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from the water body of Waalhaven
(Maas river)*
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PORTUS 42

PORTRAIT ROTTERDAM

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the online magazine of **RETE**

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PRESENTATION



Teófila MARTÍNEZ

President of RETE - Association for the Collaboration between Ports and Cities.

Technical architect by profession. In 1983 she was elected councilor in the municipality of El Puerto de Santa María, where she remained until 1987. Between 1995 and 2015 she was mayor of Cadiz, being the most voted mayor of the provincial capitals of Spain in the municipal elections of 2003 and 2007 with around 60% of the votes. She has developed a city project which has included works of key importance for the logistical development of the Bay.

She has been a member of the Congress of Deputies since 1989. Except in the period 2000 - 2008, in which she was an Andalusian parliamentarian and senator (2000-2008) for the autonomous community of Andalusia. She presided over the People's Party

of Andalusia from 1999 to 2004. She has served as People's Party spokesperson in the Public Works Commission of the Congress of Deputies and coordinator of the Popular Group Commissions in the Congress.

Currently, she is the President of the Port Authority of the Bay of Cadiz since 2019, she is committed to the integration between ports and cities and to repositioning the Port of Cadiz on the world logistics map. Her charismatic personality and great capacity for leadership and work guarantee the success of projects she takes on. She currently serves as president of RETE.



Highrise buildings next to water at the Port of Rotterdam. (Source: pexels.com).

Common aspects of cities and ports: generating value together

Naval tradition, history linked to trade, Blue Economy, geostrategic position, capacity of influence, sum of opportunities, common benefits...

If we had to look for concepts common to the cities of the world that share spaces and the presence of important ports, these would be some of the many aspects, all of them positive, that generate competitive advantages and value in their environments.

All experts agree that ports today are true value-added industries that form part of the supply chain. Experience tells us, moreover, that our port cities multiply their potential and capacity when they work on common objectives, when they feel and act in an integrated manner: port and city.

For this reason, the world's major ports are currently working on partnership strategies, also with other port systems. In the promotion of economic activity and the commitment to the development of the cities, of their urban planning, in order to make the most of this city-port binomial.

It is also important that the Port Authorities redouble their efforts to change the way in which society perceives this type of industry.

The ports, due to their capacity for adaptation and dynamism, will have to lead the supply chain and this requires a more important role in the strategic vision of the State.

Historically, no coastal city of world importance can be understood without the presence of a port, with a maritime and logistic system that connects it with the world.

This is the case of Rotterdam, the port we analyse in this special Portrait of the Portus magazine, a publication edited by RETE, a world reference for the knowledge of port cities, port-city relations and urban requalification initiatives.

Our cities have been used to living from their ports and with their ports. They are economic agents of the first order and contribute notably to the economic and social development of their areas of influence. Throughout their history, they have had to coexist with the dynamism of the cities themselves, with different expansion needs, depending on each period.

Today, our ports and cities are immersed in the scenario of globalisation and economic competitiveness. Changes are more rapid and responses demand speed, while at the same time they must combine the expansion needs of both cities and ports.

This Portus special devotes special attention to the experience of one of the most important port cities in the world: Rotterdam, which we recently visited on the occasion of the 35th RETE Meeting, held at the Delft University of Technology.

Rotterdam is an excellent example of the great challenge of ensuring that integration is achieved without detriment to productive activity and, furthermore, to further enhance the activity of urban contact areas, as we analyse in this issue of Portus, a journal edited by José Luis Estrada, whom I would like to congratulate through these lines, conveying my congratulations to his entire network of collaborators and experts, especially Carola Hein.

I would also like to take this opportunity to wish all RETE members in particular and our readers our best wishes for peace and happiness over the Christmas and New Year.

PRESENTATION



José Luis ESTRADA

Director of PORTUS Magazine, RETE - Association for the Collaboration between Ports and Cities.

José Luis Estrada has a Ph.D Civil Engineering degree, by the Polytechnic University of Madrid. He is also Fellow of the Advanced Study Program by the MIT Cambridge (MA) and Diplomat in General Management by the IESE (Barcelona).

He is specialized in Ports, Transports and Logistics, with more than 46 years of experience on the subject (48 years in total). He has worked in the Ports Authorities of Tarragona, Barcelona and Algeciras, where he was General Manager. He also has been Planning and Development Director of Puertos del Estado, Commissioner for Expansion Works at the Port of Barcelona and President of the "Puerto Seco de Madrid S.A." and "Conte-Rail S.A" (Dry port and rail operator, respectively).

In December 2009, he founded the consultant

company ESTRADA PORT CONSULTING SL, of which he is the CEO.

Doctor Estrada has combined his professional career with academic activity, teaching on port, transport and logistics subjects at different universities. He commonly participates in conferences and seminars around the world and has made numerous papers.

He was Chairman of different Technical Committees of IAPH (International Association of Ports and Harbours), where he is Honorary Member, and also he was member of the Executive Committee of the Technical Association of Ports and Coasts (Spanish division of PIANC).

He was President of RETE and he is currently Honorary Member of this Association, member of its Scientific Committee and Director of PORTUS Magazine.



Waalhaven, the centre of the maritime and offshore cluster at the Port of Rotterdam. (Source: pxfuel.com).

It is a great honor and a great pleasure for me to have the opportunity to present this PORTRAIT dedicated to the port and city of Rotterdam in my capacity as Director of PORTUS.

I would like to highlight two significant aspects, the unique character of Rotterdam and the fact that this is the first PORTRAIT to explore a city outside the Mediterranean and Latin America.

Rotterdam has always been a port of reference for the world and, of course, at a European level. With 470 million tons of goods handled in 2019, it is one of the first in the world and, of course, the first in Europe. It is a unique place for its size and traffic volumes, and for the variety and efficiency of its terminals, for the diversification of its activities, for the characteristics of its enormous and innovative developments (recently Maasvlakte 2) and, in any case, for its modernity and capacity for innovation and leadership on a global level. With a privileged position, both by sea and by land, in the North Sea, directly connected to the mouth of the Rhine, and close to the most powerful industrial concentration in Europe and one of the first in the world, its hinterland extends throughout Europe through a complete network of canals connecting the

Rhine with other major European rivers and thanks to the great development of its powerful railway network and the presence of dry ports.

But the port of Rotterdam is also a model of great interest, as regards its connection and development with the city and the territory, having carried out very interesting actions, including waterfront regeneration projects and maker district development, which are of special value within PORTUS and for the RETE Association. Given that RETE is an organization born and developed in the Mediterranean countries of Southern Europe, our work has focused mainly on the experiences of these countries and countries of Latin America, even while there are some international articles in PORTUS Magazine.

The excellent PORTRAIT directed and coordinated by Professor Carola Hein of Delft University of Technology --who also directs our sister journal PORTUSplus-- and by Professor Andrew Littlejohn of Leiden University, which, for the first time, leaves the geography of Southern Europe and Latin America, introduces us to the rich experience of a port city of great interest, the case of Rotterdam.

I can only thank Professor Carola Hein and her team

for the enormous effort made while congratulating her for the magnificent work, which greatly enriches our PORTUS Magazine and also thanking and

congratulating all the PORTRAIT authors, for their effort and quality achieved.
Barcelona, November 2021

PRESENTATION



Wim VAN DEN DOEL

Dean of the Leiden-Delft-Rotterdam Universities Alliance. Leiden University; TU Delft; Erasmus University Rotterdam.

Received his Ph.D degree in History from Leiden University in 1994. Since 2003 he has been professor of Contemporary History in the Institute of History at Leiden University. He has been interested in the history of colonialism and decolonization and published numerous books on these topics. His latest book is a biography the famous Dutch orientalist Christiaan Snouck Hurgronje (2021). From 2002 to 2006 he was chair of the Institute of History of Leiden University. From 2007 to 2016 he was Dean of the faculty of Humanities of this university. In this capacity he chaired the Steering Group of the SSH Community of the League of European Research Universities (LERU) and was active in promoting the role of SSH in Horizon

2020. From 2017 to 2020 he was member of the Executive Board of the Netherlands Organizations for Scientific Research (NWO) and Chair of the Domain of Social Sciences and Humanities of NWO. As member of the Executive Board he was responsible for the National Research Agenda (NWA), international policy and three NWO-institutes. Since Februari 2020 he has been dean of the Leiden-Delft-Erasmus Universities Alliance and responsible for the cooperation between the three universities, the cooperation of the three universities with regional, national, and international partners and the promotion of interdisciplinary research and education.



Rotterdam Erasmus Bridge, New Mesh. (Source: www.piqsels.com-id-outyr).

The Leiden-Delft-Rotterdam Region as PortCityFutures Lab

The oldest university in the Netherlands was founded in 1575: Leiden University, which also became the university of the state of Holland. Leiden University is a comprehensive university, with a traditional focus on the humanities, law, medicine, and science, although more recently the social sciences also were developed. In 1842 a Royal Academy of Engineering was founded in nearby Delft, which developed into the Delft University of Technology. But early 20th century industrial leaders from the port city of Rotterdam decided Leiden University and the Technical University of Delft were not serving the needs of their world and businesses sufficiently. They decided to establish the Rotterdam Business School, a private institution which educated those who wanted to work in the fast growing port city of Rotterdam. In later years it became the Erasmus University Rotterdam with its focus on the social sciences and medicine.

Today, three complimentary and global top-100 universities exist on a small distance of each other: Leiden University, Delft University of Technology, and the Erasmus University Rotterdam. They exist in a part of the Netherlands in which a quarter of

the Dutch population lives and work and which can be seen as the urbanized port region of Rotterdam. The three universities work together in many fields and since 2012 in the context of the strategic alliance Leiden-Delft-Rotterdam Universities, or 'LDE'.

One of the main programmes of the LDE-alliance is PortCityFutures which investigates the evolving socio-spatial conditions, use and design of port city regions, in particular exploring areas where port and city activities occur simultaneously and sometimes conflict. In other words, the programme investigates how flows of goods and people generated by port activities intersect with the dynamics of the natural area, hydraulic engineering, spatial planning, architecture, and heritage. The spatial impact of competing interests of port-related and urban spatial development needs and timetables is examined. Creative solutions and design measures to problems and their consequences for the future use of the limited space are also investigated, allowing the port, the city, and the region to flourish. The programme is directed and coordinated by Professor Carola Hein of Delft University of Technology with colleagues from Rotterdam and Leiden.

The urbanized port region of Rotterdam, or perhaps

the 'Leiden-Delft-Rotterdam Port Region', works as an important Living Lab for the scientists and scholar of the PortCityFutures Programme. The programme is very successful in its interdisciplinary research, education, and outreach, bringing together scholars and scientist from the three universities. I am immensely proud that Professor Carola Hein and her team can present their important and exciting work in the PORTUS Magazine. I hope that through the magazine even more people can learn from the work

of the PortCityFutures Programme.

The recent announcement that Professor Carola Hein has been named UNESCO Chair Water, Ports and Historic Cities is another confirmation of the excellent work done in PortCityFutures and for the Leiden-Delft-Erasmus alliance. The Chair will play a key role in connecting the research on the Dutch delta with international research and practices in port and water cities worldwide.

INTRODUCTION



Carola HEIN

Professor, Chair of History of Architecture and Urban Planning. Department of Architecture, Delft University of Technology. Delft, The Netherlands. Director, LDE PortCityFutures. UNESCO Chair Water, Ports and Historic Cities.

She trained in Hamburg (Diplom-Ingenieurin) and Brussels (Architecte) and earned her doctorate at the Hochschule für bildende Künste Hamburg in 1995. Among other major grants, she received a Guggenheim Fellowship to pursue research on The Global Architecture of Oil and an Alexander von Humboldt fellowship to investigate large-scale urban transformation in Hamburg in international context between 1842 and 2008. Her current research interests include transmission of architectural and urban ideas along international networks, focusing specifically on port cities and the global architecture of oil.



Andrew L. LITTLEJOHN

Assistant Professor, Institute of Cultural Anthropology and Development Sociology, Leiden University. Leiden, The Netherlands. Core Group Member, LDE PortCityFutures.

