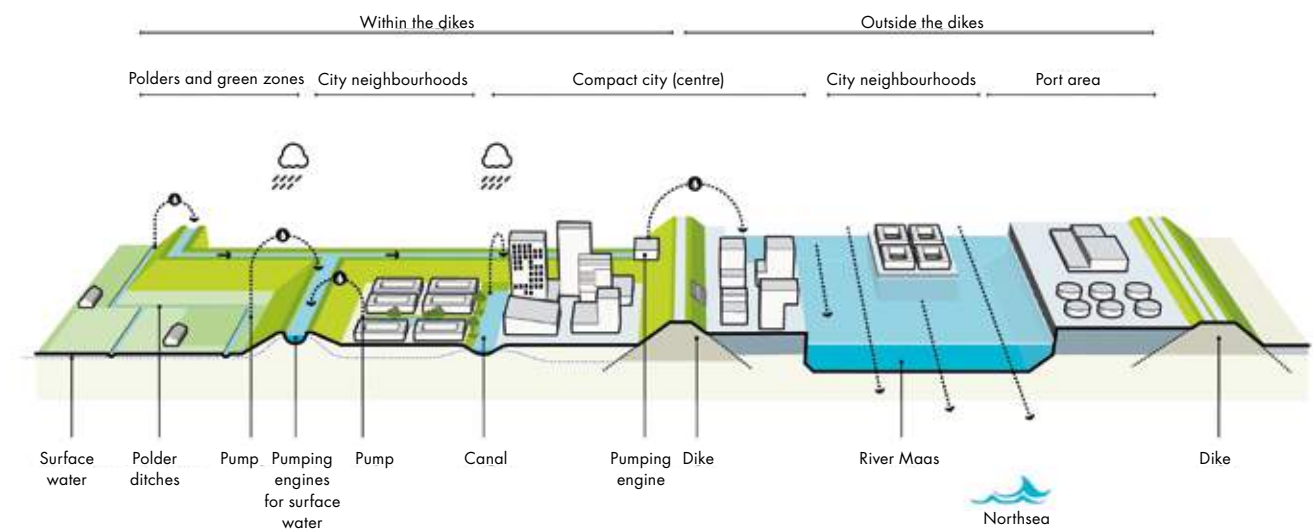
flood defences, however, and are therefore vulnerable to high water levels in the river. Although these areas are subject to a higher risk of flooding, the depth of the water is relatively low and any flooding is often short-lived.

THE ROTTERDAM ADAPTATION STRATEGY (RAS)

The Rotterdam Adaptation Strategy (RAS) – which was established in 2013 and is currently being implemented – has put guidelines in place for a more climate-adaptive city. An important principle within this strategy is that water and climate adaptation measures can contribute significantly to a more attractive and prosperous city for everyone. In this sense, the RAS is part of a long tradition of using water as an opportunity to make the city more attractive. When it comes to making the water system more climate-adaptive, Rotterdam is already leading the way in global terms.

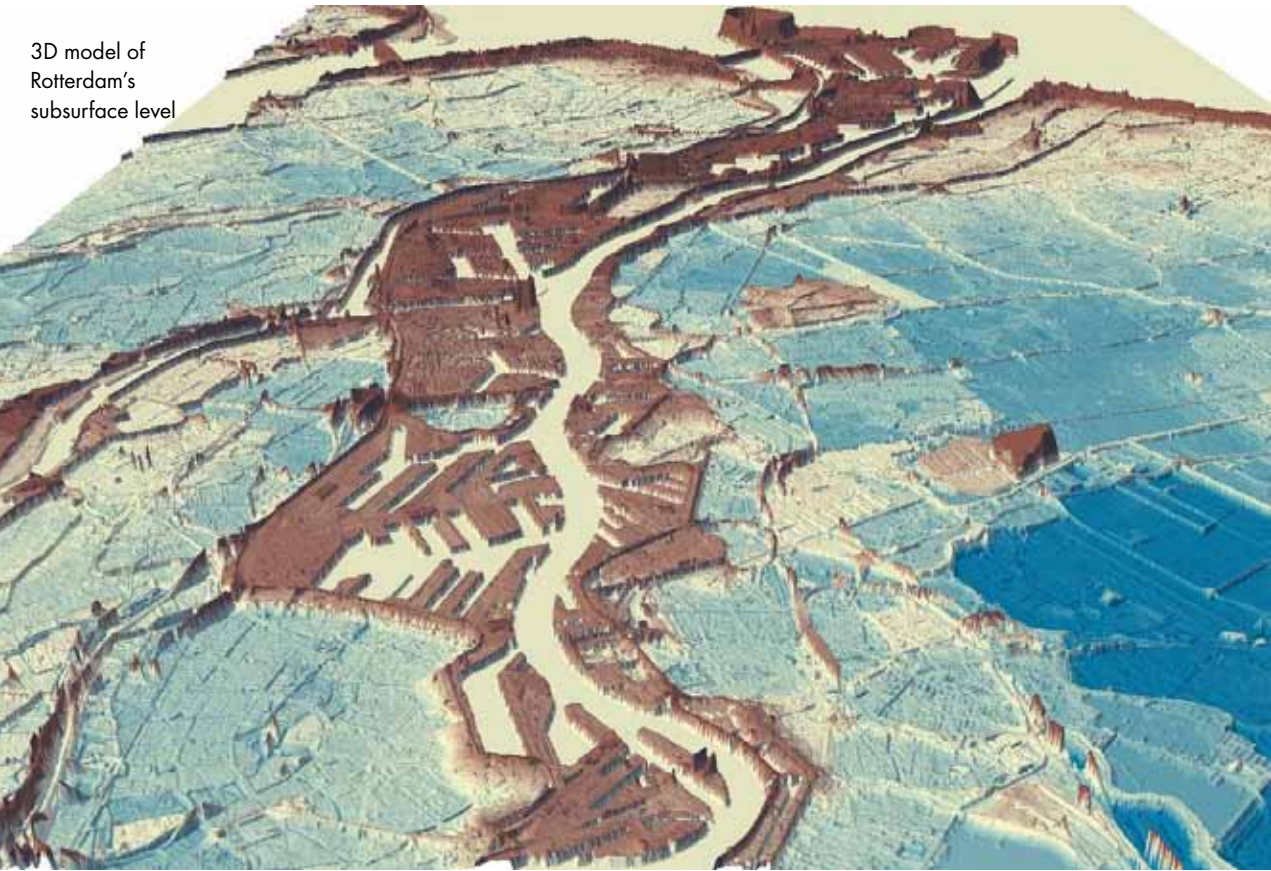
The biggest challenge for Rotterdam now is to ensure that it can continue to apply this principle at a time when the influence of the public sector is decreasing, new urban developments are on a much smaller

3Y. ROTTERDAM’S WATER SYSTEM



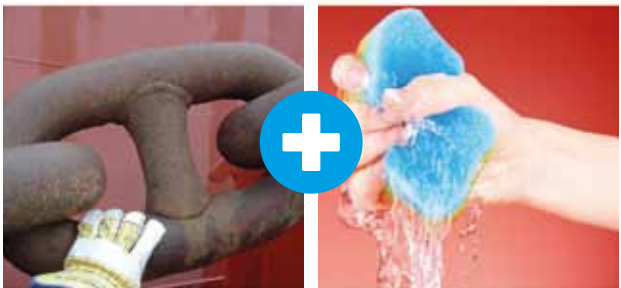
scale and tend to focus more on conservation and management, and the city is facing major socio-economic challenges. Additionally, this is a time when we are having to assess our dependence on ICT and energy-driven systems. In short, climate adaptation in Rotterdam is entering a new phase.

WATER HAS TRANSFORMED FROM A THREAT INTO AN OPPORTUNITY.



3D model of Rotterdam's subsurface level

3Z. PRINCIPLES OF ROTTERDAM’S ADAPTATION STRATEGY (RAS)



ROBUST AND RESILIENT



DELTAWORKS AND CITY’S CAPILLARIES



PROTECTION AND FLEXIBILITY



TECHNOLOGY AND NATURE

WHAT IS ALREADY HAPPENING?

- **The increasing absorption capacity of the city.**

Climate change is leading to more frequent and more intense storms and periods of wet weather. The added intensity and frequency of extreme rainfall necessitates more resilient rainwater management. The RAS includes steps to increase the city's water storage capacity using the principles of water retention, storage and disposal. The city's capacity to store water must be integrated into its 'capillary system'. This can be done by increasing the water storage capacity of public spaces, using more green roofs and increasing the absorption capacity of both public spaces and privately owned land. This challenge will be addressed in tandem with the water cycle transition project that is already underway, which involves a commitment to the separation of rainwater and sewage water, and which the municipality is working on in partnership with the city's three water boards.

- **Pilot schemes for projects outside the flood dikes.**

Rising sea levels and changing river flow volumes in the Meuse mean an increased likelihood of flooding in areas outside the flood dikes. The older areas in the former ports are particularly vulnerable. The petrochemical companies located in the post-war sections of the port are particularly vulnerable, and

this represents an increasing risk. Here, the probability of flooding is very limited, but the consequences of flooding would be severe and the impact would not be confined to our region. For that reason, several pilot schemes have been launched as part of the national Delta Programme.

- **Include the issue of heat stress in the Greening strategy.**

Climate change is also causing longer periods of above-average temperatures and below-average rainfall. These changes can lead to health problems, an increase in deaths and a fall in labour productivity. Intensively urbanized areas with little shade, green space or water are particularly susceptible to heat stress. In Rotterdam, this means the city centre and the 19th-century districts. The risk of heat stress is often seen as a lower priority in Rotterdam. Separate measures have not yet been deemed necessary. However, we will need to address this issue as we work on making the city greener.

NEW DEVELOPMENTS AND NEW CHALLENGES

There are also new developments that are leading to new challenges. Climate change means a gradual acceleration in dynamic processes such as rising sea levels, and it also brings new uncertainties. These are

likely to impact not only on the physical environment (where it is important to keep our options open) but also on the way in which we organize our community – for example our methods of policy-making, financing and allocating responsibilities. All this will place greater demands on our capacity to learn, our resourcefulness and our flexibility.

- **The changing role of government.**

We are increasingly seeing the devolution of responsibilities from central government to local levels of government. This development is occurring at the same time as a decrease in public funds. This is part of a wider shift in public and private responsibilities (and an increasingly indistinct boundary between these two spheres). Such a shift is also evident in the responsibility for healthcare and socio-economic development away from centralized national authorities to the local level.

- **Changing role of citizens.**

Citizens as individuals are becoming more assertive: they are better informed and better able to organize themselves, partly due to the influence of social media. Top-down government is therefore no longer enough when it comes to working on climate resilience. Increasingly, we will need to work in partnership with citizens and citizens' groups. This is partly because opportunities in the public sector are declining, but also because a smaller-scale approach means that we can enter the realm of the individual citizen. The changing relationship between government and citizens is also leading to a greater emphasis on the self-reliance of citizens. This is an issue in the field of climate change too.

- **Changes in the field of spatial planning**

The short-term development of real estate through public-private partnerships has led to a shift in focus towards the long-term management and maintenance of the existing city. The growing importance of asset management plays a role here. This means that on the one hand, we will need to focus more on the longer term (and the opportunities of climate change). On the other hand, more stakeholders will be involved, meaning that we will need to finance projects in a different way rather than the old collective arrangements.

- **Changing economy.**

The time of large-scale construction projects appears

(for now) to be over. Urban development is now more focused on brownfield development than greenfield development. Linking new-build areas and restructuring work will remain relevant, but the biggest challenge will be to climate-proof our existing city! This will only work if we undertake small-scale operations across the city. For example, we can choose to replace roofs with roofs that can store water and create links with urban maintenance programmes.

- **Increasing digitization and (inter) dependency.**

Digitization presents opportunities in the form of rain sensors and early warning systems, for example. The downside is that this will lead to increasing technological interdependencies and vulnerability of the water infrastructure (cascade effects).

These transitions will mean that our capacity to fund adaptation measures and our ability to implement public projects in the field of climate-change adaptation will come under increasing pressure. This will apply particularly to climate adaptation challenges that do not fall directly under the responsibility of the municipality. It would be the case, for example, with issues of heat stress and water safety outside the flood dikes (even though the city is responsible for risk assessments in this area). In many cases, there is a lack of long-term financing for the implementation of climate adaptation measures. The implementation of adaption measures is increasingly linked to other municipal programmes, such as the creation of green spaces in the city, the sustainability programme and the replacement of existing infrastructure. These programmes will therefore determine how quickly we can adapt our city. This may mean that security is in doubt over the longer term. This challenge also applies to measures to reduce the risk of flooding outside the flood dikes, to some extent.

TOWARDS A NEW PHASE IN CLIMATE ADAPTATION

It is important to continue working on the implementation of the RAS. Continuity is essential: this is an approach that will take time because it is based on harnessing the city's natural dynamism. In view of the new developments that are now underway, a number of additional initiatives have been proposed. These would lift the implementation process to a new level. A new phase in climate adaptation has begun.



3. VISION AND GOALS

1 CLIMATE RESILIENCE INTO THE CITY'S 'CAPILLARY SYSTEM', IMPLEMENTED BOTH FOR AND BY THE CITY'S RESIDENTS.

The implementation of the RAS is now in full swing. It has already led to the creation of 220,000 m² of green roofs and a number of open public areas that can store excess water, such as the water plaza at Benthemplein (Benthem Square). Benthemplein is a model for Rotterdam's approach: integrated and multifunctional, implemented both for and by its citizens. Thanks to European funding, Benthemplein has now been completed and is the subject of a great deal of international attention. Meanwhile, several other water plazas and other forms of creative water storage have also been realized. However, there is limited funding for such projects, and the opportunities also remain limited. In order to fully climate-proof the city, it will also be necessary to move towards smaller-scale measures, such as rain gardens and measures to increase the absorption capacity of hard surfaces (under the motto: 'slabs out, green in'). Small-scale measures at the level of the city's 'capillary system' are essential, but must be implemented across the whole city. Cooperation with

citizens, organizations and businesses will be necessary to ensure that these measures are implemented across 70% of the city's privately owned land.

This type of cooperation is central to the Water Sensitive Rotterdam programme, which is managed by the municipality's City Management department. The objective of the programme is to initiate a wider movement and increase the sense of urgency across a broader section of society. The programme also aims to show that smaller-scale initiatives can make a positive contribution to other local objectives, such as creating a greener neighbourhood, enhancing the quality of life and strengthening social cohesion.

The challenges are to ensure that these small-scale measures, even in the most vulnerable areas, are enough to bring about a more resilient local water system, and that public funds are used in the most effective way in this field. The ambition is to pull out all the stops in implementing the Water Sensitive Rotterdam programme and to enrich and accelerate this development wherever possible.

J FLYWHEEL ACTION Water Sensitive Rotterdam



2 AN INTEGRATED APPROACH: SUSTAINABILITY AND CLIMATE ADAPTATION GO HAND IN HAND.

Too often, measures to make existing real estate more sustainable and to climate-proof the city are being carried out separately and in isolation from one another. It is often assumed that roofs can either be green roofs or fitted with solar panels, for example. However, it has now been scientifically proven that solar panels installed on a green roof actually yield higher returns. This is just one example of the opportunities that there are to realize synergies. Better integration can yield benefits at the level of individual buildings, neighbourhoods and the city

as a whole. For example, it has been found that there is one square kilometre of flat roofing in the city centre alone – an area that could be used to accommodate multi-functional, sustainable facilities. By utilizing the potential of these flat roofs, we could make a significant contribution to the climate resilience and sustainability of Rotterdam. This is a good example of how the city-wide implementation of small-scale measures, by and for the residents of Rotterdam, really can help to improve our city as a whole.

U FLYWHEEL ACTION 1,000,000 m² Sustainable Roofs Landscape in the City Centre

3. VISION AND GOALS

3 WATER SECURITY NOW ALSO MEANS CYBERSECURITY.

The interactions and interdependencies between various forms of infrastructure (such as water, electricity and data) can lead to cascade effects, which will be exacerbated by the effects of climate change. In early 2016, TNO carried out a study into the vulnerability of Rotterdam's surface water and wastewater systems for the purpose of this resilience strategy document. The TNO quick scan revealed that Rotterdam's wastewater and surface

water management systems are resistant – and, more specifically, robust – in the face of short-term technical disruptions. There is redundancy in these systems, which would act as a buffer that will prevent nuisance and disturbances. In addition, measures are in place to prevent power outages and disruption to ICT systems. There are options for manually controlling these systems, and measures are in place to restore functionality in the event of an emergency situation. However, the quick scan shows not only that the current system is robust, but it also reveals some vulnerabilities that raise a number of questions. Autonomous developments – particularly with regard to climate change and digitization – will test the resilience of the systems both now and in the future. Digitization is leading to more advanced technologies, but ever fewer people have specific knowledge about this within the organization. The quick scan reveals that issues could arise in Rotterdam in the event of the prolonged failure of water management systems (i.e. power failure lasting longer than eight hours), due to a power outage or persistent ICT problems. This would certainly constitute a high-risk situation if it were to coincide with a period of extreme precipitation. If such a situation were to arise, then major localized issues with flooding, the failure of other infrastructure and ecological damage would be likely. We always need to ask ourselves whether the resilience of water systems would remain adequate if circumstances were to change – for example, due to the introduction of new digital systems or increased rainfall due to climate change. Reviewing the potential weak spots in our urban water system, which four different organizations are currently responsible for managing, is in itself an action that contributes to the resilience of that system. Collaboration and knowledge-sharing will continue into the future. Our joint ambitions in this field have been translated into the flywheel action entitled Cyber Proof Water System.

K

FLYWHEEL ACTION

Cyber Proof Water System: cyber secure and robust throughout the whole chain



3. VISION AND GOALS

4 WORKING ON MULTI-LEVEL SAFETY AND ADAPTIVE WATERFRONTS.

The concept of multi-level safety has been included in the RAS and the Delta Programme.

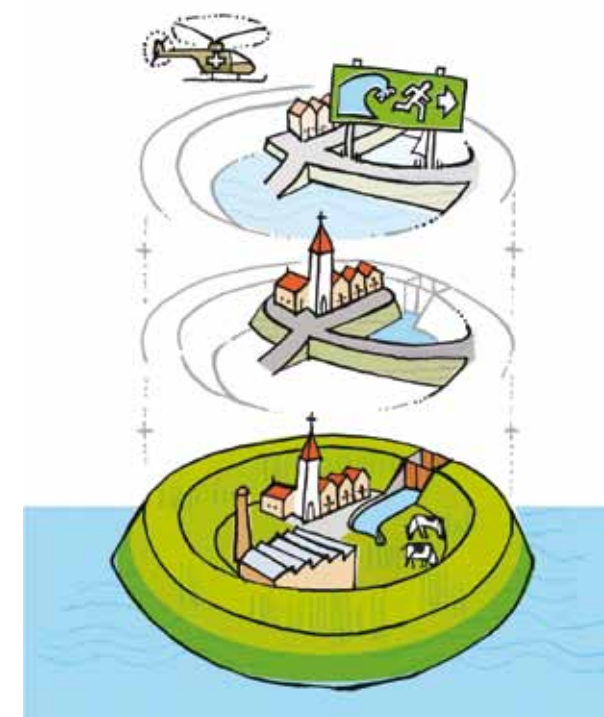
- Rotterdam is already well-prepared when it comes to prevention, the first level of water safety. One area of concern remains that dike reinforcements must be implemented in an integrated manner, i.e. with a focus on allowing space for other functions.
- The second level of measures – adaptive spatial planning – will focus on vulnerable and vital infrastructure and installations (excluding housing, for example). Proper standards are still lacking in this area, however. Our dikes will remain robust until 2050. Indeed, they are so robust that it will not be necessary to invest further in adaptive construction. In any case, this would be impossible in many locations because the ground level is so low. Adaptive construction may be useful from the point of view of coping with occasional extreme levels of precipitation. The challenge is to ensure that buildings and homes are not flooded in the event of heavy rainfall.
- The third level focuses on crisis management and evacuation. The crisis management pilot began in 2016. This pilot scheme is taking place as part of the Delta Programme, the Rotterdam Water Plan and Rotterdam Climate Proof, and is being carried out with the Rotterdam-Rijnmond Security Zone (VRR), the Schieland and Krimpenerwaard Water Authority (HHSK), the Hollandse Delta Water Authority, Rijkswaterstaat West-Nederland Zuid and the City of Rotterdam. Provisional results show that it is necessary to develop crisis management plans further to prepare for the eventuality of a dike breach. New flood analyses, developed within the framework of the Delta Programme and the Rotterdam Adaptation Strategy, are providing enough new knowledge to justify the strengthening of provisions. The basis for this will be cooperation between these parties as well as with private-sector organizations; the government will play a role in setting standards and defining the scope. It is recommended that evacuation plans are developed as part of this process. It appears that security



regions will need to play a greater role in the event of flood events; currently, the government is looking too much at the role of citizens. The vertical evacuation aspect has not yet been addressed within the evacuation component. In this regard it is relevant that the entire area outside the flood dikes can be considered as a contiguous zone that is subject to and equipped for temporary flooding. The addition of safe havens in the form of buildings and secure locations on the outskirts of the city and a good evacuation plan are likely to be necessary in order to ensure adequate multi-level safety. Chapter 4 makes clear which actions are already being taken and which actions are strongly recommended.

- Adaptive Waterfronts. As part of the Delta Programme and the implementation of the RAS, a number of pilot projects have been set up in areas outside the flood dikes. These involve all the levels of the multi-level safety plan. Both in low-lying urban areas, such as the Noordereiland, and in the higher ground of the port-industrial complex, investigations are being conducted into the best and most socially responsible manner of achieving protection, adaptation and evacuation.

3AA. MULTI-LEVEL WATER SECURITY



The section of the port area that is outside the flood dikes is the safest port area in the world, as demonstrated by the Botlek pilot project. However, the huge economic importance of this area means that the need for possible additional measures is being investigated together with the local business community. The proposals range from system-based measures (such as the creation of higher river embankments) to local measures at the company level (e.g. ensuring that public utilities and control rooms are secure, and installing security mechanisms). Companies also need to prepare crisis management plans and security plans. The results of the pilot will be translated into policy that will also apply to all areas outside the flood dikes.