Anthropologist, assistant professor at the Institute of Cultural Anthropology and Development Sociology of Leiden University. Postdoctoral Fellowship in the Weatherhead Center for International Affairs' Program on U.S.-Japan Relations at Harvard University (2017-18). PhD in Cultural Anthropology at Harvard University (2017).

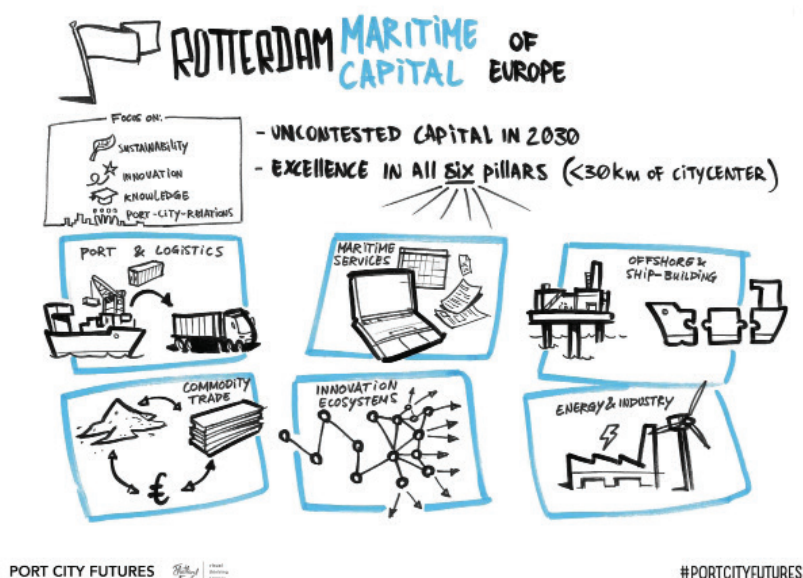


The Erasmus Bridge in Rotterdam. (Photo: Carola Hein, CC-BY 4.0).

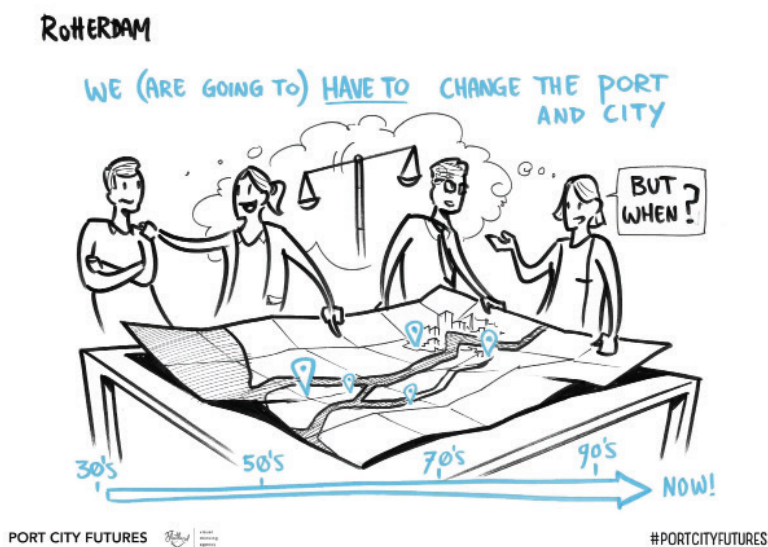
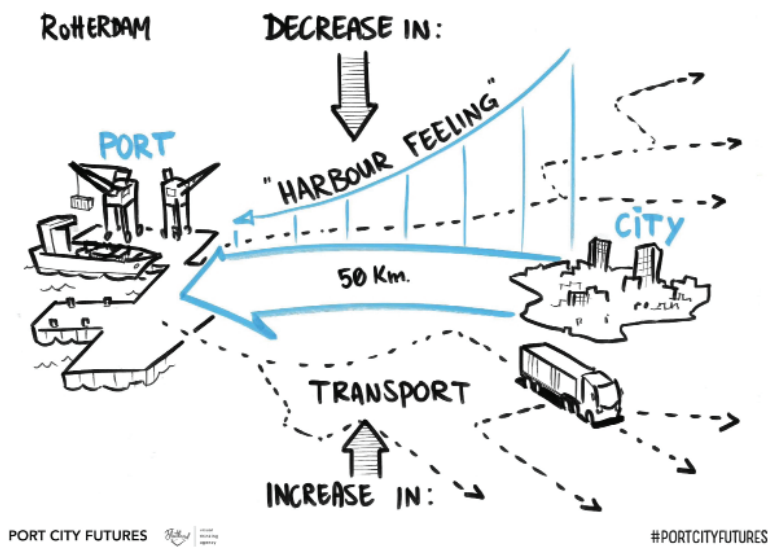
We are delighted to introduce this portrait of the Port of Rotterdam, developed by the Leiden-Delft-Erasmus initiative Port City Futures led by Prof. Carola Hein.

Rotterdam is an exceptional port, city, and port-city-territory in many aspects. For many years, it was the world's busiest port. It remains a major transshipment hub through which commodities enter and exit the EU despite ceding pole position to Chinese competitors. The port thus well-deserves its nickname, 'the gateway to Europe.' In 2018, before

the global pandemic impacted international trade, some 469 million tons of cargo moved through Rotterdam, ranging from fossil fuels to fruit juices [1]. However, volume of trade alone does not define the port. Rotterdam prides itself on being a frontrunner in technological and spatial innovation, particularly in areas such as digitalization. Local stakeholders are also working hard to improve the city's standing as Maritime Capital [2] and Rotterdam's long history and its resilience remain central to the stories that residents tell about themselves and their city.



Rotterdam Maritime Capital.
(Illustration: PortCityFutures
CC-BY 4.0).



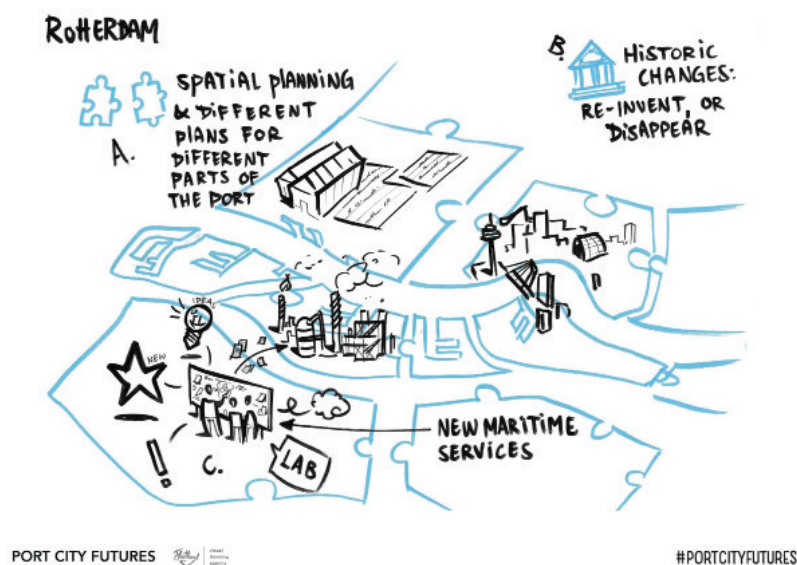
Increasing the maritime mindset.
Changing the future.
Adaptation and change in the port.
(Illustrations: PortCityFutures CC-BY 4.0).

Port, municipal and regional leadership is necessary to design the future of the port city territory. Different interest groups, including government actors, scientists, commercial interests, and residents' associations, must also collaborate to find solutions. To understand how port and city are facing the future, our portrait includes interviews with the CEO of the Port of Rotterdam, Allard Castelein; Walter de Vries, an urban planner working for the City of Rotterdam; Helmut Thoele, an urban and regional planner and Senior Policy Advisor for the Province of South Holland; and Paul Gerretsen, Director of the Deltametropolis Association, which seeks to bridge different interest groups and promote sustainable development in the wider Randstad region. These interviews offer unique insights into how leading figures are steering Rotterdam's direction of travel at a time when climate change requires profound transformations in how the port works and interacts with the wider region and its ecologies.

In the articles comprising this Portus Portrait, we first introduce the Rotterdam past and how it continues to influence the present. Our articles trace the port and city's historical development from a fishing village by the river Rotte to a global maritime hub and beyond. In doing so, we pay particular attention to the role of technological and infrastructural innovations and the development of port and city as petroleum hubs.

We also dive below the surface to seek Rotterdam's history. The city contains a rich archive underground. Under the water, meanwhile, the dredging necessary to maintain depth in the New Waterway undermines the area's wider biodiversity both literally and figuratively. Our articles explore the roles that both underground and underwater efforts have played in creating Rotterdam's port and city (and might play in shaping their possible futures).

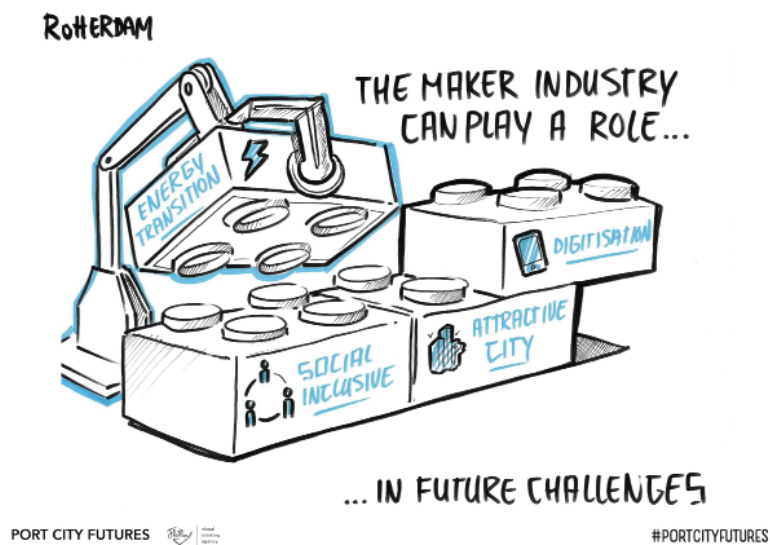
Having explored these currents of the past and their present impacts, we turn to the Rotterdam of today. The contributing authors add insights regarding the port's leading role as an innovator, exploring responsible cargo, the port's sustainable roadmap, and the role that hydrogen can play in the energy transition. The scale of the port-city-territory is not limited to the immediate vicinity of the port, of course: our authors show how logistics centers for the port of Rotterdam can be located more than hundred kilometers away, emphasizing the widespread territorial impact of the port. If attention to the regional scale is one part of innovation in Rotterdam, attention to local development and the human scale is another. Our articles explore recent innovation in former port areas, notably in Rotterdam's Makers district, the Merwe Vierhavens or M4H, as well as interventions to nurture new talent for maritime practices.



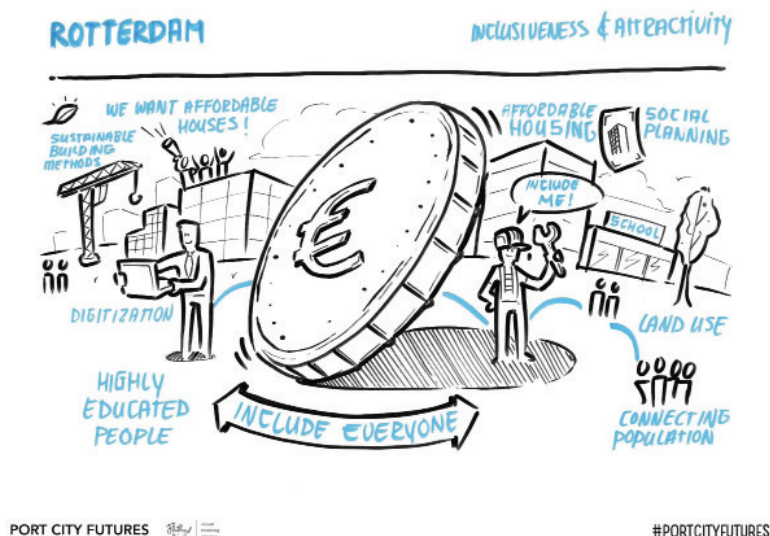
Spatial planning needs. (Illustration: PortCityFutures CC-BY 4.0).