L FLYWHEEL ACTION
Adaptive waterfront development
with added value

3.6 INFRASTRUCTURE READY FOR THE 21ST CENTURY.



“A robust and resilient underground infrastructure as a physical basis for a resilient Rotterdam”

VISION

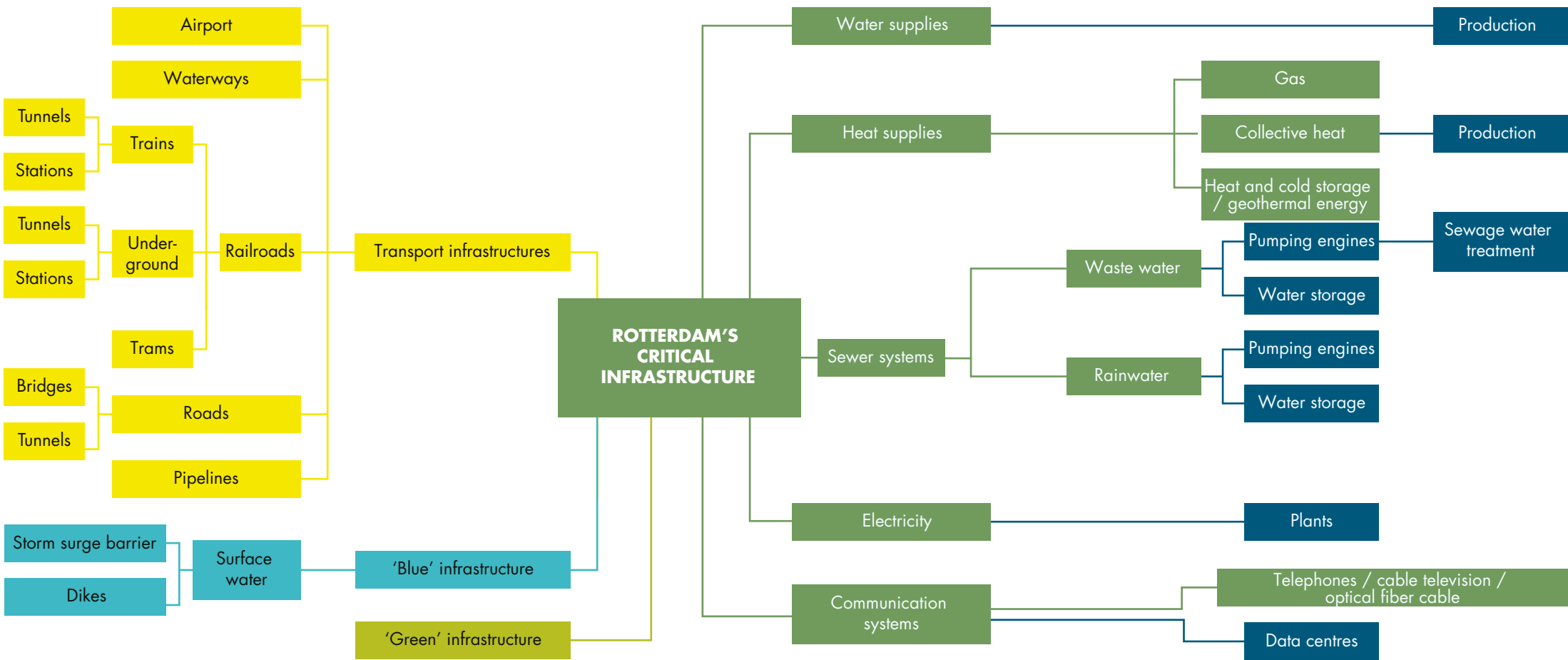
The Netherlands, including Rotterdam of course, has one of the most robust critical infrastructure networks in the world. In Rotterdam, we want to improve the quality of this infrastructure still further. In doing this, we will seek to anticipate and accommodate developments such as economic growth, further urban expansion and densification, and climate change. We are well aware of the weak spots and vulnerabilities in various elements of

our infrastructure networks, their interdependencies and cascade effects. And each stakeholder has its own role to play in the event of a shock. Investing in the resilience of our infrastructure can enhance flexibility, which will give our city the space it needs to develop further, both above and below the ground. We apply risk-oriented asset management to the infrastructure in the ground beneath us, and we bring forward innovative new forms of regulation. Our city's subsurface infrastructure is fully

integrated into its spatial development, and information about it will be fully integrated into our activities. We are determined to find the optimum balance between using, protecting, conserving and improving the city's subsurface level, both for now and for the future. The impact on the design and development of public spaces will be minimized, and inventive combinations of functions will lead to the more efficient design and use of space, both above ground and below ground level.



3AB. CRITICAL INFRASTRUCTURES



ROTTERDAM HAS ONE OF THE MOST ROBUST INFRASTRUCTURE NETWORKS IN THE WORLD.

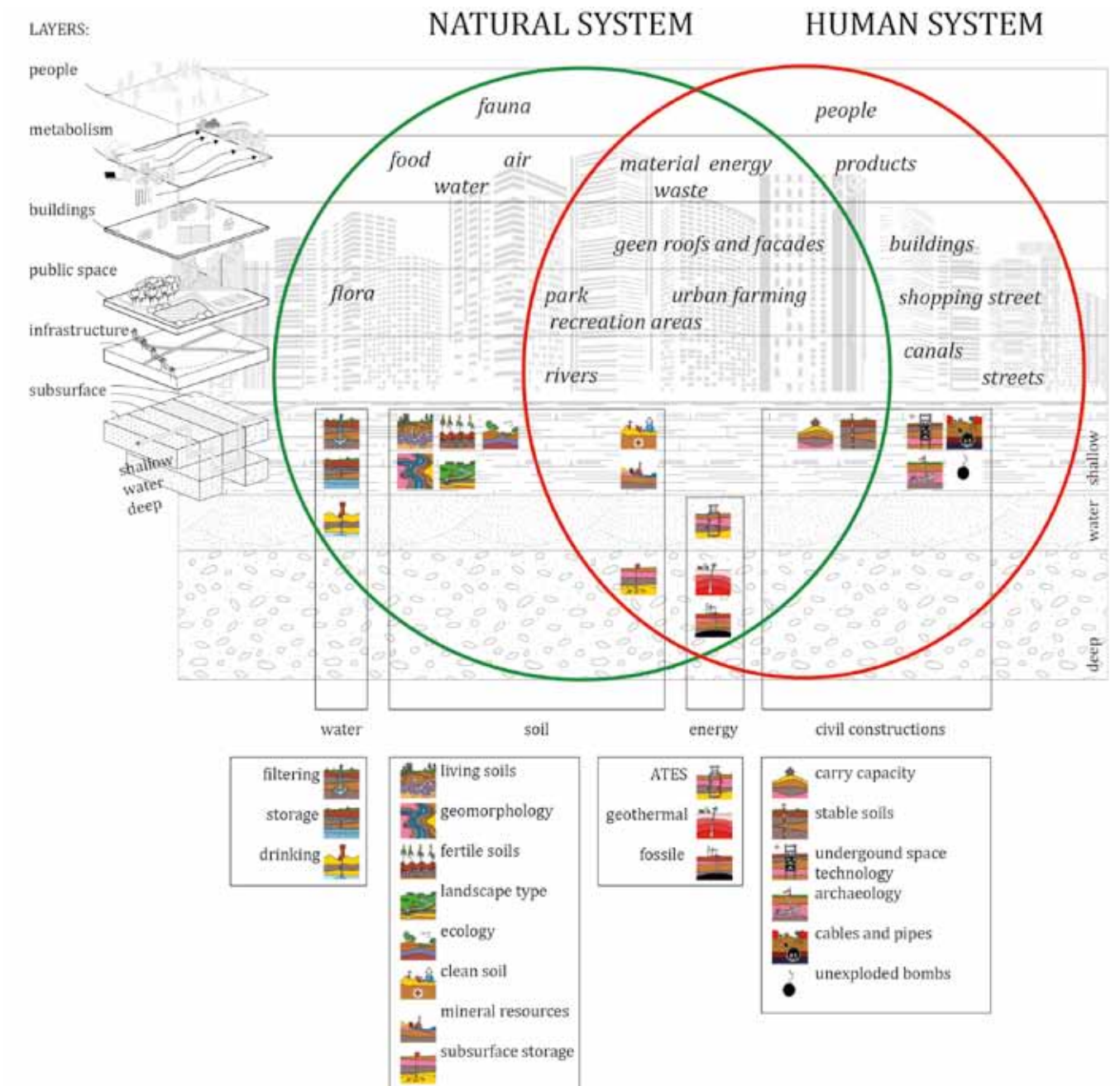
CURRENT SITUATION

The city's critical infrastructure includes infrastructure such as dikes, utilities, roads and shipping routes, as well as structures such as industrial plants, data centres, hospitals and public lighting. In the context of resilience, the focus is on vital subsurface infrastructure, because a significant portion of Rotterdam's vital infrastructure is located below ground level. This includes cables and pipelines, particularly for heating, electricity, telecommunications, water and sanitation. In addition, the city's subsurface infrastructure also performs other functions such as providing storage for rain water, space for underground buildings or objects, and the storage of cold and heat. There are also objects of archaeological value in the ground beneath us. Some of these functions are combined, while others compete for space at the same subsurface location.





3AC. SURFACE AND SUBSURFACE LEVEL SYSTEMS



Due to the growth of the city and because the subsurface level is being used to accommodate ever more functions, space is becoming increasingly scarce in the ground beneath the city. The ground itself is therefore also considered as part of the city's vital infrastructure: in a very real sense, our city relies on the ground on which it is built. Improving the organization, management and use of the subsurface level, and all the subsurface infrastructure that it already accommodates, will become an essential aspect of urban development in the future.

Currently, this aspect is sometimes neglected during the spatial planning process, which means that opportunities have been missed and risks are still present, such as higher costs and delays to development. The city's subsurface level therefore merits closer attention as part of our drive to make the city more resilient.¹

¹ The municipality's Strategic Asset Management Plan includes roads and public lighting, and resilience is explicitly cited as an important value for businesses.

3. VISION AND GOALS

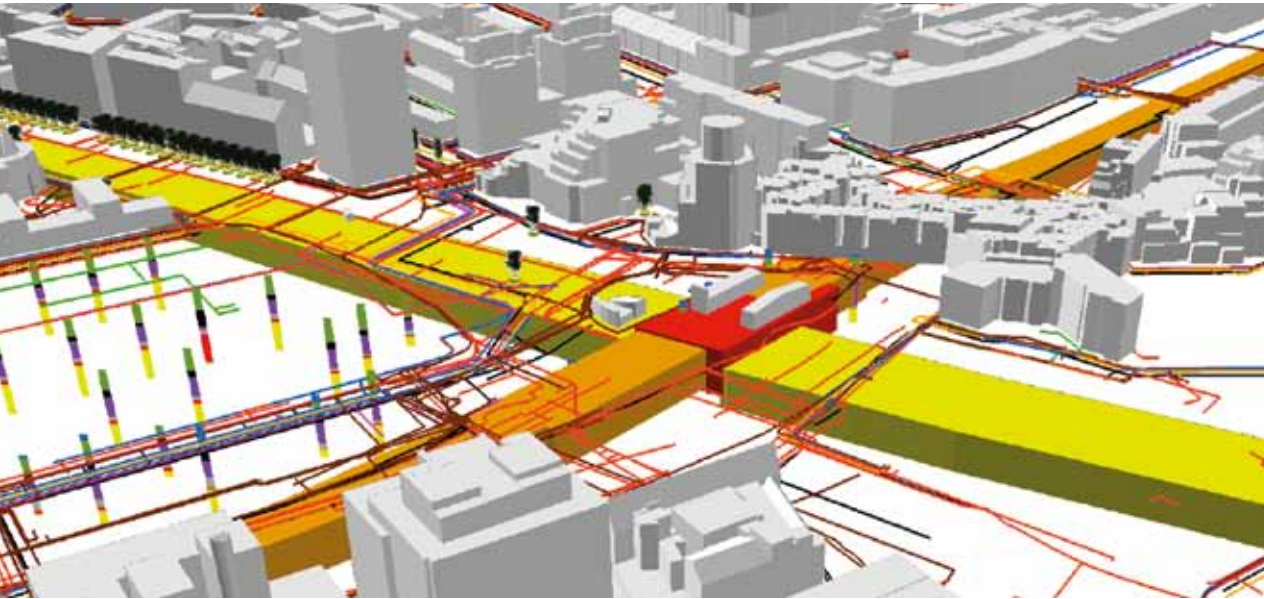
We define Rotterdam’s subsurface level and groundwater system as descending to a depth of 500 metres below the surface. That amounts to 160 km³, which currently

accommodates approximately 42,000 km of cables and pipelines and fifty different types of objects. The figures from August 2015 illustrate this.

MANAGEMENT OF ROTTERDAM’S VITAL INFRASTRUCTURE

PROVIDER	PRODUCT	CITY (M)	PORT (M)	TOTAL (M)
Eneco	Public lighting	1,224,100	312,300	1,536,400
	Gas	1,763,100	336,000	2,099,100
	Municipal heating installations	284,900	41,400	326,300
	Electricity	4,923,400	2,764,500	7,687,900
Evides	Water	1,763,400	419,600	2,183,000
Municipality	Regular sewage installations	2,270,500	260,600	2,530,900
	Pressurized sewage installations	193,100	38,300	231,400
Miscellaneous (pipes)	Gas, oil, kerosene, oxygen, nitrogen, etc.	126,500	1,255,100	1,381,600
Miscellaneous (cables)	Electricity	444,200	757,300	1,201,500
KPN	Telecommunications	10,134,400	2,141,500	12,275,900
Ziggo	Telecommunications	1,717,600	187,300	1,904,900
	Cable television	1,329,500	51,400	1,380,900
Miscellaneous	Telecommunication	5,679,300	1,350,300	7,029,600

3AD. INSIGHTS IN SUBSURFACE LEVEL INFRASTRUCTURES



The City of Rotterdam is not responsible for managing most of this vital system of subsurface infrastructure in the city. The municipality is, however, the competent authority (when it comes to organization and security) and plays a facilitating role vis-à-vis operators. The latter are obliged to inform other operators before undertaking activities and to coordinate their work insofar as possible. Long-term strategic planning is not part of that coordination, however. There are, presumably, many interdependencies, but little action is being taken in this area.

Various instruments and measures are in place to facilitate improvements and planning with regard to the city’s subsurface spatial environment, such as:

- The agreement on collaboration in public space between Stedin, Evides and the City of Rotterdam. The goals are to reduce inconvenience from simultaneous work, ensure that joint coordination takes place over the short and long term, minimize the deterioration of paved surfaces, make cost savings and ensure better accessibility in the city.
- The 2015 Rotterdam Leadership Regulation includes

provisions on cables and pipelines.

- The Geo Energy Plan Rotterdam Central Area delineates underground heating and cooling zones in the centre of Rotterdam.
- Rotterdam participates in a range of networks and research programmes in order to enhance our knowledge of the city’s subsurface environment and establish regulations in an integrated and inclusive manner.
- Maps have been developed to identify the position of subsurface pipelines and cables, in order to raise awareness of the availability of the subsurface space for area developments
- The municipality is a member of the COST - SUBURBAN programme, an international network that is committed to integrating subsurface data into urban development. As part of this programme, the report entitled ‘Rotterdam between Cables and Carboniferous’ was drawn up; it is an extensive survey of Rotterdam’s subsurface environment. The report also considers the opportunities and limitations of the city’s subsurface environment.

3. VISION AND GOALS

ENERGY

Stedin (part of the Eneco Group) owns approximately 95% of Rotterdam’s subsurface gas and electricity grids. The electricity grid is very stable. Our gas supply is reliable, even if the gas network is vulnerable and in need of replacement at some locations. Stedin works to stay aware of current operational risks, but is less concerned with the risk of cascade effects. Stedin’s main challenges are to accommodate peak energy demand and maintain the stability of the supply grid in the context of the shift towards more decentralized generation of energy. Stedin is working continually to improve its network planning and to acquire more understanding of the interdependencies between the generation of energy, the subsurface level and the water supply. The water supply is particularly important in relation to cooling systems for the generation of power.

WATER

Evides supplies drinking water and water for industry in Rotterdam, and has a ten-year plan that includes network coverage, forecasts for supply and demand, and hydraulic modelling. The plan also includes the possibility of extreme events. In the event of a loss of power, Evides could continue to provide water for ten days. The drinking water system is capital-intensive, and therefore not easy to adapt to developments. Evides is aware of its publicly vital service to customers and the major dependencies involved. The company is continually working to make improvements, such as the better coordination of planning, design, emergency

planning, crisis organization and back-up systems. The water company cooperates with infrastructure managers (including Stedin), for example, and water boards to do this. Evides analyses key trends through the H2020 research programme. Cost-benefit analyses have been carried out in relation to various scenarios for Rotterdam’s future infrastructure.

SEWER SYSTEM

The City of Rotterdam’s City Management Department is responsible for collecting and transporting wastewater in Rotterdam. This requires an electricity supply to operate the pumps. The network of sewers is extensive: if a problem arises at one location, wastewater can continue to flow through a range of alternative routes. In the event of a power failure, the sewer system can continue to store waste water for 24 hours before capacity is reached and it then becomes necessary to discharge waste into open water (such as canals). No contracts have been concluded regarding the supply of emergency pumps in the event of a prolonged power outage. Pumps and warning systems have been installed in tunnels. Very heavy rainfall in combination with a power failure could cause tunnels to overflow. This also applies to the Maas Tunnel, which would affect the accessibility of the Erasmus MC and use by the emergency services. More and more rainwater is being collected separately, reducing both the cost of water treatment and purification capacity. The separation of rainwater can also mitigate groundwater issues, helping to address the problem of the lower water table.



DEVELOPMENTS

Increasing urbanization and densification are leading to the increased use of the subsurface environment and, therefore, to increased potential for shocks and/or missed opportunities. This may lead to higher costs and delays in the implementation of projects. Because the demand for space at the subsurface level is increasing, less space is available for other functions, such as the storage of ground water and sustainable energy, which reduces flexibility. The networks themselves are growing and changing constantly – for example due to changes to the energy supply and the increasing use of smart grids. The diversification of our energy supply (in which different forms of energy and decentralized generation will play a role) will require greater flexibility in order to ensure that there is enough space for modifications to the energy infrastructure. These developments may lead to

new subsurface projects and interventions. Will thermal storage prove to be a hype or a trend, for example? Is there enough space and groundwater to allow this form of energy use to be developed? Will reduced gas consumption lead to increased demand for residual heat and geothermal energy? The energy transition involves a great deal of uncertainty and its consequences are therefore difficult to plan for.

The requirements of citizens and businesses are changing, and this is reflected in the demands that will be placed on our infrastructure. Individual citizens, groups of citizens and businesses are increasingly investing in their own forms of power generation, telecommunications, drinking water and back-up systems. From smart grids and decentralized energy generation to self-driving vehicles – all of these developments will require greater flexibility.

3. VISION AND GOALS

Higher levels of precipitation and higher temperatures in the summer may lead to flooding or increased demand for pumping and cooling. The long-term effects of climate change could include subsidence (which can lead to flooding) or the deterioration of building foundations due to drought.²

THE CHALLENGE IS TO MAINTAIN THIS LEVEL.

The role of government will change due to smaller budgets, decentralization and fewer core tasks. This runs contrary to the need for strategic development in the city's subsurface spatial environment level and the need for greater coordination between infrastructure operators. The role of government as a facilitator is expected to grow in this area.

The importance of the subsurface level has found expression in demands for a municipal policy on the subsurface environment. This will seek to reflect national government policies, which aim for a more holistic and integrated planning of our subsurface infrastructure. These plans have found expression in the national planning vision on the subsurface environment and the new Environment Act (to be implemented in 2019). Subsurface asset management is a rapidly developing area. There is an increasing awareness of risks, and this can provide a basis for a sound investment policy.

Increasing digitization, which is transforming the city into a Smart City, is creating many opportunities but also presenting us with new challenges. For example, we will need more underground cables.