We then shift our focus to how Rotterdam can meet various challenges, both in the present and coming down the pipeline. Not least among these challenges is the ever-present and accelerating crisis of climate change. Combating it necessitates wholesale transformations in our social, political, and economic systems and priorities. Some of the transformations facing Rotterdam concern the port's internal operations and its networking - both

physical and digital - within wider networks of freight transportation. Others include the need to move away from fossil fuel dependence and participate in the sustainable remaking of port, city and region. Our articles ask: What should the port of Rotterdam of the future look like? How can it not only adjust to but also actively participate in tackling broader societal issues?



Makers Industry. (Illustration: PortCityFutures CC-BY 4.0).



Inclusiveness and Attractiveness. (Illustration: PortCityFutures CC-BY 4.0).

Our authors demonstrate that innovative experiments in infrastructure of both the material and 'green' or nature-based kind - are crucial here. Whether shallowing (*verondieping*) the New Waterway through stopping its dredging or converting natural gas to hydrogen infrastructure, infrastructural transformations can help port and city meet the aforementioned challenges and participate in the production of more sustainable socio-ecological and economic systems. Regional design - which considers solutions to problems through design interventions at higher levels of scale - can also contribute. At TU Delft, students in the Research & Design studio *Spatial Strategies for the Global Metropolis* explore how the Port of Rotterdam might participate in transitioning the wider region towards a more circular economy.

Creative approaches, including art, can also play an important part in reconnecting port and city and

reconceptualizing the port city territory, as our authors demonstrate through mental mapping approaches, paintings, and photographs.

In summary, our portrait paints a picture of Rotterdam at a crossroads. Port and city have enjoyed a prosperous history thanks to their mutual development. Today, the port plays a crucial role within European distribution networks. But the threat of climate change and environmental breakdown, and the necessity of transitioning towards a more circular economy, makes change ever more urgent. In response, diverse actors - from scientists to policy-makers - are asking themselves what the port, and port-city, of the future should be. We hope that the ways they are doing so presented by our portrait can help to inspire actors in other ports and port-cities grappling with the same challenges of our current historical moment.

Notes

[1] <https://nlflag.nl/business-nl/gateway-europe>

[2] <https://www.rotterdammaritimecapital.com/>

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ROTTERDAM, THE PORT CITY TERRITORY



Interview with Allard CASTELEIN | President and Chief Executive Officer Port of Rotterdam Authority

by CAROLA HEIN

Allard Castelein is Chief Executive Officer of the Port of Rotterdam Authority. He discusses the role of Rotterdam as a port city territory hosting Europe's biggest port, focusing on its future, global leadership role and the importance of value-based planning.



Aerial photo Maasvlakte. (© Danny Cornelissen, 2020; Source: Port of Rotterdam Authority).

Thank you very much for accepting this interview for PORTUS Portrait, focused on Rotterdam.

We would like to talk with you about the role of Rotterdam as a port city territory, hosting Europe's biggest port, focusing on its future development, its global leadership role and the importance of value-based planning. In particular, we would like to hear from you about the impact that port development will have on the city and on the territory in terms of efficiency, competitiveness and business, and in light of the challenges of digitisation, climate mitigation and adaptation, sustainable development and increasingly widespread practices related to the circular economy.

Carola HEIN - Could you tell us more about how you see the future development of the Rotterdam port (and European ports more generally)? What kind of different scenarios do you imagine for the extended Rotterdam port city territory? For example, what do you think the impact of port development will be on the cities and territories nearby? How does/should the Port of Rotterdam Authority engage with other local/municipal/provincial/territorial players, and how far into the hinterland (e.g. Duisburg)?

Allard CASTELEIN - The two most important developments that have an impact on the development of ports in the next decades are the digitisation and the energy transition. Like in other parts of society, digitisation increases the efficiency of all kinds of processes. Making intelligent use of data leads to all kinds of optimisations, from just-in-time deliveries to optimising the use of the electricity grid. But digitisation also changes the way we work. Other skills are needed than those in the past. The focus shifts even more from blue overall to white

collar, from physical labour to office work, especially in IT.

The energy transition also has a huge impact on Rotterdam, as this is now Europe's largest energy hub. Some 13% of Europe's energy consumption is imported via Rotterdam, mainly as crude oil, oil products, and some coal and natural gas. This will change drastically in the next decades. I expect that in 2050 we will still play a major role in the import of energy, as north-western Europe uses far more energy than it can produce sustainably. So imports will remain crucial – no longer fossil fuels, but renewables like hydrogen. I expect Rotterdam to play a leading role in this field, as we have world-class companies here as well as world-class infrastructure.

Companies won't close down. They will move from using fossil energy and feed stock to renewables. This, I expect, will be a swift but also a gradual transition. It will be swift, as it will have to be done in some 30 years. But it will also be gradual, as most companies can't change all their processes at the same moment. So in many ways, the industrial plants you see now in the port will still look the same in thirty years, but the processes inside will be different. To a very large extent they will still make the same products. But, for instance, not making jet fuels from crude oil but from renewable feed stocks.

If Rotterdam maintains its central role in the European energy system and the industry here makes this transition from fossil-based to circular, as I expect will happen, then the port will remain a vital and essential part of the regional and national economy. To make sure this happens, we're aligning with local, regional, national, German and European public authorities.

What do you think are the main needs for the port, city and territory in light of climate change challenges, sustainable development and more circular practices? How does the Rotterdam Port Authority embrace its leadership role? What initiatives does the Port Authority take to overcome carbon-intensive practices? The Port of Rotterdam also leads digital innovation: what role does digitisation play in the development of the Port of Rotterdam and how can these new practices also benefit the port city territory?

The targets for 2030 and 2050 are clear. We have to reduce CO2 emissions drastically as well as work towards a circular economy. We have taken the initiative to make a strategy to realise these ambitions, together with the business community, public authorities and NGOs. We call this the 'in three steps sustainable' strategy. Step 1 is to reduce the emissions of existing industry by applying efficiency measures, using residual heat and capturing and storing carbon dioxide in depleted gas fields under

the North Sea. Step 2 is creating a new energy system based on renewable electricity and hydrogen. Step 3 is creating a new, circular fuels and raw materials system.

Our main role is to make it possible for private businesses to reduce their emissions, for instance by realising pipelines for hydrogen or to set up a carbon capture and storage project. Going from an oil and natural gas-based energy system to a system based on renewable electricity and hydrogen transcends the capacities of individual companies. The whole system has to change. Our role is to organise that for the port area, together with public and private parties. And by doing so, we make sure Rotterdam remains a very competitive location for companies to do business, to invest in their facilities.

Digitisation is an important element to strengthen our competitive position. That's why, together with our clients and partners, we're investing in accelerating the digitisation of the port. Our goal is to minimise

Aerial photo of the Theemswegtrace, a long railway around four kilometres that ensure a better connection between Rotterdam harbour and its hinterland. (© Danny Cornelissen, 2020; Source: Port of Rotterdam Authority).





Barge at Euromax Terminal. (© Eric Bakker, 2020; Source: Port of Rotterdam Authority).

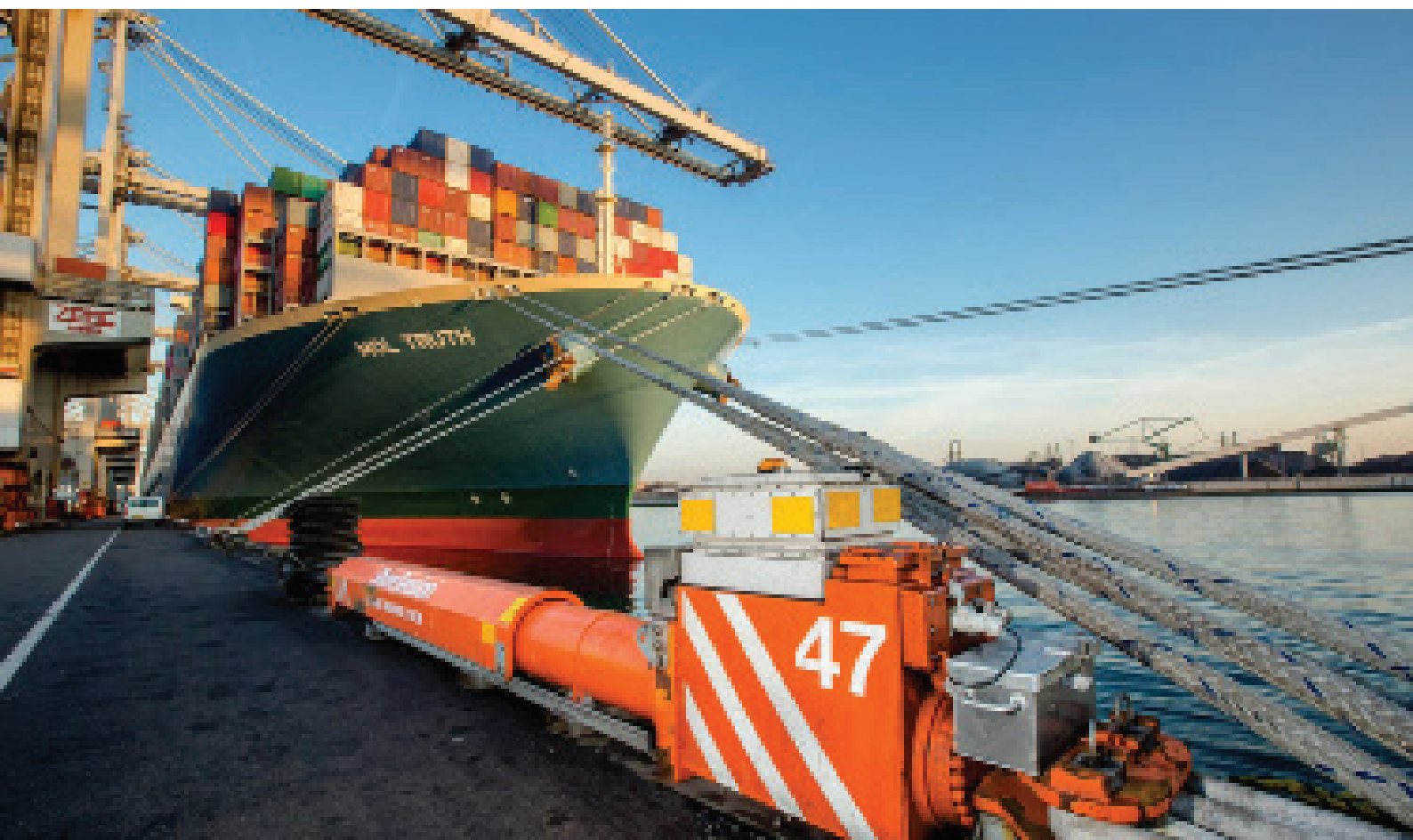
any kind of waste in terms of time, money, capacity and energy, so we can maximise the ease of doing business in Rotterdam.

Digitisation is fundamentally changing the world at an incredibly rapid pace, and the port is no exception. Behind the scenes of the visible traditional port featuring ships, containers and cranes, a digital version of the port is under construction. Considerable

investments in wireless networks, a digital twin, an IoT platform, sensors and cybersecurity will enable the port to keep pace with the evolving environment, and the wishes and ambitions of the businesses in the port.

The main features of the digitisation initiatives revolve around three focal points. By using sensors and data models we create smarter infrastructure, grounds

Shoretension mooring system. (© Eric Bakker; Source: Port of Rotterdam Authority, 2020).





ECT container cranes and Automated Guided Vehicle-AGV system. (© Leon Willems, 2020; Source: Port of Rotterdam Authority).

and buildings. An example: we've installed the first smart bollard on our quay wall. By measuring the strain on the mooring lines in real time, the bollard not only allows the real-time monitoring of safety, but it also provides a clearer picture of which vessels can moor at which quays.

Our second focal point is about smart mobility. By using smart mobility solutions, we're bolstering nautical safety and cybersecurity and optimising the shipping process and hinterland modes of transport.