VULNERABILITIES AND CHALLENGES

Our infrastructure is robust. In 2015, households in the Netherlands spent an average of only 33 minutes without power, for example. The World Economic Forum ranks the Netherlands as the country with the third most developed infrastructure in the world (after Singapore and Hong Kong). The challenge for Rotterdam is to maintain this level in order to ensure continued economic

growth, and to accommodate climate change and technological progress. Vulnerabilities continue to be a concern. These include issues such as the following:

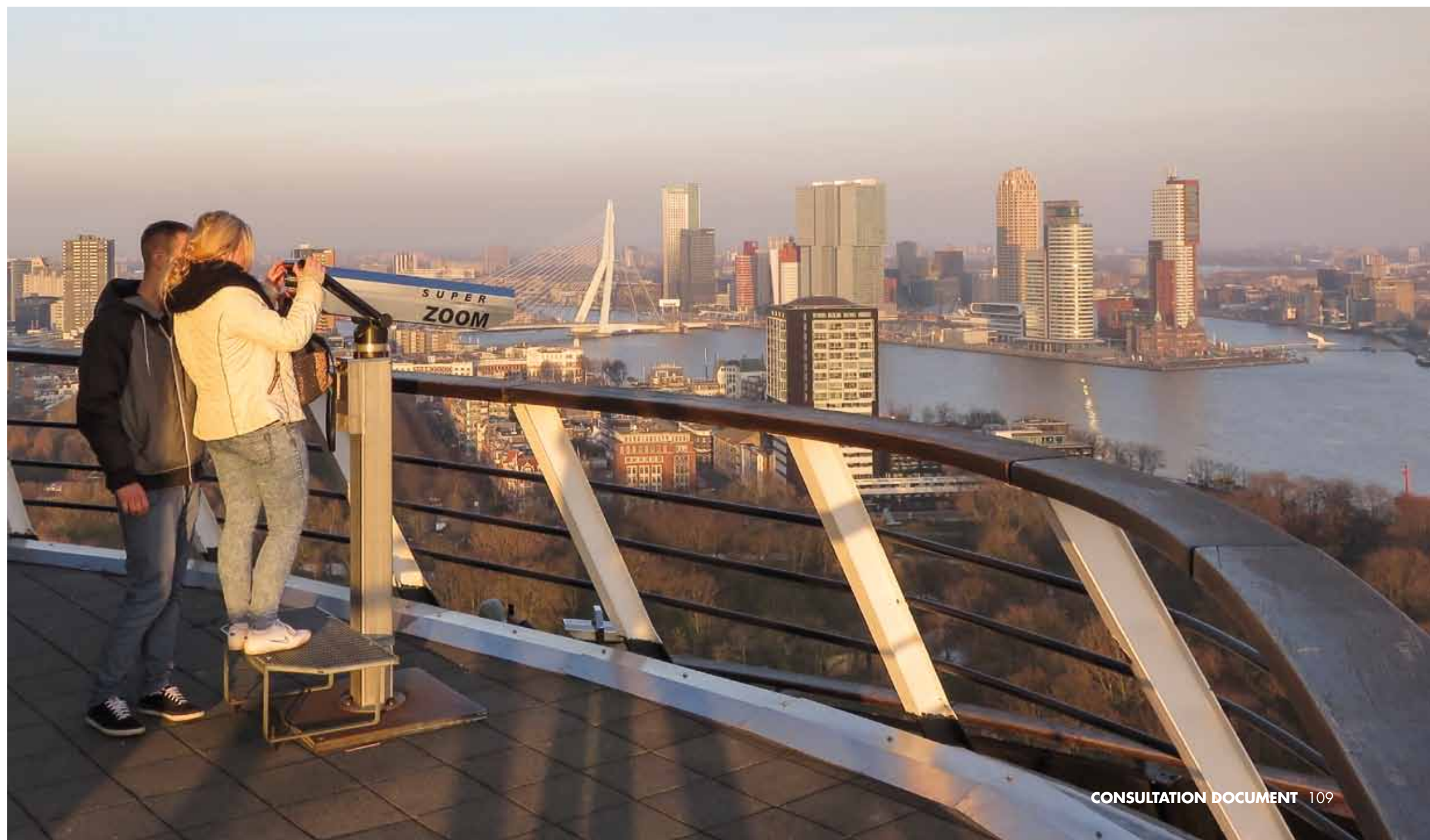
- Due to urbanization and densification, more subsurface overcrowding is expected in the future. This may make it impossible to realize certain urban ambitions, or increase the cost of doing so. It will also lead to increased pressure on our subsurface environment, as well as reduced flexibility and redundancy in the event of incidents and long-term threats (shocks and stresses).
- The location of subsurface infrastructure is known to the network operators. However, there is not always a clear picture of the specific elements that are essential to guaranteeing supply in the

event of an emergency. Furthermore, the operators work independently on the basis of their own knowledge and long-term strategies. This means that assumptions about vulnerabilities, self-reliance and the priorities of other network administrators are not always verified. The result is an increased risk of cascade effects. More knowledge is needed with regard to essential components, cascade effects and security of supply during emergency situations.

- Awareness and knowledge of the subsurface level and subsurface infrastructure must be increased within the urban planning process.
- Knowledge of underground infrastructure is currently scattered between different institutions, network operators, service providers and local government.

- Responsibility for the subsurface level is not yet clear; it would be desirable for the government to provide more direction and coordination.
- The priorities of network operators are not in line with the ambitions of the municipality.
- Reducing or eliminating the cost of outages as a result of integrating the subsurface level into the wider urban planning process cannot yet be quantified in economic terms. Consequently, the opportunities and threats that pertain to the subsurface level are not sufficiently taken into account in spatial planning or risk-oriented asset management.

¹. A further factor is managing and maintaining groundwater levels.



3. VISION AND GOALS

TOWARDS A 21ST-CENTURY APPROACH TO SUBSURFACE INFRASTRUCTURE.

1 ORGANIZE AND INTENSIFY COOPERATION WITH THE MAIN USERS OF THE SUBSURFACE LEVEL.

As mentioned, it is important that users of the subsurface level keep each other better informed, share knowledge and, where possible, coordinate their activities better.

M

FLYWHEEL ACTION

Strengthen cooperation between stakeholders

2 DEVELOP A POLICY FOR THE FULL INTEGRATION OF THE SUBSURFACE LEVEL INTO URBAN DEVELOPMENT PLANS.

N

FLYWHEEL ACTION

Develop policies that fully integrate the subsurface level into plans and projects, and translate these policies into processes and procedures

3 IMPLEMENT INNOVATIONS IN PRACTICE.

O

FLYWHEEL ACTION

The street of the future



3.7 ROTTERDAM NETWORKCITY: TRULY OUR CITY



“Residents, public and private organizations, businesses and knowledge institutions together determine the resilience of the city”

VISION

Rotterdam consists of and functions on the basis of its past, present and future residents, businesses, knowledge institutions, public and private organizations. Together, these make up the city’s system of governance. The city belongs to us all.

A resilient city works to build up its strength from the bottom up (self-organization), and works to develop resilient chains and networks. The government is able to act on the basis of its multiple roles, and deliver customized solutions using the power of improvisation, allowing much space for experimentation and new initiatives. It thus serves as a role model for large institutional actors.

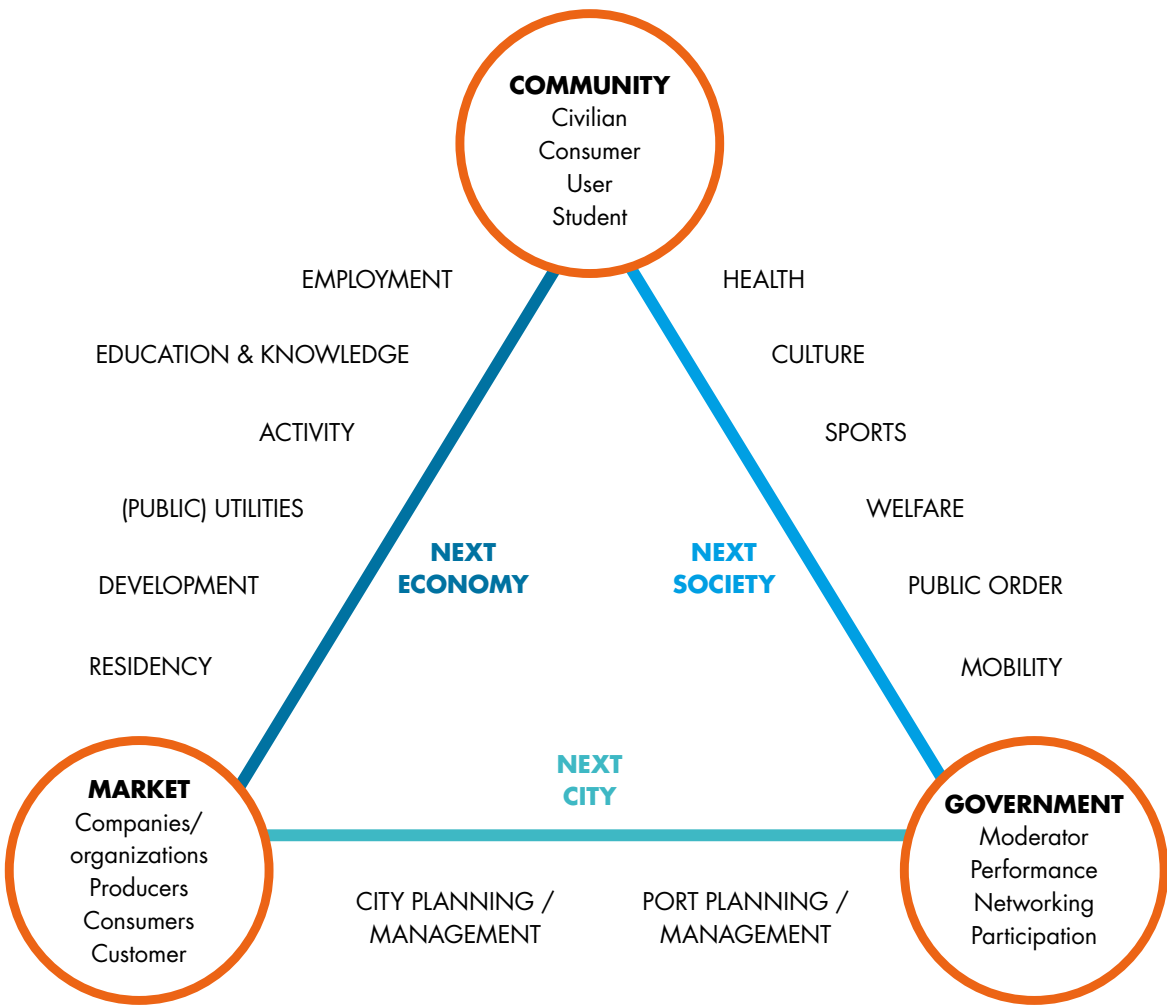
CURRENT SITUATION

The societal importance of resilience to ensure our city’s secure supplies of water and energy, strong social services and critical infrastructure is self-evident. But it is equally important that the city is organized and governed in a way that is also resilient enough to move with the times and respond to changes in the urban environment and in the city itself, so that solutions to social issues can be identified and implemented effectively on the basis of legitimacy.

The ability of a city like Rotterdam to function is based not only on a centralized system of administration, in which the municipality serves as the central control unit. The influx of new people into the city or the establishment of new businesses are not a centrally manageable mechanisms; these are the result of the individual choices and actions on the part of the city’s current and future residents and entrepreneurs.

The complete set of ways in which a city (or a region or country) makes decisions and manages itself is known as urban governance. For Rotterdam (and all cities located within an open democratic society), a distributed system of management is already in place. The choices, decisions and actions of many different actors – inside and outside the city, and both past, present and future – lead to a more or less coherent and adaptive whole that will determine the future development of the city. This includes significant events and influential individuals and organizations that exert more influence than the average (such as Pincoff, World War II, Feyenoord, the municipality).

3AE. CITY GOVERNANCE



3AF. WHO IS LEADING?

3. VISION AND GOALS

The Netherlands is internationally renowned as a well-organized country, with well-organized local government, intermediary organizations and a high degree of empowerment among its citizens. However, the system on which this is based – which for many years has been designed to carry out certain public tasks effectively, efficiently and according to the rule of law – is now becoming less relevant in certain fields. The very robustness with which these tasks are organized and carried out is increasingly becoming a drawback, it seems, because it leaves little room for tailor-made solutions and flexibility.

Traditional (institutional) players in the city are losing their traditional position in favour of the emergence of new types of social and private partners. Management methods increasingly appear to be shifting away from hierarchical forms of control towards a more equal relationship between the partners in a chain or network. There is a shift from citizen participation to government participation.

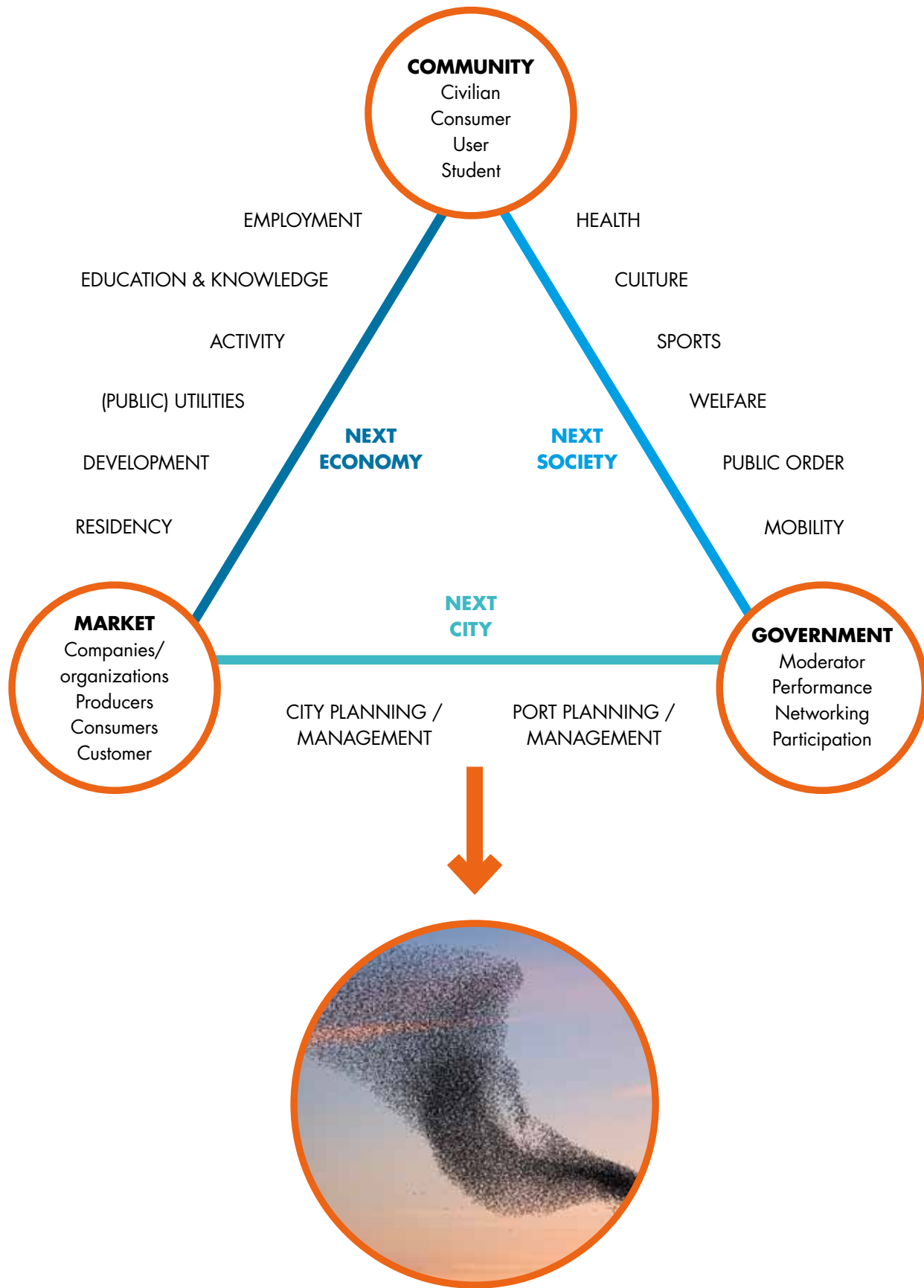
This change is having a significant impact on the question of what really determines the resilience of the city's system of governance. Resilience is, therefore,

increasingly a characteristic of networks and chains, rather than of organizations or individuals. This is also reflected in how resilience can be achieved in areas such as energy, social issues, climate change and cyber-crime. It will therefore be necessary to respond to the changing characteristics of our system of governance and to enable other actors to play a role in this. Rotterdam's system of governance is far from easy to summarize. However, to give a broad impression, the chart below includes a number of the key sectors and actors involved.

THE CITY IS THE RESULT OF THE MANY CHOICES AND ACTIONS ON THE PART OF MANY INDIVIDUALS AND ORGANISATIONS.



3AG. TOWARDS A RESILIENT GOVERNANCE OF THE CITY



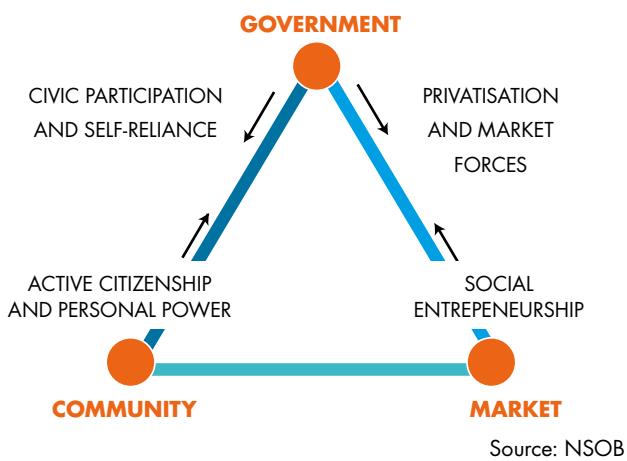
3. VISION AND GOALS

DEVELOPMENTS AND CHALLENGES

1. The nature of governance is changing

The traditional relationship between government, the market and the citizen (community) is changing rapidly.

3AH. GOVERNMENT, MARKET AND COMMUNITY RELATIONS



We can refer to this trend as ‘socialization’. In parallel to this process, the public domain is coming to be characterized by a range of hybrid activities and partnerships. Non-public parties are now helping to create public value. We are witnessing a rapid increase in citizens’ initiatives and social entrepreneurship, with

civil society organizations and citizens themselves taking a lead role in the provision and management of – for example – social care, sustainability, neighbourhood management or security. At the same time, the municipality (and the public sector more generally) is increasingly withdrawing to its core functions and forming partnerships with other actors from this position. This trend is linked to the complexity of the problems that now need to be tackled, the growing scale of these challenges, and diminishing public resources. All these developments mean that social issues are, more and more, being addressed through chains and networks. This is causing a blurring of the boundaries between the public, private and social sectors, with the public sector expected to respond in a flexible manner to developments that have been initiated elsewhere.

AN OVERVIEW OF RESIDENTS’ INITIATIVES SUBSIDIZED BY THE MUNICIPALITY IN 2015:

Social	583
Outside spaces	252
Sports and games	177
Education	165
Festivities	203
Art and Culture	163
Care	32
Security	22
Other	11
Total	1,608



2. The scope and approach of governance are changing.

The complexity of social issues is increasing and requires a more holistic approach; greater cross-sectoral collaboration involving parties from different fields is therefore required. Poverty, for example, is no longer simply a financial problem, and requires intervention in areas beyond the provision of financial support alone.

The same applies to the issue of climate change and areas such as healthcare, air quality and accessibility. In addition, social problems are being addressed less on the basis of the sectoral lines of government and more along the lines in which they are experienced by citizens and businesses. This is the essence of, for example, the programme entitled ‘Working for Rotterdam Residents’, or district oriented working, and the establishment of social district teams.

THE BOUNDARIES BETWEEN SOCIETAL, PRIVATE AND PUBLIC SECTORS ARE BLURRING.

3. The environment in which governance takes place is changing

The whole world is changing rapidly. Events far away often lead to chain reactions that affect us close to home. Disappointing economic growth in China has an almost immediate effect on investment in the port area. And this can have a direct impact on the viability of business models involving sustainability and employment opportunities.



3. VISION AND GOALS

4. The third industrial revolution.

In section 2.2, we discussed the developments of the 21st century. As with all previous industrial revolutions, this will create a lasting and powerful shock wave and lead to sustained pressures within our society. Will we still have jobs to go to in the future? Will the robots take over? Which skills will we need to develop in order to keep up? The third industrial revolution raises endless questions. And there are just as many possible answers, but these answers do not always provide clarity. Despite the revolutionary nature of the shift that is likely to occur, it is clear to businesses and citizens that our politicians are not focusing sufficiently on the changes that lie ahead. This is becoming a source of resistance, impatience and irritation. More input, more participation, more control, higher quality and service are all being demanded. The trend is towards higher levels of self-sufficiency – a development that is supported by the latest technological developments. Technology is making individual autonomy more feasible, and that means that people and groups will behave differently to how they would have under more traditional and familiar decision-making models. As we can see from the above description of the changes that are already starting to happen, these are having a particular impact on the way that government operates. But other institutional actors (such as energy companies, housing corporations and welfare institutions) are facing similar changes too. The City of Rotterdam has, for several years, been working on projects that seek to respond to the developments that we have just described. These include:

CREATING MORE SPACE FOR AND ENCOURAGING INITIATIVES THAT ARE INITIATED BY SOCIETY (SUBSIDIES)

- Residents' initiatives
- CityLab010
- Opzoomeren (streetwise small initiatives)

ENCOURAGING, FACILITATING AND CO-CREATING

- Project management, area developments, process management
- Right to Challenge

IMPROVED SERVICE PROVISION (STREET LEVEL SERVICE TO RESIDENTS)

- Information and Advice, social district teams
- District oriented working
- Professionalization
- KENDOE internships (beyond the municipal

departments) for civil agents

- Programme Working for Rotterdam Residents
- The considerate civil servant

IMPROVED SERVICE PROVISION (INTERNAL PROCESS DESIGN)

- DWARSS: customer relationship management
- Customised service provision
- Fourteen new service centres

DEMOCRATIC INNOVATION: ENCOURAGING PARTICIPATION AND INVOLVEMENT

- Local referenda
- Citizens' jury
- Digital opinion polling

Erasmus University Rotterdam has carried out research into how social initiatives are contributing to the resilience of Rotterdam's system of governance, using the seven qualities of a resilient system (this is known as the 'resilience lens', see section 1.3).¹

The university notes that there is a great deal of organizational capacity in the public realm, which is located between the market, society and government (municipality). In a number of ways, societal initiatives complement the role of the current governance regime,

which is characterized precisely by its robustness and stability. Networks bring different qualities to the current governance regime, certainly when it comes to taking a flexible, resourceful and integrated approach. At the same time, however, a number of characteristics remain underdeveloped in such initiatives – notably when it comes to their robustness (i.e. they are vulnerable to shocks or disturbances). Furthermore, their flexibility becomes more vulnerable as they grow and professionalize.

In the same contribution, based on the resilience lens, the university has developed a number of design principles that the government (and other institutional investors) can seek to implement in order to administer the city in a more resilient manner. To summarize, the process is as follows:

Integrative capacity -> integrated problem definition, unifying, cross-sector action

Inclusivity -> creation of shared ownership, involvement of as many parties as possible

Redundancy -> creating spare capacity in government, societal initiative is also a form of spare capacity

Flexibility -> adapt continuously to what the network or chain requires

Resourcefulness -> customization, use of local knowledge, creativity with limited resources

Learning capacity -> learning from experience, developing and applying new knowledge
Robustness -> not susceptible to disruptions, ensure continuity

And also:

Mobilizing capacity -> aim to energize society through incentives and encouragement

Connecting capacity -> searching for connections, open to working together, trust

Reliability -> competent governance, continuity, legally sound

Institutional flexibility -> ability to adapt rules, procedures and arrangements

As we stated previously, resilient city governance is becoming a matter of chains and networks, with all the actors that make up those chains and networks. However, when it comes to the question of governance, the resilience strategy is still mainly limited to the role of the municipality and invites other parties to think about their role in the city's governance system and to take action.

¹. Arwin van Buuren, Rosanne Meulenbeld, New Forms of Organizational Capacity for a Resilient City. How Robust Institutions and Resourceful Networks Come Together, Erasmus University Rotterdam.



TOWARDS A RESILIENT FORM OF GOVERNANCE FOR ROTTERDAM

1 FACILITATING AND MOBILIZING THE ENERGIZED SOCIETY.

The municipality is encouraging local involvement, and in doing so it is also promoting social cohesion. Where necessary, support is provided to encourage opportunities for success and professionalism.