And last but not least, we're enhancing the chains running through Rotterdam with international and domestic cooperative ventures, and anticipating new technologies and platforms. Collaboration with Portbase is an important part of this. As the logistics data hub of the Netherlands, Portbase attracts major international players who want to do business in and via the Netherlands.

As a result of digitalisation, the nature of our work is also changing. We see new professions emerging, such as data scientists and developers. The prediction is that these jobs will only become more valuable in the future. The range of tasks in various (port) professions in 2021 cannot be compared to those of 20 years ago. It is therefore important that employees

keep their skills up to date. And of course the 'old' professions also remain extremely important.

A ship must continue to sail and a truck must be maintained. So new jobs are created. It is therefore important that we continue to motivate young people to opt for various courses and professions, both traditional and new ones.

Rotterdam has an intriguing history of waterfront redevelopment – most recently and ongoing, the RDM and M4H districts. What kinds of mechanisms does the Port of Rotterdam have to interact with the municipalities, provincial and national administrations to shape the port-city relationship? What kind of conflicts are most prominent, how do you expect them to evolve and how do you address them? What are the future waterfront redevelopment projects, such as Waalhaven, that we should know about?

Redevelopment of former port areas like the ones you mention takes decades. We have made good agreements with the city of Rotterdam regarding the redevelopment of RDM, M4H and the east side of the Waalhaven area. I don't expect other port areas to be redeveloped into urban areas in the foreseeable future.



Man at work overlooking a container ship moored at the quay, Maasvlakte 2. (© Eric Bakker; Source: Port of Rotterdam Authority, 2020).

We would also like to know more about your vision of social and cultural aspects in port city development. Do you see a role for value-based future planning of port, city and territory? Does the traditional (historical) condition of the Port of Rotterdam as a municipal port have advantages in terms of the current and future port-city relationships?

There has always been a very strong link between Rotterdam as a city and the port. Rotterdam has always identified itself as a port city, more than any

other town in the Netherlands. The fact that the Port Authority now also has the state as a shareholder does not have much influence in this respect.

The land reclamation project Maasvlakte 2 has added to the sense of pride. People visit the western part of the port to look at the arrivals of the impressive containerships and we're going to set up a new visitor centre in that area, because we notice people are interested in and fascinated by the port.

FutureLand Ferry visitors. (© Eric Bakker; Source: Port of Rotterdam Authority, 2018).



A NEW NARRATIVE FOR ROTTERDAM PORT CITY TERRITORY



**Interview with Walter de
Vries | Urban Planner
Department of Urban
Development
Municipality of Rotterdam**

by PAOLO DE MARTINO

How is the municipality of Rotterdam looking towards the future? Discusses on this Walter de Vries, an urban development planner working for the Municipality. In 2007, he was recruited to work on the Stadshavens area. Today, he is responsible for the spatial planning of the area of Merwe-Vierhavens, better known as M4H Rotterdam.



Rotterdam Makers District - RDM (right) and M4H area (left). (© Programmabureau M4H; Source: Gemeente Rotterdam).

Thank you very much for accepting this interview for PORTUS Portrait, focused on Rotterdam.

We would like to talk with you about the future of Rotterdam as a port city territory, focusing in particular on the overall planning process of the Merwe-Vierhavens (M4H) area, a former port area and current Makers District that is home to creative entrepreneurs, where port and the city collaborate towards greater sustainability.

Paolo DE MARTINO - Could you tell us about your role within the Municipality of Rotterdam? What are the main challenges (and scales) the port city of Rotterdam is facing at the moment and also what kind of opportunities do you see there?

Walter DE VRIES - I studied architecture and urban design in Delft. I am an urban planner for the Municipality of Rotterdam and I cooperate a lot with the Port of Rotterdam Authority. To be more specific, on behalf of the port authority and municipality I am responsible for the overall planning process of the Merwe-Vierhavens (M4H Rotterdam) area, which is an old port area on the North bank of the River Maas developed in 1910. We are preparing an “*extreme make over*”. What makes this area interesting is that it doesn’t follow the old model of “*port out-city in*”. It is a new cooperation between the city and the port. The city has some land there and the port also owns less than half of the area.

We are cooperating to establish a new innovative district, the ‘Rotterdam Makers District’, which will

contribute to the big challenges that the port and also the city are facing. How can we make a more sustainable port? We brought a lot of energy in the 20th century to making it the biggest port of the world and it still today the biggest in Europe. A clean, smart and sustainable port is much more important nowadays, carbon free in 2050. The city of Rotterdam and especially the Port of Rotterdam and its industries also have to contribute to the Paris agreement. We face a very big task to make the port, with its tremendous fossil based industrial cluster, carbon neutral other business models. We must be very aware that if we do not innovate, then the port will be under very, very big pressure. We see this already with people going to court arguing that Shell has to respect the climate agreement of Paris. The pressure on the port industry is increasing and the Port Authority is of course not responsible for the industry itself. The Port Authority is a landlord. However, the old model of just providing space for ships and ground for industry is an old fashioned way to run the port. So, the Port Authority feels responsible for boosting innovation in the port area, and from that perspective, the Port Authority rediscovered the potential of the M4H area.

The municipality and the Port Authority think that this is an area where innovation can happen because it is close to the inner city, close to public transport, close to education facilities, close to the Universities of Delft and Rotterdam. And space to experiment. Such innovation hubs or innovation districts are not established in the Botlek area or in Maasvlakte. They need to be connected to the city system. So, the M4H area, together with the already established

RDM Rotterdam, is at that interesting interface between city and port. The city brings in knowledge about how to make attractive public spaces, how to provide education facilities, how to deal with cultural heritage, and how to organize a participation process. On the other hand, the port brings financial power, the whole international network of multinationals that are settled in the port, and they also have their own innovation program. So we said to each other: *"We need each other, we need the competencies of both parties to establish here an innovation district that contributes to the renewal of the Port of Rotterdam"*.

What, do you think, will be the impact of port development on the cities and territories nearby?

Originally, the port and city were closely connected. On the old maps of Rotterdam, you can see the water city outside the dykes where the port was established, and the more lively city on the North side of the dyke where the Church was established and the dwellings and the shops were located. In the 19th century, of course, the new waterway gave an enormous boost to the development of the Port of Rotterdam, and after the second world war, it grew very fast and the port became bigger and bigger.

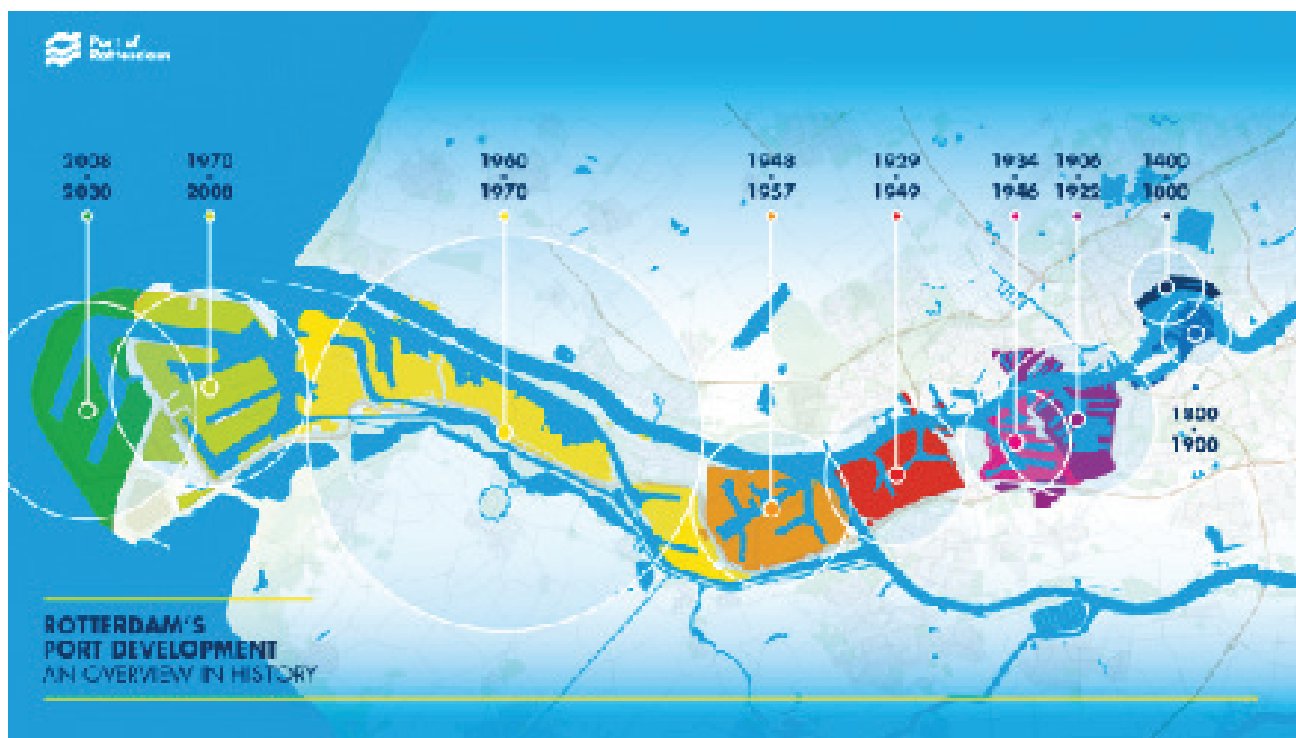
The port nowadays has two main pillars: the industrial cluster, so the chemical industry, and the logistics a cluster as a global hub handling goods from all over the world. The port authority is today also looking

for different things. On the one hand, they want to stay an energy port, but with other kind of fuels, for example hydrogen. This will be the most important new sustainable fuel for the industry and the port of Rotterdam is investing a lot in this new energy system. The logistic cluster will maybe become a more regional cluster because the prices of transport will increase in the future when international couriers have to pay taxes on fuels. The transport lines are very, very long from China or from the East to the West. Incomes in the east are also increasing so the advantage of producing in the East and transporting to the West will diminish in the future. In addition, our economy is calling for smaller scale production and diversified for different types of customers.

What kind of different scenarios do you imagine to improve environmental sustainability and to mitigate the impact that port industry has on the city in terms of environmental pollution?

There is a need to bring back production to Europe. Due to global uncertainty we do not know what will happen in China in 20 or 30 years and this reinforces the idea of having Europe more independent from an economic and productive point of view. From this perspective the Port of Rotterdam will probably also become also a production hub on the scale of Europe. And the interesting aspect of this last aspect is that it will provide more sustainable employment for the city and the region of Rotterdam.

Development of the port of Rotterdam. (© Port of Rotterdam Authority).





Smog Free Tower of the artist-engineer Daan Rosegaarde in M4H. (© Programmabureau M4H; Source: Gemeente Rotterdam).

At the moment the pressure of the port on the region is very high and since port automation less people from the region are working in the port. So, the relation between added value and negative impact is unbalanced. But if the port will become a more regional hub this relation between benefits and negative impacts will be rebalanced. This is also where the M4H area and RDM come in. We called it the Makers District because “making” is an important new concept in the European economy. What we are trying to invent in the Makers District is a new type of industry, a more sustainable (manufacturing) industry that will contribute to making the ports less dependent on only logistics and fossil fuel energy. On the contrary, the Makers District will provide more sustainable employment for the city and the region.

However, when we talk about sustainability in relation to ports there are quite often some misunderstandings. People used to think that having a sustainable port would mean to have zero environmental impact. A sustainable industry can still have very high impacts on the surroundings (e.g. noise). Therefore, a sustainable economy does not mean zero pollution, especially when we are in a transition period where we have both the industrial cluster and the development of new economies related to biomass for example or hydrogen. The Port Authority is convinced that in the next decades more and more space will be needed to host this transition. So, people need to be aware

that a sustainable port will need space to make the transition happen and this can still have some negative impacts on the city and the region. But we hope that this kind of new industry will bring more balance between profits and negative impacts.

What does the city of Rotterdam contribute in making the Port more attractive than others? What elements do you think the Port of Rotterdam contributes to the City to make it more competitive and sustainable than others?

The Port Authority and the companies within the port of course need to establish their license to operate, especially when they produce a lot of noise or a lot of traffic. In the past a large percentage of employees living in Rotterdam were also working in the port or port-related industry in some ways. Automatization has changed this making the license to operate of the port more vulnerable. When you work in the port you accept the system of the port and everything that this brings: it provides your income. But when the connection is gone you see the port only as something that produces noise and trucks. Providing more sustainable employment is therefore one of the main ambitions of the port to contribute to making the city more competitive and attractive. This is also the reason why the Port Authority and the University of Applied Science and Technical College (vocational education) established the RDM Campus to teach

skills that are needed in a port and in the Port of Rotterdam particularly.

That is part of the answer. For the second part I would like to refer to an event, *Wereldhavendagen* (World Port Days), that takes place in Rotterdam the first week of September and this is one of the biggest events in the Netherlands. You can see grandparents with their grandchildren visiting ships, doing excursions, looking at demonstrations, eating an ice cream and looking at the fireworks at the end of day. So, the port shows them its best side, and this is very important to give to the city, to citizens the feeling that they live in a port city and that they are proud of the port.

We would also like to know more about your vision of social and cultural aspects in port city development. Despite the current discussions regarding port-city integration, port and city quite often tell two different stories, also because they belong to different planning logics. What do you think is needed?

When you talk about cultural and social aspects, I think one of the important things is that the port and city in Rotterdam have come to understand that a change cannot happen without collaboration. This is a cultural assignment of course for port and city, but

should also be reflected in the governance and in the way port and city work.

Since 2004 the Port of Rotterdam is independent, it became a publicly owned company with two shareholders: the city at 2/3% and the Dutch Government at 1/3%. The port has a lot of freedom to organize port operations and as landlord. The municipality sets up the public framework (like zoning plans). However, considering the big challenges we are facing, the Port Authority and the port companies need the city and this is opening up new approaches and forms of collaborations within the existing institutional structure.

Is there anything else that you would like to share with us in light of the Port of Rotterdam's leadership role globally and in relation to the port city territory?

I think that the port of Rotterdam is still a successful and strong cluster with a lot of power, and what I hope is that we use our brains and the money to make the next steps. The municipality and the Port Authority have a social responsibility to change, so I really hope that change will come despite the economic, cultural and institutional constraints.

Artists Impression of M4H as Makers District in the future. (@ Delva Landscape Architecture & Urbanism; Source: Gemeente Rotterdam).



PORT AND CITY: TOWARDS A MORE PEOPLE-BASED APPROACH?



Interview with Helmut THÖLE
| Urban and Regional Planner.
Strategic Advisor for Spatial
Development
Department of Spatial
Planning, Province of South
Holland

by PAOLO DE MARTINO

Helmut Thöle is an urban and regional planner and strategic advisor on spatial policies for the Province of South Holland. He discusses the role of the Province in dealing with issues like economic growth, energy, water and space in an integrated way.



Societal Impact of New Technological Developments. Research project MINT, did by Provincie Zuid-Holland together with DRIFT. (Collage by Studio Marco Vermeulen, 2017).

Thank you very much for accepting this interview for PORTUS Portrait, focused on Rotterdam.

We would like to talk with you about the role of Rotterdam as a port city territory. How can the Province of South Holland facilitate future transitions in terms of urbanization and quality of life, economic and productive development?

Paolo DE MARTINO - Could you tell us about your role within the Province? What are the main challenges (and scales) the port city of Rotterdam is facing at the moment and also what kind of opportunities do you see there?

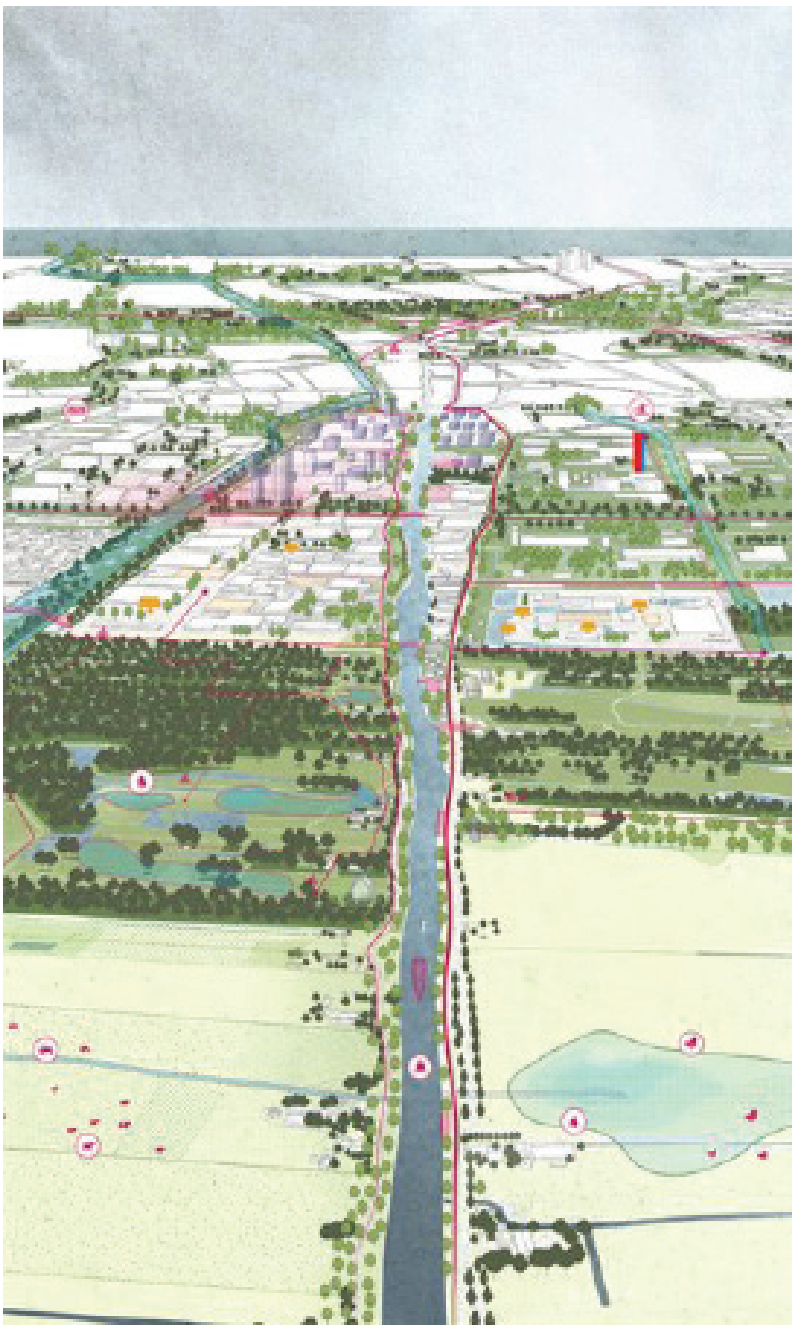
Helmut THÖLE - I work in the province of South Holland as an urban and regional planner. My role is now strategic advisor on spatial policies. I started 16 years ago coming in from the design world of Rotterdam. The dynamics and challenges of our urbanization and economic development are linked to a local, regional and (inter-)national scale. Main focus is on the Southern part of the Randstad Holland which is an urban field with a lot of diverse and strong cities and knowledge clusters, as well as large-

scale infrastructures and industry. The provincial organization is currently linked to different more or less classical themes. We are a political organization representing the regional scale between national and local level. We have a parliament and a regional government where civil servants like me are working. I am from the spatial department but what we always try to focus on is actual societal challenges. Doing that means to connect economic issues, landscape, water to metropolitan development and the professionals behind that. We are quite successful with linking our urbanization with transit-oriented development strategies on the regional scale. We have reached a point where we have to connect and align our economic development and our spatial and urban development in a better way. Not only the urban and knowledge-based part of it but very much also the Mainport Rotterdam and the industrial complex of chemical and maritime activities, and also of our highly technological horticultural industry with all its logistics and infrastructures. Based on the notion that our economy has to develop into a more sustainable, circular and digital way on the one hand – and very limited space on the other hand – there is a strong belief and urgency that we have to renegotiate how

we deal with spatial and societal challenges in this region.

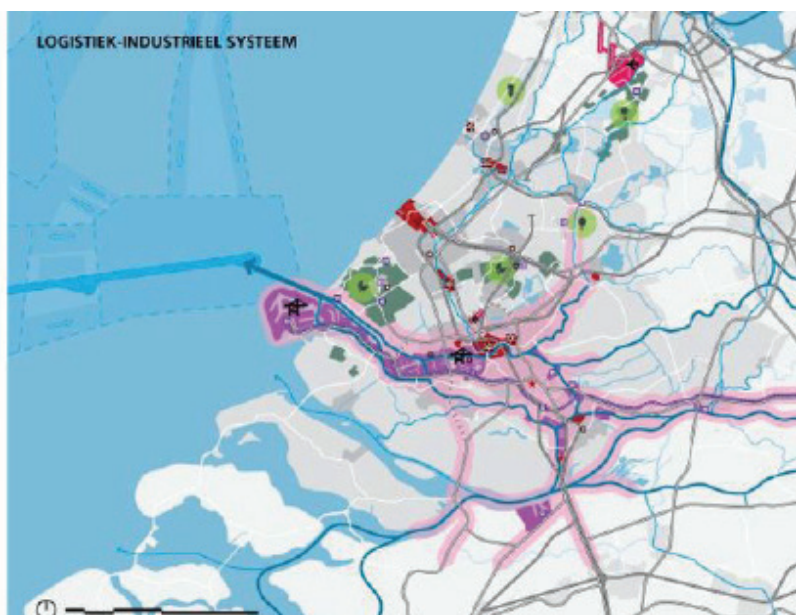
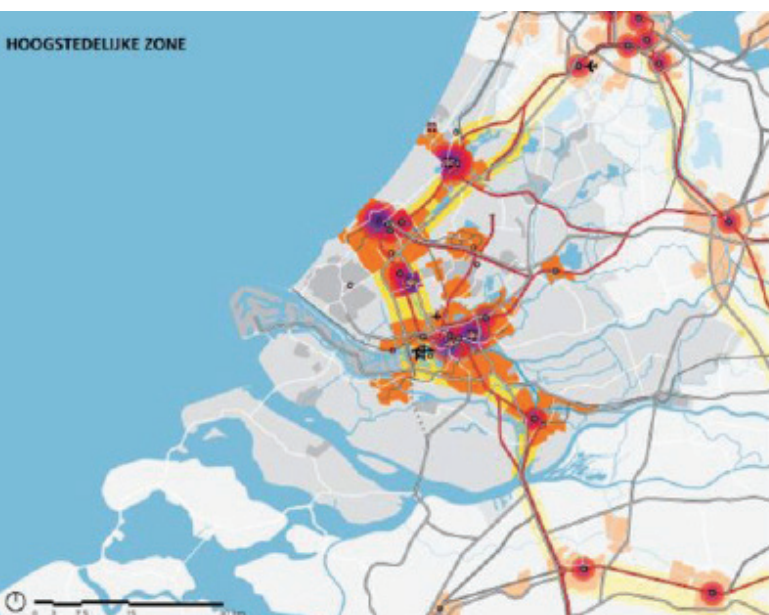
Knowing we are depending on our connectivity and a lot of partners we are also trying to act at the international level, on a scale and area that we call the Euro Delta of Rhine, Meuse and Scheldt which is a highly dense area in the European Union. We share a lot of societal challenges related to urbanization, infrastructure, energy, water. All of these are asking for space. So, we try to reflect on the societal challenges and new social and spatial questions by connecting different perspectives, but also by understanding who they belong to. What are the needs at stake and who are the different parties involved?

But we also have to learn and improve. We are used to facilitating economic growth and progress. But today this is changing and together with the port, the metropolitan region, the city of Rotterdam, people and enterprises, we are looking for opportunities and also new spatial settings where we can test and facilitate future transitions. We all know that issues like climate change, circular economy, digitization and social challenges, are really big challenges and we really have to find alternative growth paths connecting all these things instead of working with black and white or extreme scenarios like "the port has to move out". We need a more integrated and connecting vision and I believe that it can happen in a productive way.