P

FLYWHEEL ACTION

Facilitation and experimenting with self-organization

2 ENCOURAGE THE DEVELOPMENT OF NETWORKS AND HELP THESE TO JOIN FORCES.

Rotterdam is encouraging the emergence of new initiatives, reinforcing learning capacity and promoting a more integrated approach. The aim is to arrive at better solutions for pooling scarce resources and to work towards inclusiveness.

Q

FLYWHEEL ACTION

Rotterdam Networkcity, creating networks of government, citizens, institutions, market and knowledge

3 THE GOVERNMENT PROVIDES A MULTIPLICITY OF ORGANIZATIONAL FORMS, WITH MORE IMPROVISATIONAL POWER AND AMPLE SCOPE FOR NEW INITIATIVES AND EXPERIMENTATION.

R

FLYWHEEL ACTION

Neighbourhood oriented working programme ('wijkgericht werken')



3.8 ANCHORING RESILIENCE IN THE CITY.



“With stakeholders in the neighbourhoods, sharing knowledge and a facilitating organization”

RESILIENCE

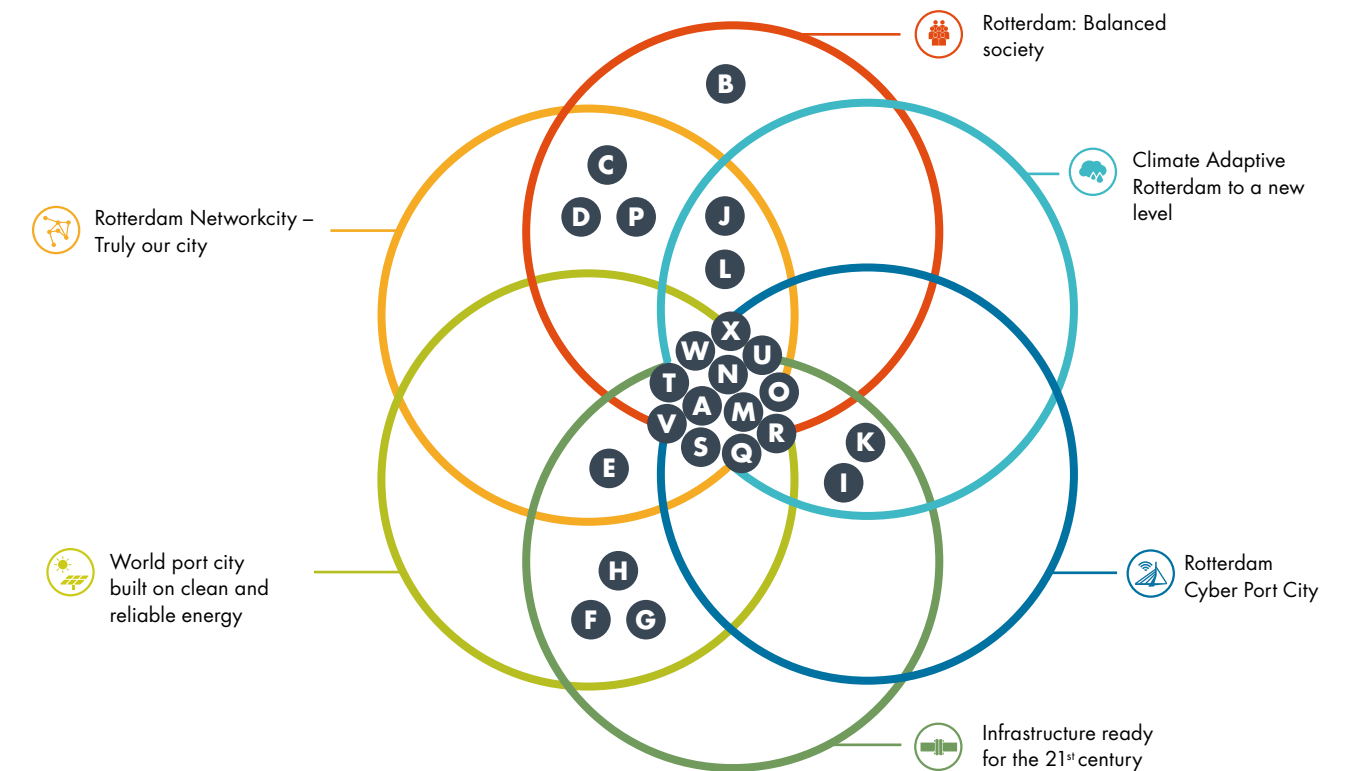
Integrating the resilience philosophy means actually applying the resilience lens in day-to-day thinking and actions. This requires actively applying the qualities that are mentioned as part of the resilience lens at all levels – city, district, street or building. We will need to learn and discover together. A joint research agenda is being developed to facilitate this. This first version of our resilience strategy represents a first step.

AN INTEGRATED APPROACH

One characteristic of resilience is taking an integrated approach. This means looking beyond just one field or economic sector. Many of the actions planned as part of the resilience strategy reinforce one another. Three examples:

- Rotterdam is strengthening the security of critical infrastructure. Enhancing Rotterdam’s 21st-century skills, including ICT skills, will contribute to the city’s cyber resilience.
- We can create a more climate-resilient city by investing at street level in small open green spaces, in rain gardens and even by installing green roofs in the form of vegetable gardens. This would also enhance residents’ levels of social cohesion, health and even their leadership skills. In short, smart climate adaptation measures can also lead to greater social resilience.
- Working on the economic (and energy) transition in the port is crucial to the resilience of Rotterdam and the wider region. It is also vital that this does not lead to increased social segregation and fragmentation. Investment in 21st-century skills is therefore crucially important. The challenge is to increase the level of resilience of the citizens of Rotterdam, so that

3AI. RELATING GOALS AND ACTIONS



everyone can benefit from and contribute to this transition.

In short, the resilience goals identified in the previous chapters are all interconnected. Actions that contribute to several resilience goals at the same time will lead to higher levels of resilience. For example, the water plaza at Benthemplein provides expanded water storage, but it is also a multifunctional and attractive public space where it is possible to participate in physical activity and sports or hold theatrical performances. Such activities have a positive impact on the social cohesion of the surrounding neighbourhood.

There are countless synergies that can be created and harnessed. One characteristic of resilience is that these synergies are constantly sought out, because this leads to added value for the city, provided implementation is not too complex and that not too many dependencies are produced. It is therefore important to be watchful in this regard.

RESILIENT NEIGHBOURHOODS

Many of the city’s challenges come together in its local neighbourhoods. For this reason, in addition to the six resilience goals that have been specified, we have also identified three pilot districts in the city where

we will actively work on developing an inclusive and integrated approach by developing and harnessing the self-organizing capacities of those districts. Here, the emphasis is on the aim of discovering together what resilience means at the local neighbourhood level. Working on the resilience goals that have been identified and the associated initiatives is a common challenge that we have only just begun to address. Learning from the implementation of the climate adaptation strategy and successes in the Zomerhof district (where the Benthemplein water plaza has served as a catalyst), the neighbourhood is the best scale at which to work on resilience at the smallest scale within the city, together with stakeholders. Designation as a pilot district has already generated new and positive energy in the district and beyond (in the form of grants, new ideas and joint initiatives). One or two catalyst projects have been identified for each neighbourhood to demonstrate which opportunities there are for working in an integrated manner, and then achieve a scaling-up effect across the whole neighbourhood. This demands flexibility, resourcefulness and redundancy on the part of the stakeholders, because so many ideas are likely to surface that will need to be decided on. The projects are being organized in a manner that ensures openness to feedback and changes of plan (i.e. they demonstrate a capacity for learning).

3. VISION AND GOALS

The pilot districts are:

- Delfshaven, including its relationship with Merwevierhaven. Catalyst projects: Resilient Delfshaven, Delfshaven cooperation, Bospolder Tussendijken / Park 1943
- Feyenoord, including Noordereiland, and its relationship with Afrikaanderwijk. Catalyst projects: Resilient Peperklip, Feyenoord Opportunity Map
- City Centre
- Catalyst projects: 1,000,000 m² Multifunctional Rooftop and Smart Schouwburgplein

URBAN PROGRAMMES

At the municipal level, too, inclusivity and an integrated approach coincide. These are large-scale programmes with multiple objectives, which actively involve a large number of stakeholders. This will create a firm foundation on the basis of which these programmes can contribute to the full spectrum of resilience and its various qualities, building up the resilience of the entire city on a large scale.

These programmes are as follows:

- National Programme Rotterdam Zuid (NPRZ)
- Road Map Next Economy (RNE)

RESILIENT ROTTERDAM KNOWLEDGE AGENDA: DEVELOPMENT AND LEARNING.

By focusing on six goals and three pilot districts, we can work together on Rotterdam’s resilience an integrated manner. At the same time, many questions remain and

we still have a great deal to learn. About how we want resilience to work in practice, for example. And about the kind of governance that is needed for a resilient city. About how resilience works in spatial terms. And about how to make effective financial arrangements. We can also learn a lot from other cities. A knowledge agenda will help us to ensure continuity, establish an agenda and make further progress along the road towards a resilient city. This work will need to be done at different scale levels. The International Architecture Biennial Rotterdam (IABR¹) has agreed that the next two biennials will be dedicated to the theme of Resilience. It has been agreed with Henk Ovink, the Water Ambassador of the Ministry of Infrastructure and the Environment, that a joint research line will be established.

The theme for the 2018 and 2020 IABRs will be Resilience.

It is clear that knowledge-sharing is an important aspect of expanding our knowledge. Participation in 100RC encourages knowledge-sharing between the various participating cities. All the cities participating in the 100RC network are unique, but at the same time they share many similar issues. Moreover, they are all involved in the quest for the resilience that will be required by the transitions of the 21st century. Below are some examples of exchanges between the cities, which have enabled them to develop stronger resilience strategies.

¹ Since 2001, the IABR has served as a biannual international platform for research and activities in the field of urban planning and architecture.



WORKING ON RESILIENCE AT DIFFERENT SCALES

Integrated Resilience Actions at different scales:

- **Building level** (for example, the study into a more resilient Peperklip)
- **District level** (for example: Resilient Delfshaven)
- **City level** (for example: NPRZ and four years of design research with IABR)
- **Metropolitan level** (for example: RNE and resilience with The Hague)
- **National level** (for example: City Deal on Climate Adaptation)
- **European level** (for example: Resilient Europe, URBACT)
- **Global level** (cities exchange within 100RC)

Agreements have already been signed in relation to the actions under 3, 5 and 6; these begin in 2016.

HOW WILL THIS BE ORGANIZED?

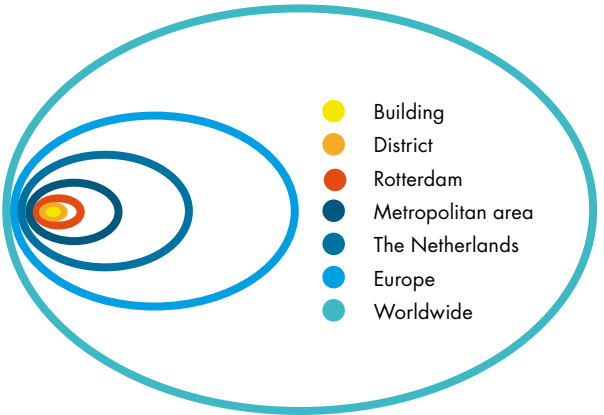
Since 2014, Rotterdam has been participating in the ambitious city network of 100 Resilient Cities (100RC). In 2016, Rotterdam – with the help from 100RC – has developed its first underlying Resilience Strategy, together with a range of partners in the city. The present strategy includes a range of flywheel actions and additional actions. The organization required to get resilience thinking off the ground and achieve our resilience targets

will be developed in the short term. What is certain is that the organization will play a facilitating role and that the CRO will play a central role in this. The goal is to continue this facilitating role until at least 2020 (when the second IABR with the theme of Resilience will be held) and then to evaluate the process, as well as conducting an interim evaluation in 2018. The ambition is to ensure that the concept of resilience becomes rooted in our city. We aim to create a movement that will bring resilience into the mainstream, and thus integral to all our thoughts and actions. Ensuring that this movement gets underway will principally be a task of the CRO.

3AJ. RESILIENT CITIES HELP EACH OTHER

HOW	WHO
Tactics for living with water Rotterdam Water Exchange October 2015 The stories of nine cities	The International Water Exchange, powered by the Rockefeller Foundation 100 Resilient Cities Rotterdam Centre for Resilient Delta Cities
URBACT: Resilient Europe The stories of twelve cities working toward social resilience	URBACT: Resilient Europe programme Antwerp, Bristol, Burgas, Glasgow, Katowice, Malmö, Potenza, Rome, Rotterdam, Thessaloniki, Vejle and the EU
Bilateral exchange	Cities of Rotterdam, Rome, New Orleans en Glasgow
Rotterdam partners active in cities	Rotterdam Centre for Resilient Delta Cities, The cities of Vejle, Mexico–Stad, Chennai–Stad

3AK. RESILIENCE SCALES



3.9 LET'S TRAVEL TOGETHER: JOIN IN!

This chapter has outlined our vision for a resilient Rotterdam and translated this into seven specific goals. We are talking here about the resilience of the city, of individual neighbourhoods, and of individual citizens. It is Rotterdam's citizens, businesses, research institutions, communities and the municipality that – together – can make our city resilient. The municipality has included as many stakeholders as possible in the development of this resilience strategy.

But the strategy is only the beginning of what we are determined will become a 'movement' – a movement that will ensure that working on resilience comes to be seen by everyone in the city as something that is vital to our future.

That awareness is already there, given the many small and large-scale initiatives at the city, neighbourhood or street levels.

We want to scale up these initiatives and ensure that they are connected, and also to learn from them.

All parties and all Rotterdammers are invited to contribute to the process of strengthening the resilience of the city. But most of all, they are invited to get started – to launch new initiatives, learn from them and ensure that successful projects continue to grow. Chapter 4 will provide some inspiration for this.

This document will be released for consultation. We want to gather feedback and more ideas for our city. The consultation process will now be taken further. The idea is to use an e-panel, a citizen jury and neighbourhood committees. We will search for ways of integrating this with consultation and communication regarding the Story of the City.

Finally, a website and (information) platform has been created: www.resilientrotterdam.nl

**WORKING ON
RESILIENCE IS A
"MOVEMENT".**



4. RESILIENCE LAB: ACTIONS.



4.1 HIERARCHY.

TO IMPROVE AND SECURE OUR CITY’S RESILIENCE WE WANT ALL STAKEHOLDERS TO CONSIDER THE RESILIENCE PERSPECTIVE IN THEIR DAILY LIVES – IN THEIR THOUGHTS AND ACTIONS. THE ACTIONS PROMOTED THROUGH THIS STRATEGY – COMPRISING 5 WHICH ARE ONGOING, 19 THAT ARE JUST BEGINNING AND 44 THAT ARE COMPLETELY NEW – SHOW SOME OF THE WAYS THAT ROTTERDAM CAN IMPROVE ITS RESILIENCE. OUR CHIEF RESILIENCE OFFICER SUPPORTS AND PROMOTES THESE ACTIONS.

Our action plan includes 5 ongoing, 44 new, and 19 starting initiatives and actions. The ongoing initiatives, like Next Economy Road Map, Water Sensitive Rotterdam and the program WE–Society, are included because they are identified as essential for a resilient Rotterdam. Where necessary these initiatives will be enhanced and developed with resilience thinking and linked to the resilience strategy to deliver positive resilience outcomes, to accelerate upscaling and to allow for lessons learnt and wider dissemination through the resilience office.

There are some new actions that are already in start–up phase, partly due to the Resilience program, which will be supported where necessary by the resilience office and other new actions that will serve as examples of how resilience thinking and interventions can be applied at a practical level at the scale of the neighbourhood, street and building. It is expected that further new initiatives will arise, to enhance the resilience of Rotterdam. The

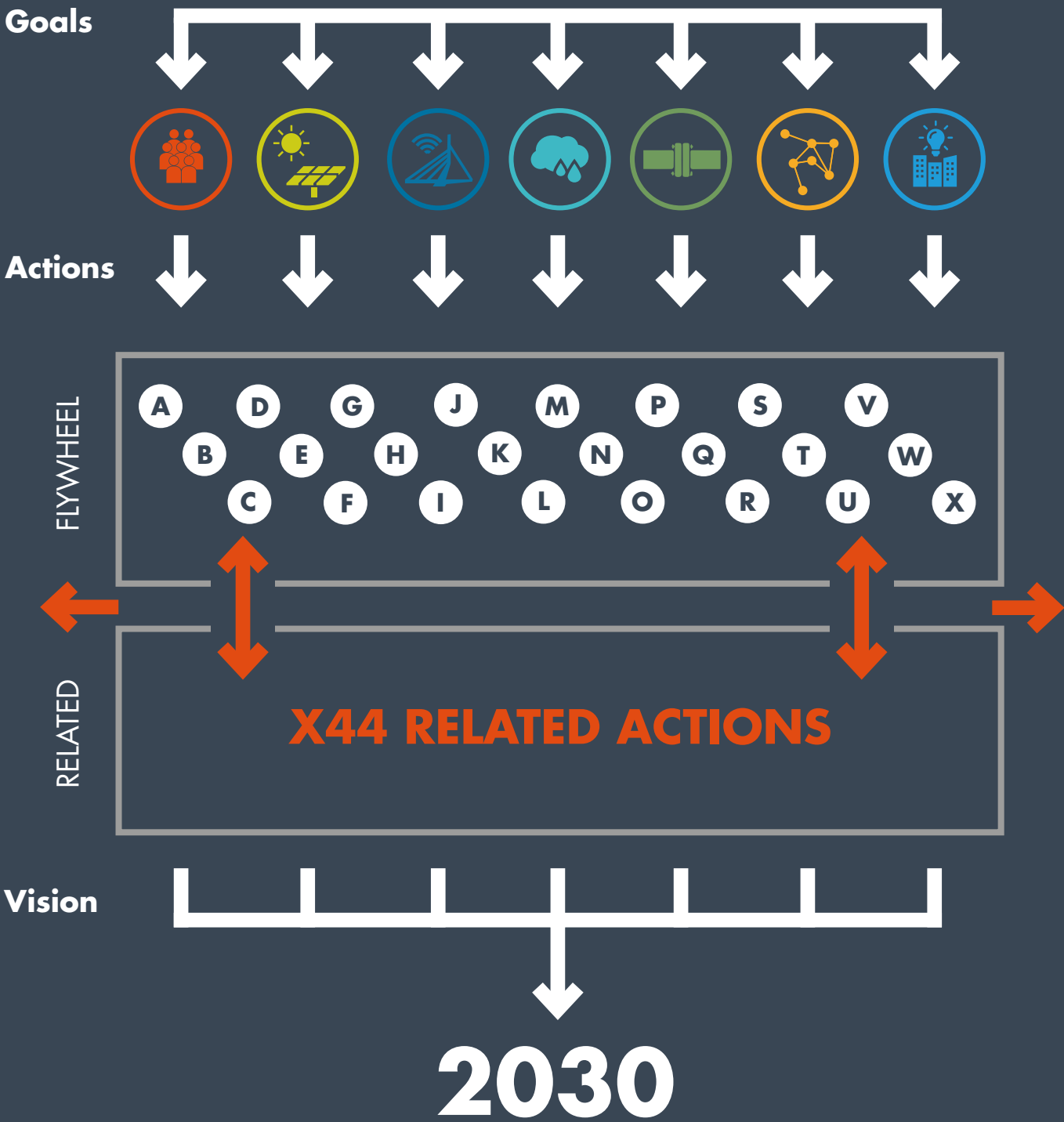
resilience office will focus on connecting, enriching and accelerating these where they are feasible, viable and deliver clear resilience dividends.

Our actions are distinguished into two types: flywheel actions and additional actions. The flywheel actions are the headline actions that deliver the greatest resilience benefit for Rotterdam or which serve as an umbrella for a cluster of supporting actions. The supporting actions are considered to have less impact individually. We have included a key to help navigation through the actions, letters (i.e. A, B, C) signpost the flywheel actions where numbers (i.e. 1, 2, 3) are used for the supporting actions. Synergies and overlaps are shown under ‘related actions’ and icons are used to relate the actions back the resilience challenge areas, to highlight the resilience qualities within the specified action and to show the scale at which the action is applicable.

LEGEND

Flywheel actions references	Related Resilience Goals	Qualities of resilience	Level of impact
A B through X	1. Society	1. Reflective	Individual
	2. Energy	2. Resourceful	District
	3. Cyber	3. Robust	City
	4. Climate resilience	4. Redundant	
	5. Infrastructure	5. Flexible	
	6. Network city	6. Inclusive	
	7. Anchoring	7. Integrated	
Related actions			
1 2 through 44			

ROTTERDAM RESILIENCE CHALLENGES



GOAL 1:
ROTTERDAM: A BALANCED SOCIETY



A PROGRAM FOR 21ST
CENTURY SKILLS AND
YOUNG LEADERSHIP



THE DEVELOPMENT OF AN EDUCATION PROGRAM ON (DIGITAL) SKILLS
AND PERSONAL LEADERSHIP FOR YOUNG PEOPLE

We will develop a program for 21st century skills to teach young people the skills they need in a rapidly changing society. The transitions we foresee will impact on the societal skills required of an individual; placing more emphasis on flexibility, collaboration, personal leadership and IT skills. There are a number of supporting actions that underpin this programme.

RESILIENCE VALUE

Development of 21st century skills can enhance personal resilience and support our goal to create a more balanced society. It supports flexibility, creativity and individual learning empowering people to take responsibility for their own future and to play a part in their local community. Training and skills development through this programme will also support our goals related to increased cyber security and new modes of governance. Digitally literate citizens can contribute to the cyber resilient city and personal leadership is important as the government retreats and the importance of participation in community networks grows.

LENS



SCALE



OWNER

Municipality / Social Department

PARTNERS

Schools, Businesses and Social Organizations

FINANCE (POSSIBLE)

Municipality and partners

STATUS

New

RESULT

Short-term

RELATED ACTIONS



RELATED ACTIONS

1 CENTRE OF EXCELLENCE FOR 21ST CENTURY SKILLS



This is the establishment of a new physical hub, a central point for learning 21st century skills in Rotterdam. It will accelerate education and establish a visible, and approachable, innovation hub in the city. The Centre of Expertise will undertake initiatives in education and business, working in collaboration with Rotterdam businesses, schools, the government and private stakeholders.