The Panorama Zuid-Holland is a means of having a conversation at regional scale about the ambitions with regard to the major transitions that embrace the complexity, and was created in collaboration with almost a hundred participants in 12 online workshops during the Month of Spatial Quality (October 2020).

In the image "Landscape Park South Wing". (Illustration by Provincie Zuid-Holland; Fotoalbum Ruimtelijke Kwaliteit, Panorama Zuid-Holland, 2021; <https://www.zuid-holland.nl/onderwerpen/ruimte/ruimtelijke-oktober-2020-maand-ruimtelijke-kwaliteit/panorama-zuid-holland/>).



Systems of environmental vision: High-City Zone and Logistics-Industrial System. (Illustration by Provincie Zuid-Holland)

Could you elaborate a bit more on governance? Do you directly influence the planning or does the Province move more on a strategic level?

As a Province we use different sets of instruments and we also have legal obligations and instruments. One of our core tasks is spatial planning and we have a set of soft and hard instruments to organize that within our area for our 3.7 million inhabitants. It is also important to see our work in the context of a decentralization of former national tasks and roles in 2010. Especially spatial planning has since been a regional task for the provinces. Another relevant task is controlling the environmental activities and effects of economic activities. We also have economic development in our portfolio next to water, mobility, landscape and agriculture. As a mid-level government we also have an important role in supporting local governance.

What we mostly try is to bring politicians and all parties together in alliances. We try to connect a lot of players around a common interest, for example, energy. One of our projects is called "Heath Network", where we try to install a multi-commodity grid where we can exchange CO₂ and heat from the industry to the Greenport, which needs a lot of heat and CO₂. This heat and CO₂ is a necessity for the city and therefore people.

What, do you think, will be the impact of port development on the cities and territories nearby? What does the city of Rotterdam contribute to making the Port more attractive than others? What elements

do you think the Port of Rotterdam contributes to the City and the Province to make them more competitive and sustainable than others?

First of all, I think it is important to link and refer to our identity as a connected and open delta region and this identity of course has the port at its core because it connects us with the world and South Holland thrives on this connectivity.

Of course, the port can be transformed and its relation with the territory renegotiated.

We see today many interesting enterprises that are following new business models. These are digital, circular minded, knowledge based and have all the new skills that the port also needs to move forward. Sometimes port activities and more urban based economic activities do not naturally connect and understand each other, however. That is why and how we like to help: to see more opportunities, to try new things and to give some space to the activities we would like to accelerate and to scale-up. But you need spaces to experiment and negotiate borders and see what could work in the future. This is what Merwe-Vierhaven (M4H) in Rotterdam is about. There are a lot of things happening in this area and for the Province this is an important case and element of our story on port city relations and how we present ourselves as a developing region. That is why, Merwe-Vierhaven is one of the 13 flagship spatial projects of our region and all partners united in an urbanization-alliance. This is one of the places where we try to develop new economic activities and we are testing a new

economic ecosystem: a Makers District consisting of a mix of urban and more industrial, maritime and logistical activities.

For the port this is a risk and it requires from us all a lot of inventiveness and flexibility. Making things happen is the slogan of Rotterdam and we take this seriously when we present ourselves internationally as a region where we pioneer with practical solutions for societal challenges. So, when you come here you can see the complexity but you also see us always trying to improve, trying to adapt to the current challenges. However, when it comes to the industrial cluster and businesses, we need to be better connected. We need to put more effort on that and connect this innovation to the city. We need more and more collaborations with enterprises and knowledge institutions such as the TU Delft. Because we see that the industrial and logistical cluster is highly innovative but can be even more innovative and attractive when more crossovers with urban knowledge clusters, but also new links with society and culture are developing. And this is

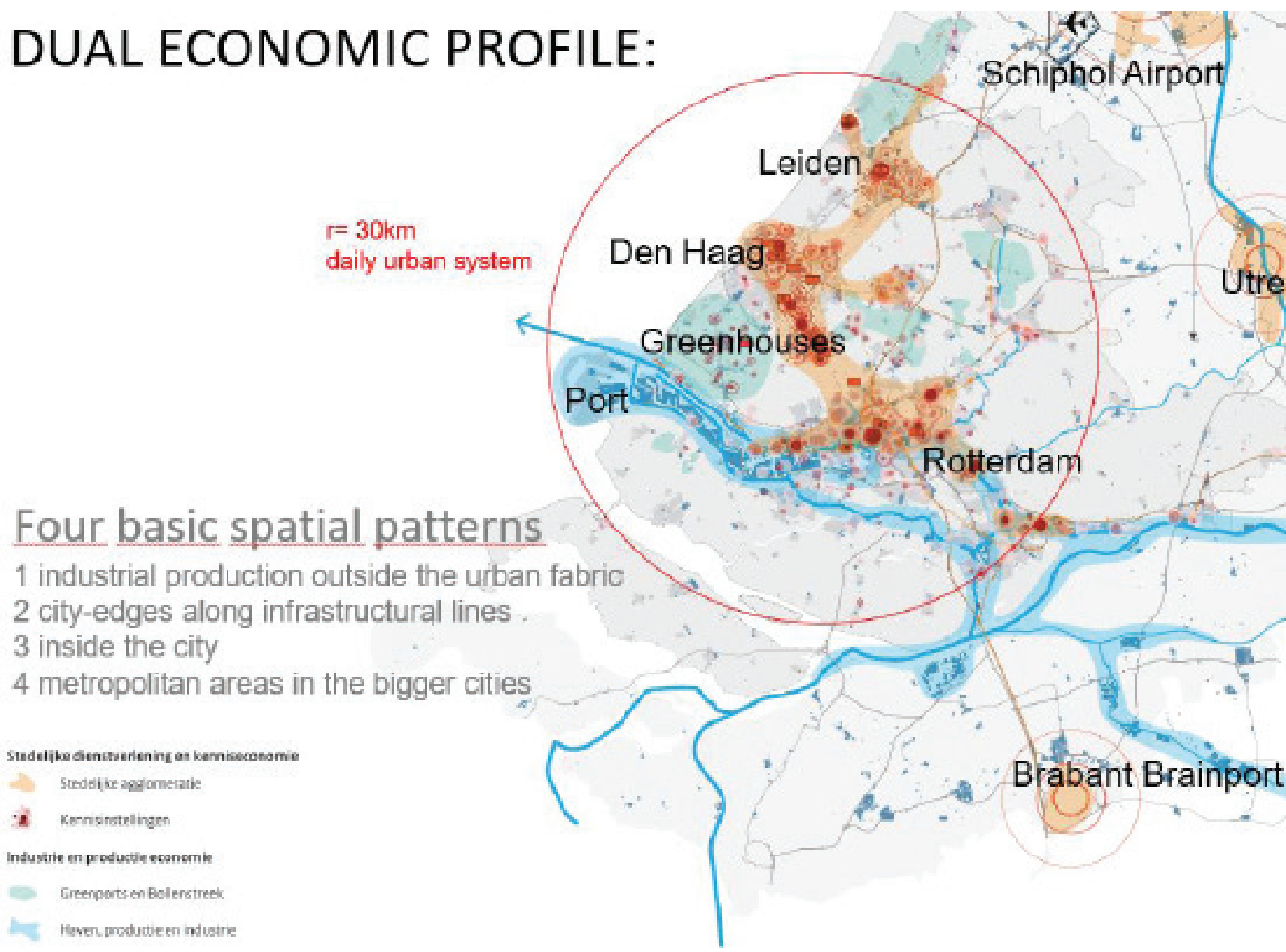
an important aspect to reflect on if we want to move towards the future.

What kind of different scenarios do you imagine to improve environmental sustainability and to mitigate the impact that port industry has on the city in terms of environmental pollution?

At the moment we are trying to develop scenarios together with national knowledge institutions. We have to take a people-based economy approach seriously because we know we need an excellent and innovative skill-set, but are we willing to give that more space and priority? What is the impact of digitalization, logistics, energy infrastructures, circular economy on space and on the quality of life for people living in the delta? Are we willing to stay close to the core of our open and entrepreneurial narrative? Or do we want to be a port region with an unclear development path and little selectivity on activities and companies where we also are happy with a lot of businesses as usual?

Dual economic profile for four basic spatial patterns: Urban agglomeration and knowledge economy; Industry and production economy. (Illustration by Provincie Zuid-Holland).

DUAL ECONOMIC PROFILE:



We need smart scenario thinking tackling these questions. They do not need to be black and white and simplistic – like the port moving out. On the contrary, they could move around the idea of reducing the carbon footprint by also integrating more digital and circular economies. But, how much space does a circular economy ask for? Are all fossil infrastructures going to disappear leaving the port and city with a lot of leftovers? We do not yet have enough answers for this so these are the kind of questions we must ask.

We like to approach it like surfers surfing the waves. That means that we cannot control all the geo-political, technological and societal challenges, but we can use their forces as opportunities to make a change. That is why scenario thinking, but also a certain pragmatism and sometimes humility is important. We can play with extremes, we can also be radical, but in the end it is always about making first - sometimes small - steps to reconnect the fragments. That is why I like the Merwe-Vierhaven so much. When I came to Rotterdam from Germany in 2001, the main trend was to replace parts of the port with housing. But that is a replacement which sometimes misses opportunities. What intrigues us more today are zone mixing experimentations.

We would also like to know more about your vision of social and cultural aspects in port city development. Despite the current discussions on port-city integration, port and city quite often “tell two different stories”, also because they belong to different planning logics. Do you see a role for value-based future planning of port, city and territory?

We have to work with cities and regions. We have a general framework, and within that framework we need robust guiding principles like multifunctional use of space and program, like combining technological

and societal innovation to be inventive, reallocate some of the activities that help us to create better environments, where you can experiment with more urban functions. And you should never forget to look back and forward at the same time to the regional context and see what these rearrangements look like at a different scale.

There is definitely space for a value-based approach. We should also keep in mind that we are dealing with improving the quality of the space and we should always try to offer good quality opportunities to both citizens and companies. We should probably be a bit more selective in specific areas because we have a people-based vision and I believe we have reached the point now where we have to say no to activities which are not contributing to our vision of an ever dynamic, open and connected delta where we take care about people and ideas and where we are always in to invest in new ideas for spatial quality.

Is there anything else that you would like to share with us in light of the Port of Rotterdam's leadership role globally and in relation to the port city territory?

We have to be aware that we are part of networks which are far beyond our scale of the region and the province and the formal policy borders. Rotterdam is part of the network together with Antwerp, Amsterdam and Hamburg. There are forces that we cannot pretend to control like China, the belt and road infrastructure, climate change, etc. Another thing I would like to go back is the shift to a people-based approach. This is a big question where big themes come in: what about climate change? What about water issues? Will we go on towards a healthy and resilient region? These are really becoming more and more urgent and we need everyone on board to deal with them.



The Panorama Zuid-Holland is a future perspective at regional scale level in which the coherence, spatial impact and opportunities of various social and cultural tasks are depicted.

*In the image "Future of the Mainport".
(Illustration by Provincie Zuid-Holland; Fotoalbum Ruimtelijke Kwaliteit, Panorama Zuid-Holland, 2021; <https://www.zuid-holland.nl/onderwerpen/ruimte/ruimtelijke/oktober-2020-maand-ruimtelijke-kwaliteit/panorama-zuid-holland/>).*

THE PORT OF ROTTERDAM FROM A REGIONAL PERSPECTIVE



Interview with Paul Gerretsen | Director Deltametropolis Association

by PAOLO DE MARTINO

What are the challenges and opportunities facing Rotterdam? Paul Gerretsen, Director of the Deltametropolis Association, offers his perspective. A designer with expertise in regional planning, urban planning and architecture, Gerretsen has directed the association since 2008. Its members include professionals, businesses, knowledge institutions and other social stakeholder involved with sustainable development in the Randstad.



The Archipelago of Knowledge is a new spatial strategy for the city of Rotterdam, Netherlands, that reconsiders the relationship between port and city. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha and Move Mobility).

Thank you very much for accepting this interview for PORTUS Portrait, focused on Rotterdam.

We would like to talk with you about the role that the Deltametropolis Association plays in the metropolitan territory of the delta as a platform to connect other stakeholders, to promote research and to reflect on future developments with a territorial vision that includes the Rotterdam harbor complex.

Paolo DE MARTINO - Could you tell us about your role within Deltametropolis? What are the main challenges (and scales) that the port and city of Rotterdam, as well as the larger region, are facing at the moment and what kind of opportunities do you also see there?

Paul GERRETSEN - At the Deltametropolis Association, we have this role of looking with an open agenda at the natural and cultural delta territory and how that interacts with the city network, the metropolitan dimension. We came into existence via the four big cities of the Netherlands and Rotterdam, being one of them, was very much involved in this development.

The first phase was to focus on the Randstad cities (Amsterdam, The Hague, Rotterdam, Utrecht) to have a platform to think about future developments. Later other stakeholders came in, so the idea of setting up an association was made to fit that agenda and to allow other stakeholders to enter. The so-called Mainports were the first to come in: the Port Authority and Schiphol Airport. This because they thought it was fundamental to look at the development of the city. However, our role today is quite limited because both the city of Rotterdam and the port authority are no longer members of our organization. We work together on all kinds of projects and in different ways but there is no direct relationship anymore.

We have developed some research on the role of the Rotterdam harbor complex in the wider setting which starts with the Euro Delta Metropole and includes Flanders (Belgium) and Northrhine Westphalia. In this collaboration the harbor plays a quite fundamental role. I think the most interesting project was one we did three or four years ago, which looked into the maritime cluster and its special implications for the wider region. It looked into the relationship between

the development of the maritime cluster as an economic cluster, for which the Erasmus University developed some scenarios, and the implications this can have on space and society.

What, do you think, will be the impact of port development (growth/shrinkage/repositioning?) on the cities and territories nearby? What kind of different scenarios do you imagine to improve environmental sustainability and to mitigate the impact that port industry has on the city in terms of environmental pollution?

I am sometimes a little bit puzzled by the scenarios because I come from a different perspective and we like to emphasize long-term thinking in our work. I think the Netherlands has forgotten about the quality they used to have in thinking about the long term. There was a real focus on the long term and the strategic steps that needed to be taken. And actually, the development of the port was very much part of that long-term perspective. It is how and why Rotterdam became the biggest port of the world.

This long-term perspective is quite challenging in the Netherlands at the moment, particularly when it concerns all of the major problems we can see coming out of climate change and the challenges that we have in terms of mitigating measures and living

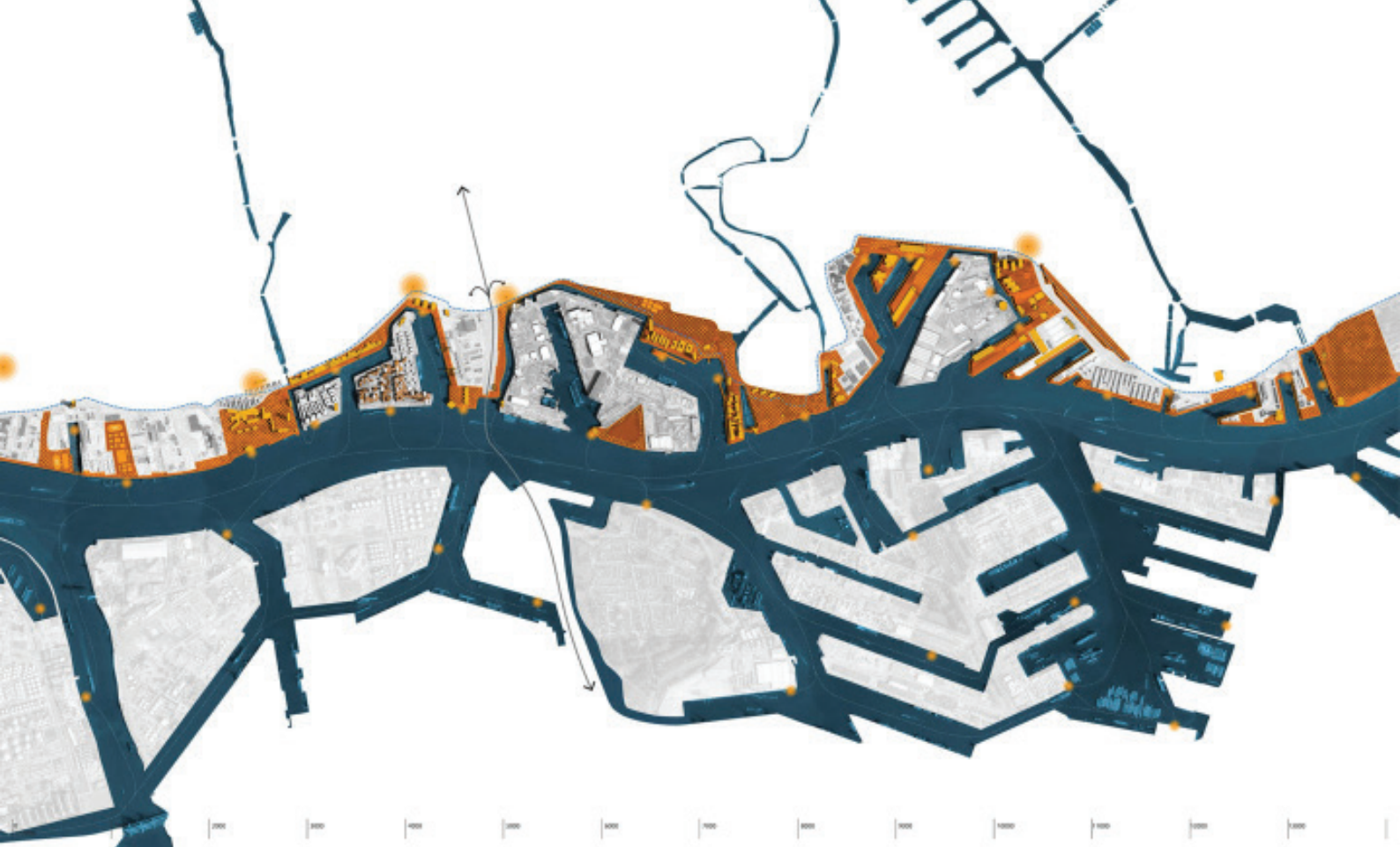
in a different way. I believe these aspects are really off the scale and not only in the relationship between port and city. This is an existential crisis that requires actions.

However, many of the scenarios, particularly coming from the port itself, but also from people thinking about port development, describe a process of economic growth as if nothing is wrong. If you look at the forecasts for the amount of fossil fuel flows, for example, in the port of Rotterdam, these are not matching at all with any of our sustainable goals in the European context. There are big steps to be made and I am sure that on a theoretical level everybody agrees that these steps need to be taken, but in practice I think we are only just scratching the surface.

This has also to do with the fact that there are forces against change. In terms of its infrastructure for example, there are actors which are very powerful in terms of influencing decisions. The Port Authority is a key player in terms of infrastructure investments. They literally sit at the table of the Minister and there's not many other organizations which have this direct influence. So, I am also a little bit puzzled by that because they could influence the debate and also make smart investments for the overall North Western European context.

Giant 7 with swans in the foreground. (© Kees Torn; Source: Port of Rotterdam Authority).





Foresight Maritime Cluster 'Archipelago of Knowledge'. (Map by Deltametropolis Association, 2017; © Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha and Move Mobility).

So, I still think that there is no long-term strategic thinking whatsoever. In addition, I have to say that the public side such as the government, the municipalities, the region are also not able to react to this lack in a proper way.

How does the Deltametropolis Association contribute to making the Port more attractive than others? And what elements do you think the Port of Rotterdam contributes to the City and the region to make them more competitive and sustainable than others?

We developed a study (Maritime Clusters) which I believe was very interesting in the way it suggests some alternatives. I thought it was an interesting approach in terms of finding positive ways in this relationship between the city and the port area.

Particularly the study tells the story of frictions related to the heavy industry and the city becoming more and more detached from the port economy. Of course, not all conflicts can be resolved in spatial terms but some of them can. We can think of spatial strategies that bring innovation at the intersection between city and port. We can think about spaces to be safeguarded for future innovative developments. We should avoid that low level uses take away the quality of these spaces of relation. So, I strongly believe that we can play a role spatially through speculative proposals to

help the port preserve the spatial quality of the port city system at different scale levels.

How important is it that the Port, City and the larger region have a shared vision and why?

Very important. We, as spatial planners don't look at these territories separately rather as a whole. A shared vision is the only way to bring in common benefits and long term planning for the port, city and region. From Deltametropool we work on the metropolitan regional scale as the focus point that includes a couple of cities and ports within the territory. This portrays our visioning and importance of shared vision and decision-making process. Our activities and programs rely on bringing these stakeholders together and providing an impartial platform to discuss their individual challenges and possible support. We are developing a research by design study with TU Delft and Centrum Ondergronds Bouwen (COB) which focuses on Merwe-Vierhavens area, an area in Amsterdam, a neighbourhood in Maastricht and three case studies in Flanders, one of which is in the harbour of Oostende. The study is looking at the relationship between the development which happens above the ground and what happens below the ground in terms of climate change and climate adaptation, but also in terms of all of the infrastructure that needs to be built underground. How can you manage this relation in the future?



CMA Visser Maasmond. (© Kees Torn; Source: Port of Rotterdam Authority).

Particularly if you look at it from the perspective of the employment, it would be wise to focus less on the role of the big multinationals and more on small and mid-size companies and their role in terms of innovation.

70% of the port is still based on the fossil fuel industry. We really need a structural change in the way we live and behave. Port and city still “tell two different stories”, also because they belong to different planning logics. What do you think is needed to plan the port as an urban entity?

Half of the kids in Rotterdam have asthma, never mind that it used to be even worse, what kind of answer is that, this is unacceptable. So yes in terms of emissions, all kinds that is, and also in all forms and all along the “supply chain” we need a complete reset. That means taking the “living environment seriously, both in the harbour, the city, region and of course globally. If you’re still unable to come to terms to that idea, there cannot be a license to operate. We cannot keep going on this way.

Is there anything else that you would like to share with us in light of the Port of Rotterdam’s leadership role globally, in relation to the port city territory and the work of Deltametropool? How do you see the port-city relation in Rotterdam developing in the future in a transnational/European context?

The relationship with knowledge and education institutes I think is very important, regional coordination is needed as well as working together. Another element, I think, to also better understand the level of the Euro Delta is to recognize the collaboration between Rotterdam and Antwerp. Basically, what you see there is that there is a further need of integration of the ports on both sides of the border. It will lead to the conclusion that ports need a territorial view on how this regional territory can be developed. Very similarly as it did with the integration of the ports of Gent and Terneuzen and Vlissingen, into North Sea Ports. So, can we challenge the port of Antwerp and the port of Rotterdam to come up with a strategy on the Euro Delta scale in terms of their collaboration, instead of seeing each other as competitors. And of course, the Amsterdam harbor is part of that thinking.

I would also hope for much more powerful public side which really addresses these big issues when it comes to climate change. Change needs central government action through collaboration with all other levels of actors. Finally, I think that if we could come up with new narratives, other ways of conceptualizing this port system, I think that would be beneficial. Perhaps we can still play a role in that.

ROTTERDAM: A HISTORICAL PERSPECTIVE FOR THE FUTURE



Paul VAN DE LAAR

Professor of Urban History. Head of History Department, Erasmus School of History, Culture and Communication, Erasmus University Rotterdam. Rotterdam, The Netherlands. Core Team Member, LDE PortCityFutures.

Paul van de Laar (1959) holds a chair in cities as a portal of globalization and urban history and is head of the History department, Erasmus School of History, Culture and Communication. Between 2013 and 2020 he was general and artistic director of Museum Rotterdam, the city museum of Rotterdam, and developed great expertise in the heritage of diversity. His research focuses on comparative port city history and migration history. He is one of the principal investigators associated with the HERA

Joint Research Programme: 'Public Spaces: Culture and Integration in Europe'. PLEASURESCAPES. Port Cities' Transnational Forces of Integration (Barcelona, Gothenburg, Hamburg, and Rotterdam) (2019-2021) <https://pleasurescapes.eu/>. He is a core group member of the Leiden-Delft-Erasmus PortCityFutures Centre (<https://www.portcityfutures.nl/home>). His research focuses on comparative port city history and migration history.