RESILIENCE VALUE

<ul style="list-style-type: none">Supporting the development of training programs to increase knowledge and enable the monitoring and evaluation of experiencesSupports collaboration between public and private sectorSupports awareness, learning and innovation	LENS	
	SCALE	
	OWNER	Municipality / Social Department
	PARTNERS	Businesses, Welfare Organizations, schools
	FINANCE (POSSIBLE)	Municipality / Municipality and partners
	STATUS	New
	RESULT	Short-term
	RELATED	

2 BUILDING A COALITION FOR YOUNG LEADERSHIP



Building on and supporting the growing coalition of businesses, civil society and schools to support the 21st century skills program. Progress so far has been bottom up and self-starting. The aim of this action is to provide additional resource and support as needed to help the existing coalition deliver on its goals.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports bottom up – community led initiatives and builds cohesion.Embeds resilience thinking amongst Rotterdam’s youthSupports knowledge sharing and networking	LENS	
	SCALE	
	OWNER	Municipality / Social Department
	PARTNERS	Businesses, Welfare Organizations, schools
	FINANCE (POSSIBLE)	Municipality / Social Department, partners
	STATUS	New
	RESULT	Short-term
	RELATED	

3 21ST CENTURY SKILLS AGENDA



The 21st century skills programme and the Centre of Excellence will need an agreed curriculum. A 21st century skills’ agenda will be prepared by the municipality and Rotterdam’s leading educationalists as part of the Citydeal for Education (collaboration with some other Dutch cities and the national government). The curriculum will ensure resilience is on the agenda for the main educational establishments across the city.

RESILIENCE VALUE

<ul style="list-style-type: none">The curriculum provides transparency and clarity as to what the demands of the 21st century are.It provides a method for embedding resilience thinking into key city educational curriculums (integration into our regular educational program)	LENS	
	SCALE	
	OWNER	Municipality / Social Department
	PARTNERS	Schools, Welfare Organizations
	FINANCE (POSSIBLE)	Municipality / Social Department, partners
	STATUS	New
	RESULT	Short-term
	RELATED	

4 DEVELOPING PROFESSIONAL NETWORKS



Starting professional networks that teach 21st century skills and young leadership within schools and colleges.

RESILIENCE VALUE

<ul style="list-style-type: none">Establish clear educational relateds between the professionals, municipality and schools in relation to resilience – to share learning experiences, to enhance the network and to allow it to adjust it to changing circumstances based on feedback.	LENS	
	SCALE	
	OWNER	Municipality / Social Department
	PARTNERS	Businesses, Welfare Organizations, schools
	FINANCE (POSSIBLE)	Municipality / Social Department, partners
	STATUS	New
	RESULT	Short-term
	RELATED	

B

BUILDING ON THE PUBLIC HEALTH ACT 2016–2019



Rotterdam is drafting the Public Health Act 2016–2019 in order to make its public health goals more concrete. The Act redefines health not as the absence of disease but as the state of resilience and being able to shape your own life no matter what happens. The Act is an inspirational guide which aims to promote Rotterdam’s ambition to connect inhabitants and important stakeholders focussing on public health. The Act touches on actions that can be taken by Rotterdammers, as well as by community groups working in neighbourhoods and by government and healthcare and welfare institutions. The Act will be discussed and enriched through a number of productive dialogue sessions, many of which will touch on important aspects of resilience. The municipality will work to build on this dialogue and support key actions arising which contribute to city resilience.

RESILIENCE VALUE

Public health dialogue sessions and resulting actions can directly contribute to many of the city resilience goals. The sessions bring people together to discuss ideas and issues, share best practice and to seed projects that can contribute to a more healthy and balanced society. The resilience office will support this ongoing initiative.

LENS	  
SCALE	
OWNER	Municipality / Social Department
PARTNERS	Central Government, Welfare Organizations, General Practitioners, Mental Healthcare, etc.
FINANCE (POSSIBLE)	Municipality, Central Government, Insurers, etc
STATUS	New
RESULT	Short-term
RELATED ACTIONS	5

SKILLS FOR THE NEXT ECONOMY – THE POWER OF THE 100 RESILIENT CITIES NETWORK

Understanding the skills needed to fuel the economy of the future and ensuring that residents have access to training opportunities to develop those skills is essential to building Rotterdam’s resilience. This is not a challenge that is unique to Rotterdam. As many cities in the 100 Resilient Cities network face similar priorities, a number of Chief Resilience Officers have kicked off a Learning Community to exchange knowledge and resources around post-industrial economies, including innovative education and training programs to build the skills of the 21st century.

100 Resilient Cities member cities involved: Bristol, Durban, Glasgow, Melbourne, Pittsburgh, Rotterdam, Boulder, Huangshi, Vejle







RELATED ACTIONS

5 ‘NUDGING’ HEALTHY BEHAVIOUR



Our city has already begun research and creating an agenda to identify what motivates goal groups to make behavioural changes to have a healthier lifestyle. We will develop and help disseminate this research to nudge our citizens (and organizations) towards healthier lifestyles, working in collaboration with the Erasmus University Medical Centre.

RESILIENCE VALUE

<ul style="list-style-type: none">• Embeds the notions of healthy behaviour and the required behavioural changes across society, targeted at specific audiences/target groups• Supports the self-sufficiency and resilience of citizens (and indirectly organisations and the economy)• Understanding behaviour and the mechanisms that can drive behavioural change can drive efficiencies and cost saving in delivering numerous programmes/initiatives together. This understanding will support delivery of initiatives that can deliver co-benefits (e.g. disseminating information on safe driving that also delivered fuel efficiency benefit)	LENS	  
	SCALE	
	OWNER	Municipality / Social Department
	PARTNERS	SO, Private Partners, Erasmus University College, Rotterdam University, Het Dok, Rotterdam Public Transport, Veldacademie, Medical Delta
	FINANCE (POSSIBLE)	Municipality / Social Department, partners
	STATUS	New
	RESULT	Short-term
	RELATED	B



PROGRAM: WE-SOCIETY



The program WE-Society is a citywide program which aims to support the current connections between population groups, facilitate further connections, promote dialogue and to stand up for one another. The programme includes a number of activities and forums that support these aims and will work with both new and existing groups and networks. It is the intention that the Mayor will share all dialogue and meeting records through the G1000 Citizens' Summit in 2017. The resilience programme will support the aims and activities of the WE-society programme and will look for opportunities to connect groups with wider city initiatives and to upscale the resilience benefits.

RESILIENCE VALUE

The WE-Society program is explicitly designed to increase the resiliency of society by joining citizens together to discuss and share common challenges and solutions and create a better understanding of cultural differences. It can directly contribute to our resilience goals 'vital citizens in a balanced society' and 'network city Rotterdam: truly our city.' The program strengthens existing networks in the city and contributes to the emergence of new community level networks.

LENS



SCALE



OWNER

Municipality

PARTNERS

Welfare Organizations

FINANCE (POSSIBLE)

Municipality / Central Management Department

STATUS

In development

RESULT

Short-term / Medium-term

RELATED ACTIONS



RELATED ACTIONS

6 INTEGRATION TOURS



Talks and events aimed at encouraging cooperation and dialogue between the city government, citizens and other stakeholders (e.g. private sector, NGO's). This action will make citizens aware of their own roles in society and how they can better contribute to city resilience. Talks will cover social and cultural integration issues and seek to break down barriers to effective dialogue.

Supports knowledge sharing, values alignment and education. These tours bring groups from different backgrounds and roles in society together to discuss different issues that are important for Dutch values. The program strengthens mutual understanding of differences in values and stresses what Dutch values stand for.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing, values alignment and education. These tours bring groups from different backgrounds and roles in society together to discuss different issues that are important for Dutch values. The program strengthens mutual understanding of differences in values and stresses what Dutch values stand for.	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Community Centres, Schools, Associations
	FINANCE (POSSIBLE)	Program WeSociety
	STATUS	In progress
	RESULT	Short-term (from 2016)
	RELATED	



7 THE G1000 CITIZEN'S SUMMIT



Foundation LOCAL is organizing a citizen's summit for 2017. It will bring together citizens and civil society and share the results of numerous recent city dialogues (see Action WE-society) that have focussed on key city issues from the citizen perspective. The resilience office will ensure the summit has slots to promote the city's work on resilience and to further education, raise awareness and promote the actions citizens can take to promote resilience. It brings together 1000 citizens that are randomly selected, seeking to provide a broad representation of the diversity in Rotterdam.

RESILIENCE VALUE

<ul style="list-style-type: none">Reinforces the good work and dialogues that have already taken place.Supports knowledge sharing and networking.Can be a catalyst for local level / community resilience projects.	LENS	
	SCALE	
	OWNER	WeSociety
	PARTNERS	WeSociety, Foundation LOCAL, Schools
	FINANCE (POSSIBLE)	Program WeSociety
	STATUS	New
	RESULT	Short-term (2017)
	RELATED	



8 BUILDING RESILIENCE THROUGH CULTURAL ACTIVITIES



The Foundation for Arts Education Rotterdam (SKVR) has a program which includes activities with a specific social objective. These activities are offered free of charge or at low rates. One example is to use music to increase resilience at a district level. These activities are developed with social partners in the city and public funds and are co-financed. Aimed at individual citizens the resilience office will work to integrate this activity into its broader resilience programme.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports bottom – up community led initiatives and build cohesion.	LENS	
	SCALE	
	OWNER	Foundation for Cultural Education
	PARTNERS	Social partners, Municipality, Funders
	FINANCE (POSSIBLE)	Funds, Municipality, Social Partners
	STATUS	In progress
	RESULT	Short-term
	RELATED	

9 100 HOMES FOR ASYLUM SEEKERS



The Foundation Verre Bergen has purchased 100 homes for families seeking asylum in Rotterdam. This forms part of their New Home Rotterdam program’s ambition to teach asylum seekers Dutch, assist them to find employment and education and to feel comfortable in their homes and neighbourhoods. This action will be supported and will be connected to wider efforts because it is an excellent example of an initiative contributing to the resilience of Rotterdam. Housing for refugees – and migration more broadly – is an important urban resilience challenge. A number of CRO’s within the 100 Resilient Cities network have started a conversation on migration which may lead to a formal exchange. 100 Resilient Cities member cities actively involved in this conversation include: Montreal, Athens, NYC, Thessaloniki, Vejle, Paris, Amman, Ramallah and Byblos. Rotterdam will consider whether we can contribute to this exchange in the future.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports and promotes an integrated and inclusive society.Supports knowledge sharing and networking.Demonstration of a private sector led initiative that contributes to a city wide goal.	LENS	
	SCALE	
	OWNER	Foundation De Verre Bergen
	PARTNERS	Municipality, the Central Agency for the reception of Asylum Seekers, Refugees Southwest
	FINANCE (POSSIBLE)	Foundation De Verre Bergen
	STATUS	In progress
	RESULT	Short-term (2017)
	RELATED	



STRONG SHOULDERS PROGRAM



The City of Rotterdam is aiming to increase the proportion of highly educated residents in the city in the coming years. Part of making this happen is in understanding the needs of this group of people to stay in Rotterdam or to migrate to Rotterdam. The program ‘Strong Shoulders Strong City’ develops and promotes activities aimed at achieving this goal, and takes energy from a group of successful entrepreneurial Rotterdammers. The program consists of four action lines:

- Inventory of good practices: what makes this group of citizens want to live in Rotterdam?
- Removal of existing barriers.
- Development of new projects following the needs and initiatives from the community.
- Communication and promotional activities.

RESILIENCE VALUE

The citywide program Strong Shoulders – Strong City contributes directly to the resilience objective ‘vital citizens in a balanced society’. More highly educated people will strengthen existing networks and the resilience of the local community and economy. It also strengthens the resilience goal Network City since this group of people strengthen the potential for self-organization of the community.

LENS	
SCALE	
OWNER	Program Strong Shoulders
PARTNERS	Municipality, District Committees, City Marketing
FINANCE (POSSIBLE)	Program Strong Shoulders, Partners
STATUS	In progress
RESULT	2016 – 2020
RELATED ACTIONS	<div>1011</div>

RELATED ACTIONS

10 VISION ON HOUSING (WOONVISIE)



The Woonvisie is Rotterdam’s vision to become an attractive residential city. It promotes attractive living environments, and housing that is future proof. Woonvisie creates a balance in housing for different groups of residents, improving housing quality. As such it has some cross over with the WE–society programme. The Woonvisie is the basis for agreements with all housing corporations and offers a framework for city developers and for the policymakers for the housing of specific goal groups.

RESILIENCE VALUE

<ul style="list-style-type: none">• The Woonvisie is an important instrument to provide adequate housing for different groups in the city supporting the goals of a balanced society and creates inclusiveness.• Supports Rotterdam’s brand and ‘pull’ as an attractive cosmopolitan city.	LENS	
	SCALE	
	OWNER	Urban Planning Department
	PARTNERS	Housing Corporations, District Committees
	FINANCE (POSSIBLE)	Urban Planning Department, Housing Corporations
	STATUS	New
	RESULT	Short-term / Medium-term (2016/2020)
	RELATED	<div>D</div>

11 PROMOTING CITIZEN COLLABORATION

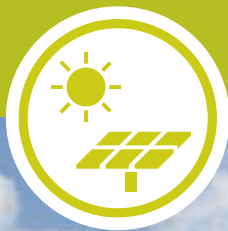


Within the Strong Shoulders program – supported by field work and surveys – work has been undertaken to consider how high and low–skilled Rotterdammers could work together in effective and harmonious ways. As a result of this work a range of approaches (‘how to’ guides) were developed. Some of the solutions are straight forward and simple whilst others require an intensive effort to seed more effective collaboration. This agenda needs to be developed and experiences learnt from other cities around the world, and specifically from with the 100 Resilient Cities network.

RESILIENCE VALUE

<ul style="list-style-type: none">• Contributes to a better understanding of conditions that enhance social cohesion and therefore supports a balanced society and inclusiveness.• Having different groups living in one neighbourhood enhances resourcefulness with more viewpoints and perspectives available to create ideas and solutions.• Can draw on the 100 Resilient Cities network	LENS	
	SCALE	
	OWNER	Program Strong Shoulders
	PARTNERS	District Committees, Municipality / Urban Planning Department and Urban Maintenance
	FINANCE (POSSIBLE)	Program Strong Shoulders, Municipality
	STATUS	New
	RESULT	Short-term (2016/2017)
	RELATED	<div>D</div>

GOAL 2:
WORLD PORT CITY BUILT ON CLEAN
AND RELIABLE ENERGY



ACHIEVING OUR ENERGY TRANSITION –
INSPIRATION FROM LONDON

Rotterdam wants to be the front runner in the clean energy transition and support recent political agreements through COP21 in Paris. Rotterdam looks to London for knowledge sharing in this area; the two cities are already partners in the EU CELSIUS Smart Cities project. Rotterdam hopes to engage further in this topic through the 100 Resilient Cities network. As an existing partner city for the CELSIUS project (comprising London, Rotterdam, Gothenburg, Cologne, Genoa), there are

obvious synergies between the two cities in terms of focus on district heating infrastructure and also in their wider climate change agendas and targets. Both cities need to use their respective planning policies to promote renewable energy uptake and to support the roll out of infrastructure that can support a low carbon energy transition, whilst also investing in improving energy efficiency in their existing buildings.

100 Resilient Cities member cities involved: Rotterdam, London.

E

ROTTERDAM ENERGY
INFRASTRUCTURE PLAN



A transition to efficient and renewable energy requires – in addition to building-related efficiency measures – a supporting and flexible infrastructure. Moving this from ambition to reality is challenging and will require a clear roadmap (or strategy). This roadmap will outline options, costs and benefits and set out a preferred strategy. It will consider technology innovation, phasing, emissions and infrastructure flexibility. This action will support the development of a clean energy road map. It will outline what is possible in terms of a future clean energy mix, (considering waste heat (e.g. heat roundabout), developments in the port area and renewable energy potential from wind and solar), set out infrastructure implications relating to phasing, potential disruptions, cost and flexibility and address any issues around approvals, regulations, partnerships and funding. This is a flagship action for Rotterdam and we will collaborate on this with other cities in the 100 Resilient Cities network such as London and New York. We have existing energy related collaborations with London through the CELCIUS project.

RESILIENCE VALUE

The renewable energy infrastructure plan (REIP) will set out a roadmap for how Rotterdam can deliver on its clean energy transition. This will reduce our emissions, improve our energy security and ensure we are future proof. It is also a key area of resilience where we will collaborate with the Port authority and a range of other utility stakeholders and technology providers.

Rotterdam wants to be the front runner in the clean energy transition and support recent political agreements through COP21 in Paris. Rotterdam looks to London for knowledge sharing in this area; the two cities are already partners in the EU CELSIUS Smart Cities project. Rotterdam hopes to engage further in this topic through the 100 Resilient Cities network. As an existing partner city for the CELSIUS project (comprising London, Rotterdam, Gothenburg, Cologne, Genoa), there are obvious synergies between the two cities in terms of focus on district heating infrastructure and also in their wider climate change agendas and goals. Both cities need to use their respective planning policies to promote renewable energy uptake and to support the roll out of infrastructure that can support a low carbon energy transition, whilst also investing in improving energy efficiency in their existing buildings.

LENS



SCALE



OWNER

Municipality with partners

PARTNERS

Stedin, Eneco, Nuon, Housing Corporations Woonstad, Portsteder, Vestia and Woonbron, Municipality of Rotterdam Urban Planning Department and Urban Maintenance Department , Central Government

FINANCE (POSSIBLE)

Partners

STATUS

Under development (supported and enhanced by this strategy)

RESULT

Medium-term / Long-term

RELATED ACTIONS



REINFORCING ROTTERDAM
MOERDIJK INDUSTRY CLUSTER



The Rotterdam / Moerdijk chemical cluster is different from other Dutch chemical clusters because of its strong integration with the oil refining sector, utilities and energy suppliers. An action plan will be developed together with the private sector with the aim to reinforce the Rotterdam / Moerdijk industry cluster. The action plan will contain concrete and specific measures to ensure companies stay within the cluster, and to further reinforce collaboration and initiatives within the cluster. The cluster is expected to play an important role in the transition from a linear, fossil economy to a circular, bio-based economy (see Action ‘A transition from a fossil fuel to a bio-energy for our Port’).

RESILIENCE VALUE

The industrial port cluster is of fundamental economic importance for Rotterdam and the Netherlands. The survival of the industrial cluster is vital for the city port region and the Netherlands. This initiative also delivers benefits in terms of the clean energy transition and next economy, including 21st century skills. The action plan must safeguard the leading position of this cluster in Europe.

LENS



SCALE



OWNER

Port Authority, Port business community

PARTNERS

Most companies in the port area

FINANCE (POSSIBLE)

Port Authority, Ministry of Economic Affairs

STATUS

Under development

RESULT

Short-term / Medium-term

RELATED ACTIONS





PARIS PLUS (SUSTAINABILITY PROGRAM)



In order to support the Government's COP21 climate commitments Rotterdam is required to implement additional emissions saving measures. These include simple, cost-effective provision and installation of solar panels as well as the development of large solar parks, and switching a large portion of the municipal vehicle fleet to more efficient vehicles. The Rotterdam Climate Initiative (RCI) is also working in the port to reduce energy consumption, through: reuse of industrial waste heat, renewable energy generation (using wind, solar and biomass), promoting the use of LNG and hydrogen, and the capture, transport, reuse and storage of CO₂ (carbon capture and storage). In rolling out these actions we will integrate resilience thinking to ensure the actions and activities contribute to the city resilience goals set out in this strategy document.

RESILIENCE VALUE

By building on the momentum and government support through the climate agreement developed following COP21, this programme of measures will seek to accelerate the energy transition in Rotterdam. It can also provide a platform to integrate resilience thinking into initiatives that already have political support.

LENS



SCALE



OWNER

Municipality

PARTNERS

Housing corporations, Port Authority Rotterdam, Deltalinqs

FINANCE (POSSIBLE)

Municipality, partners

STATUS

New

RESULT

Short-term (2016/2017)

RELATED ACTIONS



PORT TRANSITION FOCUSED ON BIO-BASED ECONOMY



The Port Authority along with the Dutch Research Institute for Transitions (DRIFT) is working to establish a bio-based port forum. In addition to established parties in the port, a number of smaller frontrunner parties and external port observers will be included in this, including organizations from the industries of food, logistics and agriculture and recycling. This forum will give rise to a “transition agenda” for the future of the bio-based port. The transition agenda will set out:

- A vision and guiding principles for the bio-based harbour
- Goals and goals
- Practical steps / actions and initiatives to realise the vision
- Commitment by the key parties for immediate follow-up on the identified actions.

The resilience office will support the development of this forum and supporting agenda and will work to ensure the plan and actions respond to Rotterdam’s resilience challenges.

RESILIENCE VALUE

Making a transition from a fossil fuel-based energy system to a bio-based economy in the Rotterdam will be a challenge, but will build resilience through by creating supply chain networks, reducing emissions and enhancing the area’s brand. A shift towards a sharing economy also supports agendas around the next economy, skills development and smart technology approaches. Taking a lead on this agenda should also give Rotterdam a competitive advantage and allow knowledge share with a number of other port or post-industrial cities. Rotterdam has explored collaboration potential with Glasgow and Bristol through the 100 Resilient Cities network. The forum will be inclusive of a wide range of stakeholders and will build relationships which could lead to collaboration in other areas, for example on the broader clean energy transition (wind and solar) or on climate adaptation.

LENS



SCALE



OWNER

Port Authority

PARTNERS

Drift, stakeholders

FINANCE (POSSIBLE)

Port Authority

STATUS

In progress

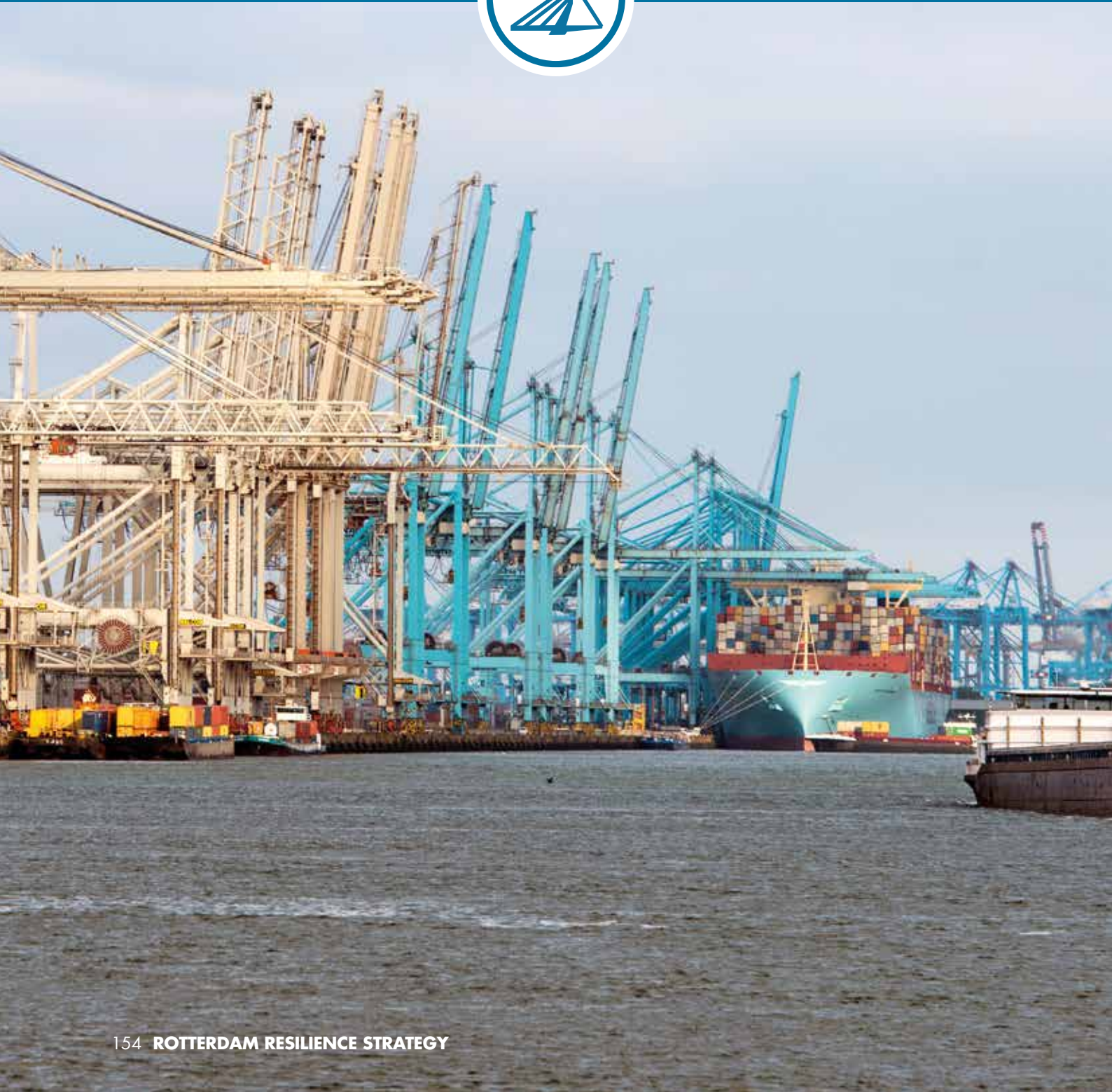
RESULT

Medium-term / Long-term

RELATED ACTIONS



GOAL 3:
ROTTERDAM CYBER PORT CITY



I

TURNING A SMART CITY
INTO A CYBER RESILIENT
CITY (DELTAPLAN CYBER)



INTEGRAL IMPLEMENTATION OF CYBER RESILIENCE BLOCKS FOR CITY
AND PORT

This action will support the further development and implementation of the cyber resilience building blocks. These building blocks – for city and port – have been developed in collaboration between the City of Rotterdam and Microsoft and when taken together form a sub strategy on cyber resilience. Since the Port and City are two different entities – each with specific issues and goal groups – they will be dealt with primarily individually but in a connected way whenever possible.

RESILIENCE VALUE

The implementation of the cyber building blocks for port and city contribute directly to the development of Rotterdam cyberport city. This action is considered as integral to our resilience strategy; smart technology will help to connect many of our initiatives. These underpinning ICT systems need to remain safe and resilient in the face of cyber threats.

LENS



SCALE



OWNER

Cyber Resilient Platform Rotterdam, Business partners connected to the Port Resilience officer, Mayor, Chief Prosecutor, Chief of Police

PARTNERS

Municipality, partners, Businesses

FINANCE (POSSIBLE)

Municipality, port, Businesses, partners, EU

STATUS

New

RESULT

Short-term / Medium-term

RELATED ACTIONS



RELATED ACTIONS

12 CYBER BUILDING BLOCKS: PORT



- A Port Cyber Resilience Working Group has been established to develop and implement the key building blocks, as follows:
- Appoint a Port Cyber Resilience Officer to support coordination
 - Establish a Cyber Co-op to promote cyber products and services, to share learning and encourage private sector engagement
 - Set up a Cyber Notification Desk to allow real-time cyber incident notification
 - Establish a Cyber Threat Intelligence Watch to monitor cyber threat signals – actual cyber threats and trends
 - Put in place a Cyber Response Team as the first response team with the objective to de-escalate cyber incidents
 - Establish a Cyber Resilience Community of Practice
 - Begin structured communication about cyber threats and incidents

RESILIENCE VALUE

<ul style="list-style-type: none">• Creates an approach to detect and deal with the vulnerabilities in the cyber systems that are vital to the functioning of the port and its industries• Supports knowledge sharing and networking• Embeds resilience thinking across all port related activities	LENS	
	SCALE	
	OWNER	Cyber Resilience Officer of the port
	PARTNERS	Deltalinqs, port, Businesses, municipality
	FINANCE (POSSIBLE)	Port, municipality, Businesses, EU
	STATUS	New
	RESULT	Short-term / Medium-term
	RELATED	I

13 CYBER BUILDING BLOCKS: CITY



- For the city a Cyber Resilience Platform will be established to coordinate and start-up actions to implement the cyber resilience building blocks. These actions include:
- Establishing the Cyber Resilience platform
 - Developing a programme around Cyber Awareness
 - Developing a learning programme around Cyber Competences.
 - Establishing a Cyber Co-op to promote cyber products and services, to share learning and encourage private sector engagement
 - Developing codes of practice and requirements for cyber products and services
 - Collecting learning on Cyber Disruption
 - Establishing a Cyber Resilience Community of Practice

RESILIENCE VALUE

<ul style="list-style-type: none">• Creates an approach to detect and deal with the vulnerabilities in the cyber systems that are vital to the functioning of the city and stakeholders including the citizens. Supports knowledge sharing and networking.• Embeds resilience thinking across all city related activities.	LENS	
	SCALE	
	OWNER	Cyber Resilience Platform
	PARTNERS	Businesses, Welfare Organizations, municipality, citizens
	FINANCE (POSSIBLE)	Port, municipality, Businesses, EU
	STATUS	New
	RESULT	Short-term / Medium-term
	RELATED	A I

14 CYBER COLLABORATION – LONDON AND SINGAPORE



Cyber resilience is a key focus in London and Singapore. This action will further explore opportunities for city to city knowledge transfer within the cyber field, drawing on the 100 Resilient Cities city network and specialists from amongst the 100 Resilient Cities platform partners. Microsoft has already provided support to Rotterdam in relation to cyber security.

RESILIENCE VALUE

<ul style="list-style-type: none">• Supports knowledge sharing, innovation and networking.• Creates efficiency through resource and knowledge sharing.	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Municipality Londen, municipality Singapore
	FINANCE (POSSIBLE)	100 RC, City, port
	STATUS	New
	RESULT	Short-term
	RELATED	I

COLLABORATING ON CYBER SECURITY – LEARNING FROM LONDON AND SINGAPORE, AND USING 100 RESILIENT CITIES PLATFORM PARTNERS.

Cyber security has been identified as a key resilience challenge for Rotterdam. We have already collaborated with Microsoft – a 100 Resilient Cities platform partner – to consider actions that we can take to increase cyber resilience. We now want to exchange knowledge with other 100 Resilient Cities cities. London and Singapore have been identified as cities that may be able to support us in this area. We have agreed an action within our resilience strategy to exchange knowledge and insights on cyber security with London and Singapore.

100 Resilient Cities member cities involved: Rotterdam, London. Singapore. Platform partners: Microsoft



15 CYBER RESILIENCE OF INDUSTRIAL AUTOMATION



The cyber resilience of all automated infrastructure that is run by the municipality will be evaluated against vulnerabilities to identify cyber threats. Once the threats are understood an action plan will be developed to mitigate risks.

RESILIENCE VALUE

<ul style="list-style-type: none">Ensures that cyber resiliency is considered specifically as an important condition to keep the municipal infrastructure running.	LENS	
	SCALE	
	OWNER	Municipality / Urban Planning Department
	PARTNERS	Maintenance Departments
	FINANCE (POSSIBLE)	Municipality / Urban Planning Department, Partners
	STATUS	New
	RESULT	Short-term
	RELATED	

16 CYBER RESILIENCE OF SMART CITY INITIATIVES



Rotterdam is developing a Smart City program and already carrying out different smart initiatives. The cyber resilience of the Rotterdam Smart City Programme initiative will be assessed and related to the development of the cyber resilience building blocks.

RESILIENCE VALUE

<ul style="list-style-type: none">Ensures that as new smart technology is deployed for efficiency and sustainability benefits the cyber risk and resilience issues are thoroughly considered; an important element in developing a smart city programme.	LENS	
	SCALE	
	OWNER	Municipality / Urban Planning Department
	PARTNERS	Municipality and Businesses
	FINANCE (POSSIBLE)	Municipality / Urban Planning Department
	STATUS	New
	RESULT	Short-term
	RELATED	



17 CYBER COLLABORATION – METROPOLITAN AREA



This action will facilitate collaboration across the Rotterdam –The Hague Metropolitan Area level, specifically sharing knowledge and resources on the topic of cyber and water management. Research findings and / or actions identified through this collaboration will be integrated within the building blocks of the city and port cyber resilience strategies. Opportunities will be sought to jointly secure grant funding, such as from the EU. We will seek to open up communication channels between our metropolitan collaborators and with our international collaborators (see Action Cyber collaboration – London and Singapore).

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing and networking across the region and internationally	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Universities, Universities of Applied Science, Innovation Quarter, Metropolitan area Rotterdam – The Hague
	FINANCE (POSSIBLE)	Partners and MRDH
	STATUS	New
	RESULT	Medium-term
	RELATED	

GOAL 4:
CLIMATE ADAPTIVE ROTTERDAM
TO A NEW LEVEL



J

WATER SENSITIVE
ROTTERDAM (WSR)



EMBEDDING CLIMATE ADAPTATION INTO THE URBAN FABRIC OF THE CITY

This action will develop and enhance existing programmes aiming to prepare the city for the impacts of climate change. Measures included within this action are in line with projects already completed in Rotterdam such as Benthemplein, and will be designed to support community learning – specifically in respect of understanding the urgency of the need to take action on climate change. Measures will range in their type and scale but we envisage:

- A large number small projects that can be led by citizens and businesses under the motto “many small actions; make a big difference”
- A small selection of key projects specifically designed to inspire and create publicity and profile
- Effective large-scale projects that run quietly in the background to deepen understanding, support research and tools developed (e.g. rigorous cost / benefit analysis).

We specially want to seed a new way of thinking. To not see rain water as a problem or a threat but to recognise it as a valuable raw material that should be utilized as much as possible locally. We want to move further towards fully integrated water cycle management – integrating the water cycle into our urban environment including collection (attenuation), treatment and conveyance. We will seek to related our climate change projects to other resilience actions and to publicise the synergies.

RESILIENCE VALUE

All climate change projects and initiatives will consider how they can contribute to the further development of a liveable city; promote social cohesion whilst also increasing Rotterdam’s resilience to water stresses and shocks. It especially appeals to inclusiveness; involving property owners to participate and integration to use and enrich ongoing developments with water management actions.

LENS



SCALE



OWNER

Municipality / Urban Maintenance Department

PARTNERS

Water boards, county, housing associations, citizens, Market parties. Parties may differ for each initiative.

FINANCE (POSSIBLE)

Municipality, partners

STATUS

Under development

RESULT

Short-term / Medium-term / Long-term

RELATED ACTIONS

18

RELATED ACTIONS

18 ZOHO: 1ST CLIMATE-PROOF DISTRICT



Zomerhofkwartier (Zoho) together with the support of users of the area (residents, businesses, organizations and visitors) has undergone a gradual urban regeneration. A neighbourhood which previously had a lot of empty commercial units has been transformed into a district where everything is possible, with 120 companies now operating in the area. The unique multifunctional Waterplein Benthemplein acted as a catalyst project for further development of Zoho. Climate adaptation was found to act as a driver for sustainable development and has strengthened social cohesion. The resilience office will collect experiences learnt in Zoho and scale them up to other districts and the surrounding areas. The district and wider region can therefore be used as an example for how to scale up green and creative solutions for water retention whilst also strengthening community relateds and building knowledge capital.

RESILIENCE VALUE

Using climate adaptation as the driver the Zoho project has successfully integrated urban design, landscape, arts and community projects to provide a catalyst for a whole scale regeneration of a district in Rotterdam. It is a fantastic example of how combining a suite of initiatives in a single area together with careful community and business consultation and engagement can deliver a range of beneficial outcomes. This district is now more resilient to flooding, more self-sufficient and has a stronger and more connected community. The challenge now is to take the learning from Zoho and apply it in other districts in Rotterdam. This can help to disseminate resilience thinking, encourage participation and support learning.	LENS	
	SCALE	
	OWNER	Havensteder, Municipality, Urbanisten, AIR
	PARTNERS	Havensteder, Municipality, Urbanisten, AIR
	FINANCE (POSSIBLE)	EU, Partners and owners
	STATUS	In progress
	RESULT	Long-term
	RELATED	



K

CYBER PROOF WATER SYSTEM



FLOOD 2.0: DEVELOPING A PLAN FOR MAKING OUR WATERMANAGEMENT SYSTEM CYBER PROOF

A TNO study into the vulnerability of the wastewater and surface water systems in Rotterdam indicates that these systems are generally robust. Climate change and increasing digitalization and automation of the systems will test this, and will likely expose more cascading impacts and vulnerabilities, specifically to ICT disruptions. The TNO study was carried out from the resilience perspective, with particular consideration for ICT, security and emergency response. Operational specialists and policy-oriented professionals from both municipal and water authorities collaborated on the study. A quick scan of risks for critical functions of the water systems (undertaken for the study) highlighted a greater need for tactical awareness regarding the cyber risks of Industrial Control Systems. A deeper assessment and action plan will be developed responding to this risk.

RESILIENCE VALUE

By increasing automation of the City's water systems it is important to also consider the cyber risks of ICT systems as well as cascading impacts if there is a technology malfunction. Climate cyber resilience and critical infrastructure are closely related; we expect some learning from this action to support other actions relating to critical infrastructure asset management.	LENS	
	SCALE	
	OWNER	Municipality, Water Boards
	PARTNERS	Chainpartners
	FINANCE (POSSIBLE)	Municipality, Water Boards
	STATUS	New
	RESULT	Medium-term
	RELATED ACTIONS	



ADAPTIVE WATERFRONT DEVELOPMENT



GAINING ADDED VALUE FROM FLOOD DEFENCES: FEIJENOORD

Feijenoord is considered to be an area vulnerable to flooding from the river and is also undergoing urban development. In order to balance these – at times – conflicting characteristics it is important to understand the level of flood risk, the implications of this and also the opportunities that may be presented to integrate flood management strategies into the urban design response.

Agreements between the developers and other parties which outline the distribution of costs and benefits to contribute to the design and development integrated and sustainable development of the district have initially gained support. This could involve the municipality and water board bearing the costs of the construction and management of a flood defence with private parties contributing a proportion to the investment costs in return for direct benefits in terms of reduced flood risk and improved socio-economic conditions within the district. In order to capitalize on these opportunities, it is necessary to work with all stakeholders in the flood-prone areas to develop a water safety plan in conjunction with the development masterplan. The resilience office will support this and help upscale lessons learned from this development.

RESILIENCE VALUE

There are opportunities to respond to risk (flooding) in an integrated and inclusive way as part of a development plan and vision. This can also be supported by an alternative funding model where investors can accrue benefit due to reduced flood risk, reduced insurance and higher development values. This approach can serve as a model for integrated climate resilient waterfront development elsewhere in the Netherlands and internationally.

LENS



SCALE



OWNER

Municipality, Water Board

PARTNERS

Housing Corporations, Residents, Property Owners, Developers, Utility Companies

FINANCE (POSSIBLE)

Municipality, partners

STATUS

New

RESULT

Short-term / Medium-term

RELATED ACTIONS



RELATED ACTIONS

19 PLAN FOR CLIMATE RESILIENT CRITICAL INFRASTRUCTURE



An important part of the Delta Program is “spatial adaptation”, such as spatial adjustments to the existing city within the dykes. An important part of this is critical infrastructure. A new spatial plan will be developed based on regional analysis of critical infrastructure resilience to climate change.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing, innovation and networking.A spatial overlay and mapping can deliver co-benefits in considering development growth opportunities and overlaying other considerations such as socio-economic metrics, renewable energy potential and broader infrastructure opportunities and constraints.	LENS	
	SCALE	
	OWNER	Municipality, Central Government, Water Boards, Deltaprogram partners, RDC
	PARTNERS	Municipality, Central Government, Water Boards, Deltaprogram partners, RDC
	FINANCE (POSSIBLE)	Municipality, Central Government, Water Boards
	STATUS	New
	RESULT	Short-term
	RELATED	

20 VERTICAL EVACUATION PLANNING



An important part of the National Delta Program is the concept of “multi-layer safety”. This involves prevention (1st layer) spatial adaptation (2nd layer) and evacuation (3rd layer). The evacuation layer has yet to be fully planned and developed. The pilot study “crisis management during floods” found that vertical evacuation needs proper consideration as a serious option for layer 3. Specifically, consideration should be given to the fact that the highest areas are located along the river, outside the dykes and the entire port area. We will develop a vertical evacuation plan as part of our resilience strategy implementation.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports preparedness and embeds considerations for evacuation into all aspects of the city and port.	LENS	
	SCALE	
	OWNER	municipality
	PARTNERS	central government, water boards, RDC
	FINANCE (POSSIBLE)	central government, water boards, Regional Safety Board, RDC
	STATUS	New
	RESULT	Short-term
	RELATED	

21 CLIMATE RESILIENT WATERFRONT AREAS



In 2014 the National Delta Programme was established. In Rotterdam, as part of the Rotterdam Adaptation Strategy, there are a diverse range of pilot studies which focus on climate resilient development in the wider region; looking at both urban and industrial areas. Some include Pilot Noordereiland, Pilot Botlek, Pilot Feijenoord, Pilot Crisis management and flooding. The results of these pilots will be collated and translated into overall policy for the area outside the dykes in Rotterdam.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing and networkingDevelopment of new strategies for floodprone areas.Embeds climate resilient thinking into all areas of Rotterdam.	LENS	
	SCALE	
	OWNER	Municipality, HbR
	PARTNERS	Water boards, Province, Central government
	FINANCE (POSSIBLE)	Municipality, Port Authority, Partners
	STATUS	In progress
	RESULT	Short-term (2016)
	RELATED	



22 ROTTERDAM–THE HAGUE EMERGENCY AIRPORT (RHEA)

The Rotterdam–The Hague Emergency Airport (RHEA) will create an economic cluster focussing on clean technology and water security in an airport setting. As a ‘safe haven’, the site can be an excellent example of water security in The Netherlands (demonstrating multi-layer security: 3rd Layer). We will establish a knowledge and training centre for service providers, business, research, NGOs and aid organisations that will tap into RHEA companies and scientists specialized in clean technology products in the region.

RESILIENCE VALUE

<p>This centre will serve as a demonstrator for Rotterdam. It will achieve a critical mass of organisations and institutes that will be a catalyst for innovation and research. The cluster will support resilience goals around water, energy transitions and next economy / 21st century skills.</p> <p>It will provide a safe area in case of regional emergencies and a base from which support can be delivered to disaster prone areas around the world.</p>	LENS	
	SCALE	
	OWNER	Rotterdam The Hague Airport, Schiphol Real Estate, Municipality of Rotterdam, Municipality of The Hague, Metropolitan Region Rotterdam–The Hague, Ministry of Infrastructure and Environment, Ministry of Economic Affairs, Clean Tech Delta, Deltares, Sweco, Innovation Quarter, UNESCO–IHE, TU Delft
	PARTNERS	Rotterdam The Hague Airport, Schiphol Real Estate, Municipality of Rotterdam, Municipality of The Hague, Metropolitan Region Rotterdam–The Hague, Ministry of Infrastructure and Environment, Ministry of Economic Affairs, Clean Tech Delta, Deltares, Sweco, Innovation Quarter, UNESCO–IHE, TU Delft
	FINANCE (POSSIBLE)	Partners
	STATUS	New
	RESULT	Medium–term
	RELATED	

23 FLOATING CITY

The municipality of Rotterdam – through their Climate Proof and Adaptation Strategy – have stated an ambition to explore opportunities presented by building floating developments. The Floating Pavilion was our first move. This was followed by floating houses in the Nassau Harbour, Experimental Zone Aqua Dock and innovative designs for a floating farm and water treatment. Upscaling of these approaches and bringing them into the mainstream is our next step and is an action we will take forward as part of implementing our resilience strategy.

RESILIENCE VALUE

<ul style="list-style-type: none">• Supports innovation in climate resilient building and infrastructure provision• Raises awareness of climate risks	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Resilient Delta Cities (RDC)
	FINANCE (POSSIBLE)	Municipality, Private Partners
	STATUS	Under development
	RESULT	Medium–term / Long–term
	RELATED	



TWINNING NEW ORLEANS AND ROTTERDAM – WATERMANAGEMENT

New Orleans (NOLA) and Rotterdam have been collaborating since 2008, specifically in relation to water management. After hurricane Katrina Dutch experts assisted NOLA by hosting the “Dutch Dialogues”. Learning from this dialogue contributed to the development of NOLA’s Integrated Water Management Plan. Now NOLA participates in the Connecting Delta Cities network and the two cities are further linked by their participation in the 100 Resilient Cities programme. The two cities have both benefitted from earlier knowledge sharing and are committed to more collaboration in the future. Future efforts will be directed towards climate resilience, social resilience and the development of business and knowledge.

GOAL 5:
INFRASTRUCTURE READY
FOR THE 21ST CENTURY



M

COOPERATION
BETWEEN INFRASTRUCTURE
PROVIDERS



The subsurface is required for routing multiple infrastructure types and numerous agencies have an interest in how the subsurface is managed. The municipality plays an important role in this management, but there are multiple network providers which operate independently of each other. There is a need for greater organisation and cooperation, especially in times of emergency when a disruption to one type of critical infrastructure can have cascading impacts across infrastructure networks. There is a greater need to ensure that the providers coordinate approaches and share experiences and knowledge. This action seeks to incorporate resilience into the agenda at a strategic level as well as on to the existing platforms for infrastructure / utility providers.

RESILIENCE VALUE

This action will facilitate dialogue between different network operators, allowing them to verify their resilience and eventually increase the resilience of the overall system of critical infrastructure. Communication regarding resilience at operational and strategic levels will strengthen and broaden relationships between stakeholders which will lead to benefits in our other resilience goal areas (e.g. energy transition).

LENS



SCALE



OWNER

Municipality

PARTNERS

Stedin, Evides and other Infra providers

FINANCE (POSSIBLE)

To be determined

STATUS

Under development

RESULT

Short-term / Medium-term

RELATED ACTIONS



N

THE SUBSURFACE
ABOVE GROUND



DEVELOPING POLICY TO RAISE THE IMPORTANCE OF SUBSURFACE IN
PLANNING AND PROJECTS

Consideration and understanding of both above and below ground will allow the city to better realise its ambitions for densification, greening and water storage. Once spatial planning is comprehensive and inclusive, there is more room for flexibility and ingenuity. There is a need to better consider above and below ground development in an integrated manner as currently when making spatial plans for the city there is currently too little consideration given to the subsurface infrastructure. Developing policies goaled at the subsurface planning and management is an integral part of spatial development and allows for appropriate corridor protection and optimal space use. These policies will be developed as an action as part of the implementation of this resilience strategy.

RESILIENCE VALUE

A shared vision and policy for ‘underground in Rotterdam’ will raise awareness of risks and opportunities of the underground systems to both urban planners and infrastructure managers. It will support better planning and asset management and therefore help improve resilience.

LENS



SCALE



OWNER

Municipality / Urban Maintenance Department and Urban Planning Department

PARTNERS

Province, water boards, Port Authority

FINANCE (POSSIBLE)

Municipality

STATUS

New

RESULT

Short-term / Medium-term

RELATED ACTIONS



RELATED ACTIONS

24 ANALYTICAL RESEARCH ON INFRASTRUCTURE AND FEATURES IN THE SUBSURFACE

Gaining a better understanding of interdependencies and cascading effects as well as insight into the most fragile assets of the critical underground networks will allow opportunities for increasing resilience to be identified. This will require a full assessment and investigation of the existing networks in Rotterdam. This assessment will be taken forward as an action associated with the implementation of this resilience strategy.

RESILIENCE VALUE

<ul style="list-style-type: none">Embeds resilience thinking across all activities related to critical underground infrastructure.Supports knowledge sharing and networking.Helps to tease out synergies between critical infrastructure and other resilience goals.	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Resilient Delta Cities (RDC), Private parties
	FINANCE (POSSIBLE)	Municipality, Stakeholders
	STATUS	New
	RESULT	Short-term / Medium-term
	RELATED	

25 QUICK SCAN OF SELF-RELIANCE

This action will provide a scan of the extent to which residents of Rotterdam are or can be self-reliant in terms of disruptions to critical infrastructure (long term power failures, heating, drinking water supply, etc).

RESILIENCE VALUE

<ul style="list-style-type: none">Supports greater understanding of residual vulnerabilities from infrastructure disruptions.Provides context on community and business resilience activities and investmentSupports understanding of the role government can play in providing back up services during emergencies.	LENS	
	SCALE	
	OWNER	Municipality / Urban Maintenance Department and Urban Planning Department
	PARTNERS	Regional Safety Board (VRR)
	FINANCE (POSSIBLE)	Municipality, Region
	STATUS	New
	RESULT	Medium-term
	RELATED	

26 COST BENEFIT ANALYSIS OF INFRASTRUCTURE DECISION MAKING

Generally, risk management and spatial planning do not consider the costs and benefits of development in the longer term (i.e. the full life cycle considerations), but this can support effective decision making and help make the case for investment in redundancy. This is particularly prevalent in the context of underground critical infrastructure. The action will seek to determine how through cost benefit analysis can support infrastructure decision making, including for example, approaches to take account of the value of the subsurface space taken up by the infrastructure.

RESILIENCE VALUE

<ul style="list-style-type: none">Embeds resilience thinking and proper (lifecycle) cost benefit analysis into critical underground infrastructure decision making and delivery	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Project developers, area developers
	FINANCE (POSSIBLE)	Municipality
	STATUS	New
	RESULT	Medium-term
	RELATED	

27 THE DEVELOPMENT AND IMPLEMENTATION OF ASSET MANAGEMENT FOR OUR UNDERGROUND INFRASTRUCTURE

The municipality of Rotterdam’s asset management team used to maintain and manage all assets in public spaces as well as manage a risk register. This included for items such as bridges and quay walls and also green spaces and lighting. Asset management not only considers the costs and current status of the assets themselves but also the potential risks that the failure of the assets could have on the functioning of the city. By mapping the risks, decisions can be made as to what measures should and should not be performed based on a balance of performance, risk and cost. Smart investments now can often deliver savings in the future. This action will develop protocols for the asset management of underground infrastructure, intended to support decision making in respect of maintenance and replacement.

RESILIENCE VALUE

<ul style="list-style-type: none">Embeds resilience thinking into the management of current assets as well as future planned and developed.Supports knowledge sharing, specifically of infrastructure risks amongst infrastructure providers and developers.	LENS	
	SCALE	
	OWNER	Municipality, Urban Maintenance Department
	PARTNERS	Municipality, Urban Maintenance Department
	FINANCE (POSSIBLE)	Municipality, Urban Maintenance Department
	STATUS	Under development
	RESULT	Medium-term
	RELATED	



STREET OF THE FUTURE



SUBSURFACE INVESTMENT PRIORITIES FOR THE STREET OF THE FUTURE

Rotterdam's subsurface environment is getting overcrowded, in some areas this is a limitation on new development. There are a growing number of disruption incidents as a result of still insufficiently subsurface mapping and accidental excavation of critical infrastructure, and co-ordination and dialogue between the various utility companies needs to be improved. The city is improving our old degraded infrastructure (e.g. gas networks and around 40km of sewer per year) whilst at the same time investing in new infrastructure that is fit for the future, for example, to support a clean energy transition and the next economy (digital).

As a result of the underground upgrades, investments now could deliver long term pay back though increased flexibility and redundancy to allow greater surface level building development. Ensure appropriate investment relies in part in having a future vision. This action will seek to conceive the street of the future. We imagine new multi-utility service corridors, improved subsurface 3D mapping, enhanced co-ordination and dialogue and thorough market and citizen engagement will help us to determine now what infrastructure investments are needed to ensure sufficient flexibility for the street of the future.

RESILIENCE VALUE

Engagement with utilities will help to better understand the infrastructure required to support key city transitions (e.g. energy and smart city). The physical works will ultimately facilitate development, grow the economy and ensure new infrastructure investments consider resilience. Secondary benefits will come from business and citizen engagement (i.e. participatory design process) and through enhancing knowledge around the impacts of climate change on the subsurface environment.

LENS



SCALE



OWNER

Municipality / Urban Maintenance Department

PARTNERS

Residents, Stedin, Evides, Businesses

FINANCE (POSSIBLE)

To be Determined

STATUS

Under development

RESULT

Medium-term

RELATED ACTIONS

GOAL 6:
ROTTERDAM NETWORK — TRULY OUR CITY



ACTIVE CITIZENS



FACILITATION AND EXPERIMENTING WITH SELF-ORGANIZATION OF CITIZENS

Rotterdam has already developed a suite of tools to respond to the needs and aspirations of its citizens. The city uses this suite of tools, such as small grants for Residents Initiatives, CityLab010 for innovative actions, Opzoomeren for street activities, the “Right to Challenge” and Citizens Jury, Referendum and Digital opinion research to engage and support community and private sector grass roots initiatives in the city.

The city recognises that in order to further the engagement and mobilization of citizens there is a need for a shift from top-down city level and framework approaches to bottom-up interests and initiatives at the citizen and neighbourhood level. The municipality is continuously seeking to optimise the value gained from its processes and activities and understands that to derive most value from these tools it needs to improve its back office processes around initiative selection, management and funding to provide a smoother interaction for the citizen.

RESILIENCE VALUE

The ability for self-organization is a key element for a resilient city. This action will seek to build engagement at citizen and community level by enhancing the user experience associated with existing city funding and support initiatives. Providing greater incentive for citizens to come forward with solutions they can implement at local level can strengthen social cohesion and support a number of our resilience goals. It is expected community initiatives will include local energy production, small-scale water measures and social entrepreneurship.

LENS



SCALE



OWNER

Municipality

PARTNERS

Bottom line this action belongs to the Municipality, but it will involve other stakeholders who themselves also need to change. For example housing corporations and infrastructure providers

FINANCE (POSSIBLE)

Municipality, District Committees

STATUS

Under development

RESULT

Short-term

RELATED ACTIONS



ROTTERDAM
NETWORK CITY



CREATING NETWORKS OF GOVERNMENT, CITIZENS, INSTITUTIONS,
MARKET AND KNOWLEDGE

There is a changing role for the government, instead of a central guiding policy role, the role is increasingly shifting to frameworks, facilitation and enabling. The community and the market have increasing ambition to tackle social issues and therefore also expect to get more space and support from the government to do so. It is important that the market, community and government facilitate each other and find an effective method for cooperation and collaboration. That is the basis for a resilient system of governance for Rotterdam. Make it happen: the motto for the city encompasses this. This action is intended to ensure that we become more aware, that we recognise the importance of networks and platforms for engagement and that we share our knowledge around key initiatives.

RESILIENCE VALUE

This action contributes to building relationships between citizens, companies and institutions and can deliver benefits across most of the identified resilience goals.

LENS



SCALE



OWNER

Municipality

PARTNERS

It is a call to all stakeholders that contribute to the network of the city

FINANCE (POSSIBLE)

Not Applicable

STATUS

In progress

RESULT

Short-term

RELATED ACTIONS



RELATED ACTIONS

28 WORLD EXPO 2025



World Expo 2025 is an initiative led by a group of Rotterdam entrepreneurs. Their plan includes a ten-year economic program that culminates during the Exhibition in 2025. The Expo will last six months and attract an estimated twenty million visitors. Only the Dutch Government can put Rotterdam forward as a candidate for the Expo; a decision has yet to be taken on this. The municipality has approved the plan and agrees that the spatial integration contributes to the necessary infrastructure upgrades. Additionally, proposed is an 'Expo Works' authority, which is a special program aimed at creating jobs for young people in Rotterdam. The theme of the World Expo 2025 would be 'Rotterdam Changing Currents', with one of the subthemes titled 'Deltas in Transition'.

RESILIENCE VALUE

- Supports inward investment in development and infrastructure and can leave a legacy (see Lisbon, Milan etc).
- Embeds resilience thinking to wide range of activities.

LENS



SCALE



OWNER

ING, Rabobank, KPMG, EY, Eneco, Royal Haskoning DHV, Van Oord, AVR, ABN AMRO, Robeco, First Dutch, TBI, KPN, TNO, Vopak, VTTI, KLM

PARTNERS

Municipality

FINANCE (POSSIBLE)

Partners, Central Government

STATUS

New

RESULT

Medium-term / Long-term

RELATED



29 INTERNATIONAL ADVISORY BOARD AND RESILIENCE



The International Advisory Board Rotterdam (IAB) is a unique advisory council made up of international leaders in academia and the private and public sectors. The IAB meets once every two years to advise the Municipal Executive of Rotterdam on economic and other aspects of urban development. The IAB serves as a sounding board for the Municipal Executive on issues related to international economic developments. The IAB is currently chaired by Jan Peter Balkenende, former prime minister of the Netherlands. Rotterdam with partners, we will explore the possibilities to address Resilience as main topic for the IAB 2017.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing, innovation and networking and builds the profile of the Rotterdam Resilience Programme.	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Municipality and partners
	FINANCE (POSSIBLE)	To be determined
	STATUS	New
	RESULT	Short-term (2017)
	RELATED	

30 CITY MAKERS CONGRESS



An annual congress in which a wide range of interested parties from the city, such as developers, housing corporations, design agencies and interest groups collaborate on design issues in the city. The aim is that through city labs issues are addressed and solutions are devised. The resilience office will support this congress and bring resilience to the table for discussion.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports bottom up – community led initiatives and builds cohesion.Embeds resilience thinking to wide range of activities and stakeholdersSupports knowledge sharing, innovation and networking.	LENS	
	SCALE	
	OWNER	Municipality, Van Der Leeuwkring, AIR
	PARTNERS	
	FINANCE (POSSIBLE)	Municipality, Van Der Leeuwkring, AIR
	STATUS	In progress
	RESULT	Short-term / Annual
	RELATED	



NEIGHBOURHOOD ORIENTED GOVERNANCE



The city of Rotterdam is constantly looking for ways to connect urban interests and the interests of the individual citizen, streets and neighbourhoods. Rotterdam has 14 regions and 42 districts. The City of Rotterdam recently started working with the district controlled planning program. The aim is to enhance the organization and effectiveness of municipal district level activities, and to promote full involvement from citizens and government in planning and running these districts. Financing and accounting systems will be adapted to allow for more decentralized governance in the future and special district officials are appointed to monitor what is happening in the neighbourhood and to align the service provision for the central municipal departments (clusters). The neighbourhood action plans are the results and activities at the district level. Citizens are closely involved and their satisfaction and engagement in the process are monitored.

RESILIENCE VALUE

<p>Improving the function of the government by incorporating more flexibility, integration and inclusiveness to all the needs of the citizens to be better understood and addressed in a more decentralized approach.</p>	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	District Committees
	FINANCE (POSSIBLE)	Municipality
	STATUS	Under development
	RESULT	Short-term / Medium-term
	RELATED ACTIONS	

RELATED ACTIONS

31 OPPORTUNITY MAPPING: FEYENOORD



Led by local entrepreneurs, an opportunity map was developed which identified a series of initiatives. In cooperation with the municipality a strategy for how these should be realized is being developed, with the aim to deliver a robust self-supporting network. The next steps have been established with this strategy acting as a test case for the creation of an effective and efficient network at the neighbourhood level. The aim is to facilitate this development process and to learn from it, allowing lessons to be learnt and taken forward to other areas across the city.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports bottom up – community led initiatives and builds cohesion.Supports knowledge sharing and networking.Supports innovation and future thinking across all scales.	LENS	
	SCALE	
	OWNER	Local businesses and core team
	PARTNERS	Municipality, local businesses
	FINANCE (POSSIBLE)	Entrepreneurs
	STATUS	Under development
	RESULT	Short-term / Medium-term
	RELATED	



32 GOVERNANCE LAB EUR



The City of Rotterdam together with the Erasmus University will start a Governance Lab, a joint initiative to come through design research to strengthen the organizational capacity of the city. This initiative is organized in line with the Rotterdam Resilience Strategy and is intended for use by design and action research to implement the city’s vision of resilience. Many elements of the resilience strategy relate to the mobilization and utilization of a self-organizing, able society, and the market increasing the resilience of the city. A joint Governance Lab should make it possible to bring together the knowledge questions from Rotterdam and the research interests of the EUR and matching. It is important that the municipality combines knowledge questions and invests in the lab, especially as the university is looking towards current research programs in space, to capitalise on this knowledge. Ultimately, it comes to designing research: the translation of scientific theory and empirical research into useful concepts and designs for the practice of the city (via experimental, designing and action research).

RESILIENCE VALUE

<p>A resilient system of governance is the foundation for a resilient city. The establishment of the resilient system of governance is situationally determined, and requires room for experimentation, improvisation and learning.</p>	LENS	
	SCALE	
	OWNER	Municipality, Erasmus University Rotterdam
	PARTNERS	Housing corporations, Infra Providers, Energy Providers
	FINANCE (POSSIBLE)	Municipality, Erasmus University
	STATUS	New
	RESULT	Short-term
	RELATED	

33 DELFSHAVEN CORPORATION



A new type of control and participation at the district level, Delfshaven Cooperative began in 2015 as a foundation; working towards a cooperative where likeminded committed people could work together for Bospolder/Tussendijken. By bringing together large companies and institutions with local residents initiatives can create benefits for all parties involved. The goal is to increase the performance opportunities of the place and for its people in the long term. The Delfshaven Cooperative is an innovation in working and should be monitored in order to draw lessons to be shared with other districts.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports bottom up – community led initiatives and builds cohesion.Embeds resilience thinkingSupports knowledge sharing and networking	LENS	
	SCALE	
	OWNER	Residents, Municipality, Havensteder, Rabobank
	PARTNERS	
	FINANCE (POSSIBLE)	Owners
	STATUS	New
	RESULT	Short-term
	RELATED	

34 DEVELOPMENT OPEN DATA PLATFORM



Rotterdam has developed an online data log www.rotterdamopendata.nl. From this site it is possible for anyone to open datasets regardless of the content and conditionally use it. Through active sharing of data it is expected that there will be increased economic and innovation activities as well as new forms of cooperation to better develop the economy and Rotterdam as a smart city. The site also encourages greater participation and self-reliance. Although Rotterdam is among one of the frontrunners in Europe, the municipality still wants to further increase close cooperation between the government, citizens, businesses and knowledge institutions in the city and wider region, moving to a relationship whereby these parties can freely share ideas and datasets (open data). This action will ensure the ongoing development and dissemination of learning from the open data portal.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports bottom up – community led initiatives and builds cohesion.Supports knowledge sharing and networking	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Citizens, Businesses
	FINANCE (POSSIBLE)	Partners
	STATUS	New
	RESULT	Short-term
	RELATED	

35 FURTHER DEVELOP DIGITAL INFORMATION AND INSPIRATION PLATFORM



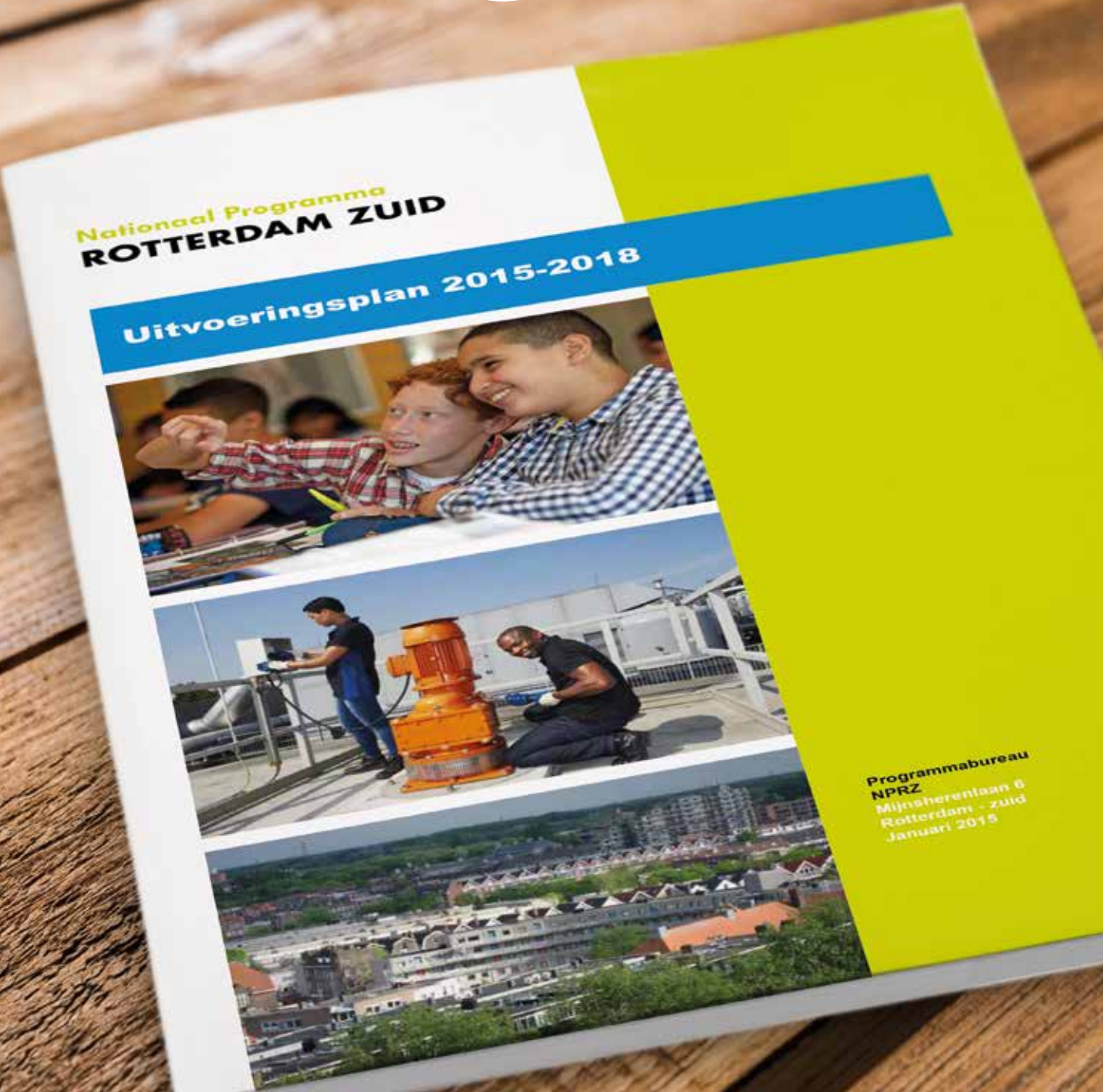
Rotterdamers are bursting with great ideas for their city. The municipality works to harness this through various online platforms: www.rotterdam.nl/meedenkenendoen (to find inspiration and information) and www.citylab010.nl (to share innovative plans). It is however recognized that improvements to these could be made to increase customer-usability and consequently to inspire more people. This action will develop and enhance the existing citylab010 platform.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports bottom up – community led initiatives and builds cohesion.Embeds resilience thinkingSupports knowledge sharing and networkingBuilds profile	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Citizens
	FINANCE (POSSIBLE)	To be determined
	STATUS	New
	RESULT	Short-term
	RELATED	



GOAL 7:
ANCHORING RESILIENCE
IN THE CITY



NATIONAL PROGRAM
ROTTERDAM ZUID



Rotterdam South is different from the rest of Rotterdam and the other three major cities in The Netherlands. Unfortunately, the socio-economic conditions are often worse; the average educational level is lower, there is a higher unemployment rate, the quality of housing is worse and its inhabitants are less optimistic about the future of the district. On top of this, there is a higher percentage of households receiving unemployment benefit in the south (9% in The Netherlands compared to 19% in Rotterdam south). Within Rotterdam south there are 7 focus areas which scored worse still on key socio-economic indicators than average even for Rotterdam south.

The National Programme Rotterdam South (NPRZ) aims to improve the lives of those living in Rotterdam South so that in 2030 it is doing at least as well as the rest of Rotterdam and the three other major cities in The Netherlands. NPRZ has three pillars: school, work and life. The NPRZ wants to ensure that people living in Rotterdam South reach a higher level of education, find more work, have improved housing, and have access to a better more attractive environment. These three pillars are closely connected and influence each other. It is a joint program on which the national government, City of Rotterdam, schools, welfare and housing associations and businesses collaborate. It focuses on the people to ensure that it meets the needs of residents. This is something that the Rotterdam Resilience Strategy Program considers important and supports.

RESILIENCE VALUE

NPRZ is a prime example of an integrated approach. The program covers an extensive and active group of stakeholders at different levels together in a collaborative approach to address a large societal problem. The integrated approach focuses on both social and physical (between school, work and environment) to ensure that the outcomes are robust. The program is essential for social resilience in Rotterdam. It strengthens social cohesion in Rotterdam South while also focusing on opportunities for training and work to increase the resilience of individuals.

LENS



SCALE



OWNER

Central Government, Municipality, Schools and Hospitals, Housing Corporations and Businesses

PARTNERS

Central Government, Municipality, Schools and Hospitals, Housing Corporations and Businesses

FINANCE (POSSIBLE)

Municipality, Central Government, Housing Corporation

STATUS

Under development

RESULT

Short-term

RELATED ACTIONS



ROADMAP TO THE NEXT ECONOMY



The metropolitan region of Rotterdam – The Hague is working on the development of a Roadmap Next Economy (RNE). There are global economic and technological transitions that require investment projects in the region. The metropolitan region has mandated international economist and political advisor Jeremy Rifkin to the RNE. The RNE will include a strategy and implementation plan to maximize the opportunities presented by the ‘Next Economy’, including in the areas already identified; digitization of information, energy and mobility / logistics

These three pillars are included in RNE connected to the major economic clusters in the region, crossovers between the pillars and economic cluster innovations are encouraged. There are established specific working groups for the pillars. Work and lessons learnt from RNE will be supported and integrated to other initiatives.

RESILIENCE VALUE

The integrated approach with numerous stakeholders used in the Roadmap to the Next Economy ensures that it is far reaching. There are concrete projects, results and commitments, which seek to enhance the ingenuity and flexibility of the region. This is necessary if the region is to cope with the exponential changes taking place globally.

LENS



SCALE



OWNER

Metropolitan Region Rotterdam – The Hague

PARTNERS

Municipality, province, central government, educational institutions, businesses

FINANCE (POSSIBLE)

Metropolitan Region Rotterdam – The Hague

STATUS

Under development

RESULT

Short-term (2016)

RELATED ACTIONS



1 KM² SUSTAINABLE ROOFSCAPE CITY CENTRE

Rotterdam was the first municipality in the Netherlands to successfully support green roofs, with currently more than 220.000m² of green roofs in Rotterdam. There is even an award winning festival, Rotterdam Rooftops Day 2015. A policy program implemented green roofs as part of the climate adaptation strategy and Rotterdam received a C40 Cities Award in Paris for its work in this area. Challenges for water, greening, renewable energy, air quality and a lack of space can be addressed through an integrated approach to the development of green roofs. Techniques for greening roofs have developed and can now effectively cater to multiuse roofs including urban farming, solar panels, water storage and even sports facilities. These spaces can contribute enormously to the sustainability and viability of the city centre. It contributes to a favourable climate for businesses, tourism and offers an attractive and healthy environment for young families and professionals. This action for a sustainable roofscape brings the enthusiasm of Rotterdam and the policy objectives together to publicize the many opportunities of large scale green roofs retrofit. We are goaling green roofs covering 1,000,000m² across our city centre.

RESILIENCE VALUE

The program offers a distinct added value to Rotterdammers by encouraging a combination of integrated solutions such as solar panels above a green roof, for a higher return. In practice this means more water storage, increased permeability of the urban area, energy generation, greater ecological value, food production, cleaner air, health and social cohesion amongst other benefits. Adding value on this scale will be revolutionary for the city centre. Finally, the program can be deployed at short notice without major issues.

LENS



SCALE



OWNER

Roof owners in the centre, such as the Municipality of Rotterdam, HOA's and Housing Corporations

PARTNERS

Users and tenants in the city centre. Some multinational corporate companies have shown interest in this initiative (e.g. Akzo Nobel).

FINANCE (POSSIBLE)

Subsidies, Real Estate Owners

STATUS

New

RESULT

Short-term

RELATED ACTIONS

36



RELATED ACTIONS

36 SMART SCHOUWBURGPLEIN 7 SQUARE ENDEAVOUR



The aim here is to create a pleasant living environment around the Schouwburgplein for all users, which is also future proof. The square and surrounding area should not only support healthy and active lifestyles but also provide enjoyment for users. Sustainability is an integral component taking into account clean energy, recycling of materials, additional water storage and Smart Grid. This project on street level can function as a catalyst project comparable to the water square. This project will be developed and implemented in cooperation with a wide range of stakeholders, sharing ideas, knowledge and resources. We will connect this project to resilience goals and enrich and facilitate where possible to maximize the resilience dividend. With the Schouwburgplein Rotterdam participates in the international 7 Square Endeavour Initiative, together with 6 other world cities.

RESILIENCE VALUE

- Supports bottom up – community led initiatives and builds cohesion.
- Embeds resilience thinking in the areas development and provides opportunities for this to act as a catalyst for resilient thinking.
- Supports knowledge sharing and networking

LENS



SCALE



OWNER

Rotterdam City Theatre

PARTNERS

Arcadis, De Doelen, Dura Vermeer, Eneco, Municipality of Rotterdam, TNO, Hoogheemraadschap Schieland & Krimpenerwaard (water board), Ministry of Infrastructure and Environment

FINANCE (POSSIBLE)

Partners, PPP

STATUS

New

RESULT

Short-term / Medium-term

RELATED





RESILIENT DELFHAVEN



EXPERIMENTING WITH COOPERATIVE AREA DEVELOPMENT

Merwede4havens (M4H) is a dynamic area with high levels of economic innovation, with new industries settling in the port area where existing port activities interact with innovative manufacturing and creative entrepreneurs. However, in the surrounding areas there are social issues with up to 25% unemployment, 80% of people are immigrants, there are rising debt problems and a struggle against drug trafficking and use and other nuisance behaviour. This is one of the most difficult urban environments in the Netherlands. However, at the same time, exciting and innovative initiatives are happening, such as syrups and Reading West that make neighbourhoods more vibrant and dynamic. A growing number of partners in both areas have forged a coalition around the Rotterdam Renaissance, where a connection is made between knowledge harbour M4H (economic innovation), and the manufacturing districts in West (social innovation). Through these actions, steps are being taken to help people to shape their own future.

RESILIENCE VALUE

By relating economic and social innovation robust networks have developed. It generates a shared ownership of the neighbourhood. This plan reinforces social cohesion and promotes social entrepreneurship. This increases the self-organizing capacity of the area.	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Delfshaven Cooperative, residents, businesses, Urban Innovative Actions Framework
	FINANCE (POSSIBLE)	Municipality, Delfshaven Cooperative, additional funding is needed (e.g. through European Union)
	STATUS	New
	RESULT	Medium-term
RELATED ACTIONS		37



RELATED ACTIONS

37 BOSPOLDER TUSSENDIJKEN/PARK 1943



The implementation Plan for the development of Park 1943 area seeks to act as a catalyst for strengthening the resilience of Bospolder/Tussendijken. Opportunity mapping and stakeholder analysis carried out for the area will enable the development to mobilize ideas of residents, boost health and encourage exercise, to better use open space and to create a water asset. Connection with development possibilities are given for Great Visserijplein and surrounding residential buildings such as green roofs and better use of the gardens.

RESILIENCE VALUE

<ul style="list-style-type: none">Embeds resilience thinking in the development of Bospolder/TussendijkenSupports knowledge sharing and networkingSupports holistic approaches to redevelopment targeted at improving the lives of the residents and users.	LENS	
	SCALE	
	OWNER	Delfshaven Cooperative
	PARTNERS	Municipality, District Committees, Havensteder, Citizens
	FINANCE (POSSIBLE)	Municipality
	STATUS	New
	RESULT	Short-term / Medium-term
	RELATED	V



RESILIENT PEPERKLIP



IMPROVING SOCIAL RESILIENCE, ATTRACTIVENESS, QUALITY OF LIFE AND FUTURE-PROOFING OF AN ICONIC BUILDING

The Peperklip was designed by architect Carel Weeber and built in the 1980s; the residential building occupies a small area, with a length of 500 meters; containing 605 homes. In recent years there has been considerable investment in improving the social issues in and around the development; unfortunately the investment has not been sufficient enough to bring about real change.

The building is about to undergo a major physical renovation project, which can be used to jointly tackle the social and physical problems. The renovation includes 11.500m² roof and semi-public courtyard which creates space for ‘place making’ as well as a combination of power, buffering and re-use of water, public spaces and gardens. There is also a unique opportunity to establish a related with the municipal contribution program for residents and the labor market. This will tackle the resilience of both the physical and social. The aspiration is for Peperklip to become an example of social resilience, in combination with physical climate resilience. The project has the potential to have the largest collective roof gardens in Europe. The project is supported and should seek to share knowledge and lessons as well as learn from other initiatives in this strategy.

RESILIENCE VALUE

A resilient system of governance is the foundation for a resilient city. The establishment of the resilient system of governance is situationally determined, and requires room for experimentation, improvisation and learning in developments such as the Peperklip. This action provides the opportunity for a large scale combined effort tackling multiple important issues.

LENS	
SCALE	
OWNER	Housing Corporation Vestia
PARTNERS	Residents and users of the Peperklip, Municipality of Rotterdam
FINANCE (POSSIBLE)	Vestia, Municipality of Rotterdam, water boards, energy corporations, investors, European Union
STATUS	New
RESULT	Medium-term / Long-term
RELATED ACTIONS	





INTERNATIONALE ARCHITECTUUR BIENNALE ROTTERDAM



In January 2016 a letter of intent for cooperation on Resilient Cities was signed between the International Architectuur Biennales (IABR) and the Municipality of Rotterdam, for the period 2016–2020. Both parties will use this time to focus on resilience, with content and financial support from the Rotterdam Resilience Program. The biennales will include collaboration with the government of the Netherlands, notably; Henk Ovink (Water Ambassador for the Netherlands) and will promote the UN's Sustainable Development and Climate Goals (COP21) both fully endorsed and supported by the City of Rotterdam and the IABR.

In 2018, the focus of the IABR 'resilience + cities' production will be on the physical aspects of resilience (adaptation to climate change, infrastructure energy, water issues, etc.), whereas in 2020, social and softer aspects will be the focus (social resilience, cyber resilience and resilience as a "new culture"). The question surrounding the resilience of 'governance' and what new financial development models can be developed; will be included in both editions. We will develop a joint research program about resilience by design stretching over the full four year period.

RESILIENCE VALUE

This long term partnership will not only contribute to knowledge development and sharing, but also to network development and ideas creation. Moving resilience into the design space facilitates innovation and creative thinking as noted recently at the Designing City Resilience forum hosted by RIBA in London.

LENS



SCALE



OWNER

Municipality, IABR, Central Government

PARTNERS

RDC and others

FINANCE (POSSIBLE)

Municipality, Central Government, IABR

STATUS

New

RESULT

Short-term / Medium-term (2018 / 2020)

RELATED ACTIONS



RELATED ACTIONS

38 ROTTERDAM CENTRE FOR RESILIENT DELTA CITIES (RDC)



RDC is a public–private network organization which aims to accelerate the transition towards safe and sustainable delta cities around the world. Together RDC members develop strategies for integrated solutions which enhance safety and add value in terms of spatial and ecological quality, social outcomes and economic potential. RDC will strengthen and enhance the knowledge sharing and innovation ecosystem to better capitalise on the Rotterdam leadership position on resilience.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing, innovation and networkingEmbeds resilience thinking amongst Rotterdam’s leaders	LENS	
	SCALE	
	OWNER	RDC–partners
	PARTNERS	RDC–partners
	FINANCE (POSSIBLE)	RDC–partners
	STATUS	Under development
	RESULT	Short–term
	RELATED	

39 NATIONAL CITYDEAL CLIMATE ADAPTATION



Nine public partners signed on March 9th 2016 along with seven (semi) private partners called an agreement called Citydeal climate adaptation. The partners will collaborate on national and international levels in order to strengthen their approach to climate–proof design in the urban environment. The Citydeal will work with the partners over the next four years, to ensure a practical learning environment and breeding ground for innovation, which will be supported and shared across initiatives within the Rotterdam resilience strategy.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing and networking	LENS	
	SCALE	
	OWNER	City Deal partners
	PARTNERS	City Deal partners
	FINANCE (POSSIBLE)	City Deal partners
	STATUS	New
	RESULT	Short–term
	RELATED	

40 RESILIENT EUROPE



RESILIENT EUROPE is the title of an EU URBACT partnership of 12 cities. These cities all invest in the development of a resilience strategy and its implementation. Emphasis is on an integrated approach, especially social and climate resilience. Funding is secured for the second tranche of the project partnership.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing and networking, specifically in this case to overcome implementation barriers.	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Eleven European cities, including Glasgow, Vejle, Bristol, Thessaloniki
	FINANCE (POSSIBLE)	EU, partners
	STATUS	Under development
	RESULT	Short–term
	RELATED	

41 NATIONAL INNOVATION CHALLENGES: MAKE ROTTERDAM MORE RESILIENT



The City Challenge contest provided 150 ideas for the City of the Future in 2016. There were 10 finalists, and the winner was announced in mid–April 2016. An idea has emerged for an “11th project” – an expansion of the final 10 ideas for an area development. Selected parties will now investigate in the designated pilot areas of focus feasible and viable approaches to integrate Resilience.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports bottom up – community led initiatives and builds cohesion.Demonstrates innovation applied practically in a development context	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Challenge winners
	FINANCE (POSSIBLE)	Include in projects, subsidies
	STATUS	New
	RESULT	Short–term / Long–term
	RELATED	All flywheel actions

42 RESILIENT CITIES NETWORK:
CITY EXCHANGE



Rotterdam has participated in the ambitious cities network 100 Resilient Cities from 2014. Therefore, Rotterdam has access to a wealth of knowledge gained through discussions with other cities and professionals in the 100 Resilient Cities network. Developing and sharing knowledge plays an important part in contributing to building resilience in other cities. There is scope for Rotterdam and its knowledge partners to use bilateral relationships to support other cities. As an example, we hosted a successful network sharing session in October 2015. We will look for other opportunities to utilise the 100 Resilient Cities network.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing and networking across the 100 Resilient Cities network	LENS	
	SCALE	
	OWNER	Municipality, 100 Resilient Cities
	PARTNERS	RDC partners
	FINANCE (POSSIBLE)	Cities, RDC, 100 Resilient Cities
	STATUS	New
	RESULT	Short-term
	RELATED	All flywheel actions

43 RESILIENT ROTTERDAM:
GETTING IT ORGANISED



Since 2014, Rotterdam has participated in the ambitious urban network 100 Resilient Cities. This strategy presents the actions developed through that process. There is now a need to implement the actions identified, requiring the formalisation of the role and resources of the resilience office and Chief Resilience Officer and the agreement of partnering arrangements.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing and networking across the 100 Resilient Cities networkEmbeds resilience thinkingSupports effective delivery of all other resilience actions	LENS	
	SCALE	
	OWNER	Municipality
	PARTNERS	Stakeholders
	FINANCE (POSSIBLE)	Municipality, 100 Resilient Cities
	STATUS	New
	RESULT	Short-term
	RELATED	All flywheel actions

44 RESILIENT ROTTERDAM—THE HAGUE
METROPOLITAN AREA



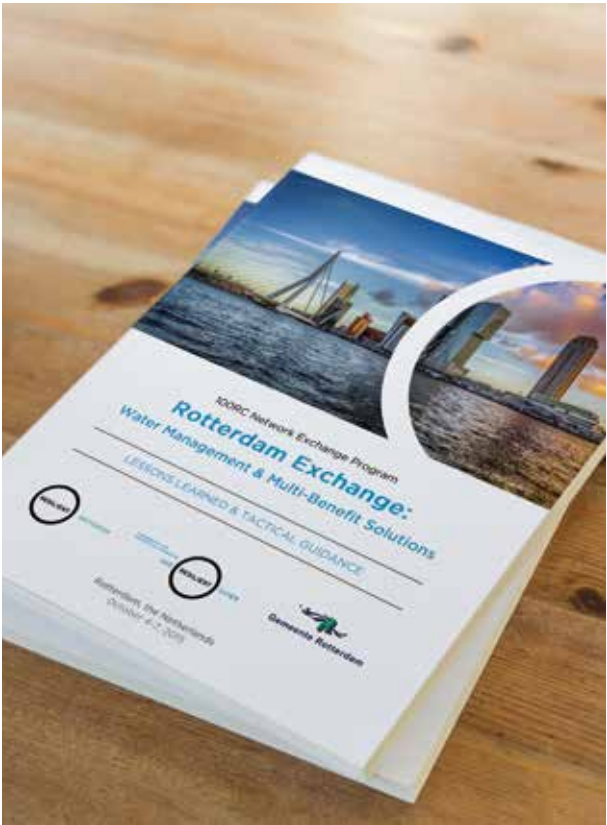
Rotterdam—The Hague Metropolitan Area (MRDH) is a consortium of 23 municipalities. These municipalities have jointly invested in the Next Economy Roadmap (RNE). Many resilience issues extend beyond municipal boundaries. MRDH with interested municipalities, particularly The Hague, is cooperating to deliver concrete actions and results for resilience for the wider region. Rotterdam is sharing its learning from the 100 Resilient Cities process into this consortium, and the selection of The Hague by 100 Resilient Cities as a third wave city could give a further boost to the metropolitan region in terms of how it considers its future resilience across key areas such as water, climate and cyber.

RESILIENCE VALUE

<ul style="list-style-type: none">Supports knowledge sharing and networkingSupports tackling of cross municipality issues and challenges	LENS	
	SCALE	
	OWNER	Municipality Rotterdam, municipality Den Haag
	PARTNERS	MRDH—municipalities, InnovationQuarter
	FINANCE (POSSIBLE)	MRDH—municipalities, subsidies
	STATUS	New
	RESULT	Short-term
	RELATED	

In October 2015, 28 Chief Resilience Officers and resilience team members from 9 cities convened in Rotterdam for a Network Exchange on integrated water management. Through site visits, expert presentations, and multi-disciplinary workshops involving more than 30 water experts from Rotterdam and the Netherlands, participants grappled with common challenges facing cities today – from flooding and sea level rise to water scarcity – and proactively shared knowledge and insights about each other’s successes and failures. The Rotterdam exchange catalyzed some concrete actions, and attendees returned to their cities to act upon the lessons learned.

100 Resilient Cities member cities involved: Bangkok, Berkeley, Mexico City, New Orleans, Norfolk, Rome, Rotterdam, Surat and Vejle.



FACTSHEET RESILIENCE STRATEGY.

7 RESILIENCE GOALS <ul style="list-style-type: none">• Rotterdam: A balanced society• World port city built on clean and reliable energy• Rotterdam cyber port city• Climate adaptive city to a new level• Infrastructure ready for the 21st century• Rotterdam network – truly our city• Anchoring resilience in the city		12 METHODOLOGIES <ul style="list-style-type: none">• Student Challenges• EU funds• Research• City Resilience Framework• Interviews• Pilot districts• Collaboration between cities• Visualisation (film)• Collecting data• Resilience by design• Back casting• Harvesting
7 RESILIENCE SCALES <ul style="list-style-type: none">• Building• District• Rotterdam• Metropolitan area• The Netherlands• Europe• Worldwide	8 (PLATFORM)PARTNERS INCLUDING KNOWLEDGE INSTITUTES <ul style="list-style-type: none">• Microsoft• AECOM• TNO• Drift• Resilient Delta Cities (RDC)• Urbanisten• Erasmus Universiteit Rotterdam• DELTARES	
68 ACTIONS, INCLUDING 24 FLYWHEEL ACTIONS SUCH AS: <ul style="list-style-type: none">• Leadership institute• 1 km² of sustainable rooftop landscape• ‘Deltaplan Cyber’• Resilient Delfsport• Architecture biennales of 2018 and 2020		3 LAYER MODEL OF ROTTERDAM RESILIENCE PROGRAM <ul style="list-style-type: none">• Strategic (city)• Resilience initiatives by municipality• Fundament: ongoing initiatives by citizens
200+ INVOLVED WITHIN 1½ YEARS		
17 STAKEHOLDERS SO FAR <ul style="list-style-type: none">• Utility companies (2)• Municipality organizations (6)• Housing associations (3)• Waterboards (3)• Port Authority Rotterdam (1)• Civilian platforms (1)• DCMR Environmental Agency (1)		3 SYNERGETIC APPROACHES <ul style="list-style-type: none">• 7 resilience goals• 3 pilot districts• Integral research

ACKNOWLEDGE- MENTS.

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STEERING COMMITTEE

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Arie Deelen (DCMR – director)
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