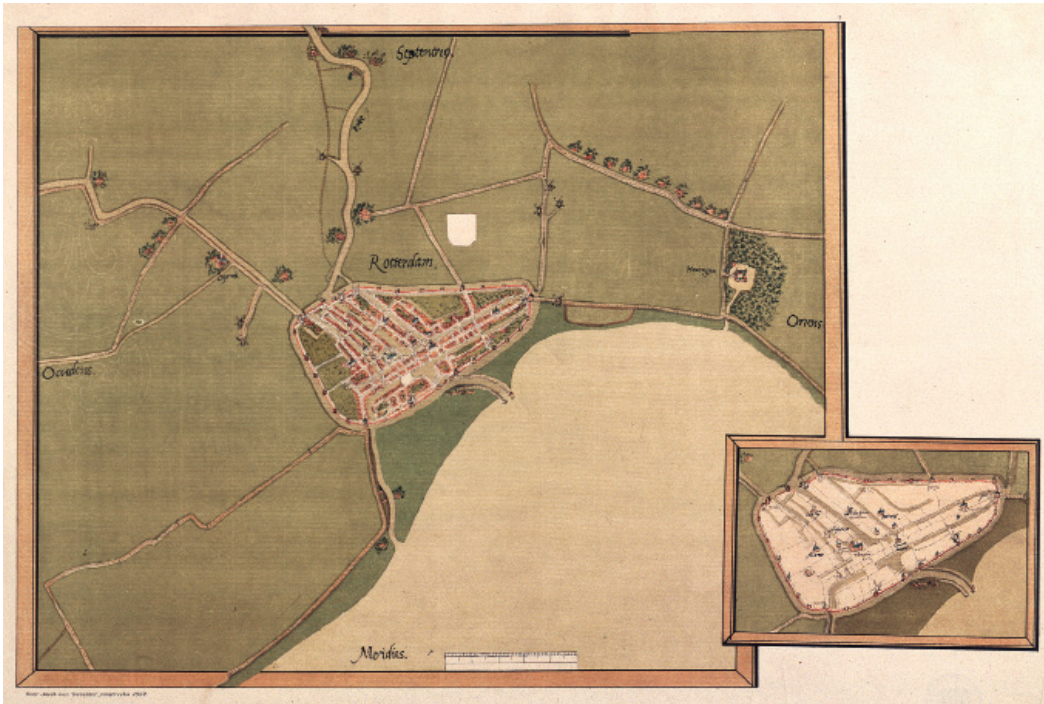
View of the Boompjes and the Maas from a room in the Victoria Hotel on Willemsplein, a favourite location for many painters. From there you had a magnificent view on the working port that was still part of the city. Painting by Jacob Nieweg, 1931. (Source: Collection Museum Rotterdam).

Small but beautiful

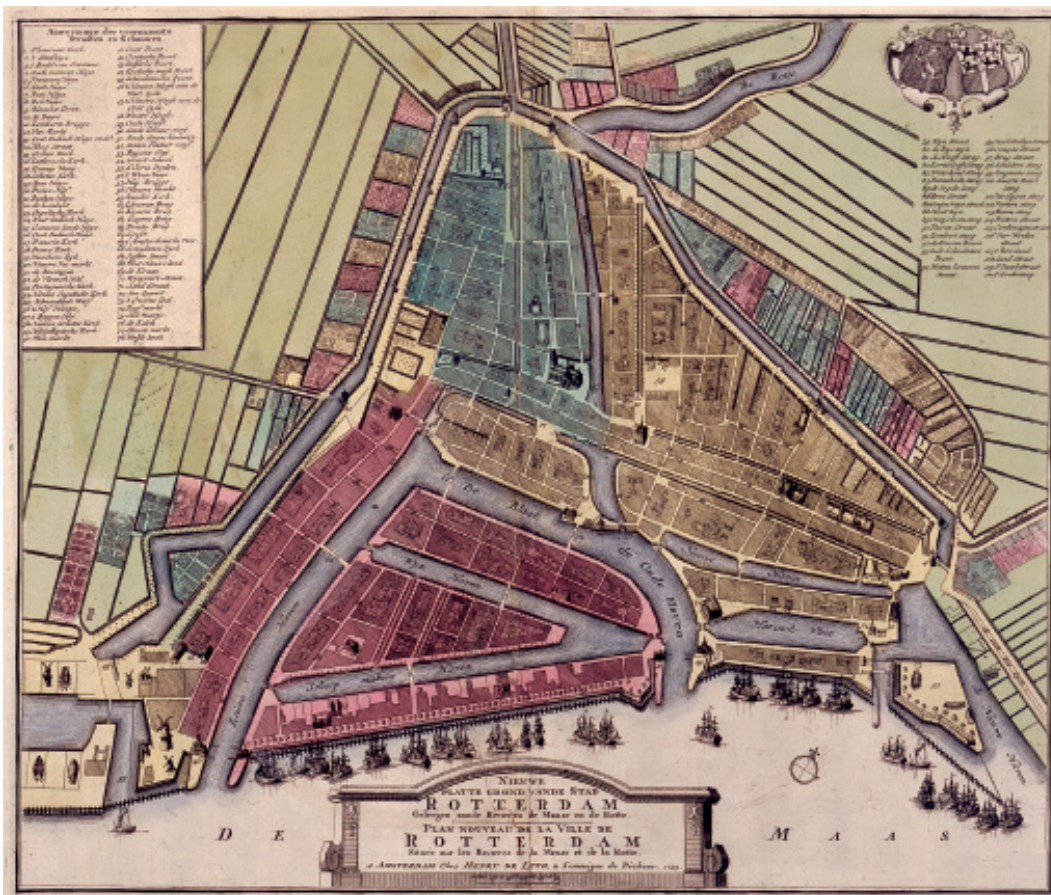
The fishing village of Rotterdam was founded in 1270 when the river Rotte, a peat stream from which the city took its name, was dammed. Seventy years later, the river town acquired city rights and privileges from the count of Holland. Visitors to Rotterdam will probably not realize immediately that it is a historical city. There is virtually nothing to remind us of this earliest period in its history, apart from the landscape that still features the medieval water structure and band of dikes that protected the inhabitants from flooding. For that matter, Rotterdam at that time was of little significance and for a long time overshadowed by other towns and cities in the region, such as Delft and Dordrecht, that were older, richer, and more influential.

The herring trade pushed Rotterdam's advance as a commercial city only around 1550. Herring as a commodity turned out to be perfectly suited to domestic and foreign wholesale trade with the Rhine and Scheldt regions and with France. Ships that travelled to these regions brought cargoes back

with them, which boosted Rotterdam's position as an international entrepot. In Rotterdam, the herring made a series of other economic activities easier to achieve and laid the foundations for its huge success as an international trading centre. At the end of the sixteenth century, Rotterdam also took advantage of new trading opportunities as the Netherlands started to dominate the global financial, trade and colonial markets. Rotterdam merchants mainly emphasised trade with the west: France, England, and Scotland. The wine trade with southwest France became substantial: in 1618, the town council considered this trade to be the town's primary one. In less than half a century, Rotterdam had ascended to the rank of the Republic's second merchant city after the impressive and much larger and richer Amsterdam. The unruly growth of the urban area in the seventeenth century was a reaction to this sharp increase in trading and shipping activities and led to the building of the Waterstad (Watertown). This port-city expansion gave Rotterdam its characteristic triangular shape that would define the urban landscape, port-city relationships and also urban planning policies until 1850.



Map of Jacob van Deventer (ca 1575-1578). (Source: Biblioteca Nacional de España, Madrid).



City map published by Hendrik de Leth, 1733. Bottom left is the Nieuwewerk, bottom right the Reuzeneiland (Giant's Island), where the Admiralty established its new shipyard in 1689. (Source: Collection City Archives Rotterdam).

The transitpolis of the Rhine Delta

Over the nineteenth century, Rotterdam would break through as a major international port city. Changes in the organization of trade and transport, the shift from sailing ships to steamships, and a new international geo-political order dominated by Britain and Prussia challenged the Rotterdam business community between 1830 and 1870. From 1870 the town was rapidly modernised, the effects of which were most clearly visible in the expansion of the harbour landscape on the southern bank of the Maas opposite the old town centre. Rotterdam profited from its natural location on the Rhine and was able to exploit this position through the construction of the Nieuwe Waterweg, the connection to the North Sea which began a new stage in the port city's development and unprecedented economic growth. The transformation started with the area of Feyenoord across the river Maas and from the mid-eighties' onward, river docks like Rijnhaven, Maashaven and Waalhaven (Rhine, Meuse and Waal docks) were developed that reshaped the river landscape south of Rotterdam. The river – 'wet' – docks were based on the concept of large water basins: huge docks easily accessible to sea-going ships, where ships moored to buoys could be loaded and unloaded 'midstream', from or into inland vessels moored alongside. Before the First World War Rotterdam celebrated its port's successes.

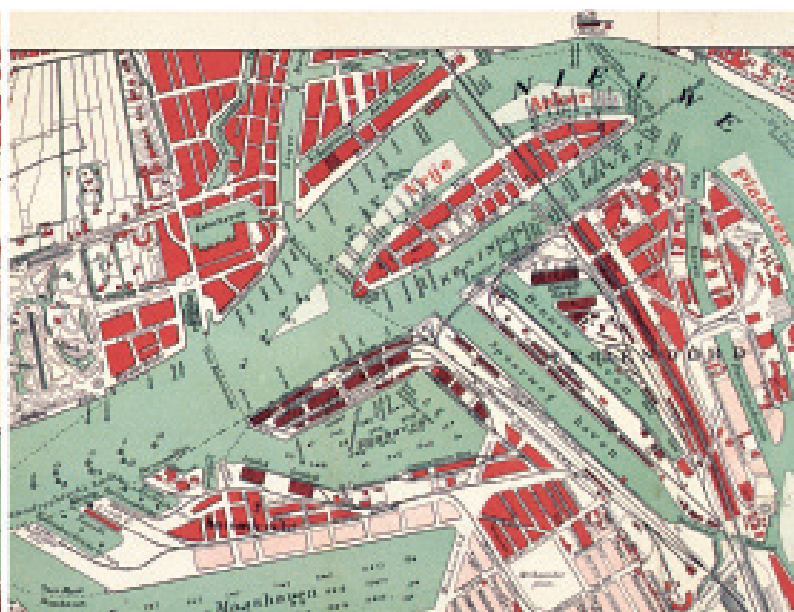
In 1913 the tonnage transmitted by Rotterdam to Germany was almost eight times higher than in 1890. It had risen from about 2 million tons to 16

million tons, with an average annual growth rate of 9%. Rhine barges carried to the hinterland steel, iron, cereals, and oil, which accounted for approximately 74% of total transit trade. The annual growth rate for transshipment from Germany to Rotterdam was about 13%, from half a million to 7 million tons in the same period. Coal was the major bulk good sent to Rotterdam. Initially, the city did not have a very strong position in oil-transshipment, but its successful transformation into a transit port also made it a place of interest for transnational oil firms entering the European market selling new products. After 1918, however, the city was forced to rethink the economics of its port. The Rhine economy had almost collapsed and the city government hoped to reduce dependence on the German hinterland. Leading business officials, politicians and the Chamber of Commerce tried to increase the industrial output of the Rotterdam region. However, the region was not successful in attracting non-maritime related industries other than the petroleum business. The restructuring of the oil industry also impacted port-city relations, and this would continue after the Second World War.

The port city region of oil

The bombardment of Rotterdam on May 14th in 1940, which reduced large sections of the city to rubble, forced its inhabitants to build a new city. It became clear soon after the flames had been extinguished and work began on clearing the debris that pre-war Rotterdam would not be rebuilt. Rotterdam would rise as a new city, planned in accordance with the

Map of Rotterdam's harbour area, 1907. (Source: Collection City Archives Rotterdam).





Panorama of the city centre after the rubble was cleaned and ready for a new modern plan. Photo F. Grimeyer, 1941. (Source: Collection City Archives Rotterdam).

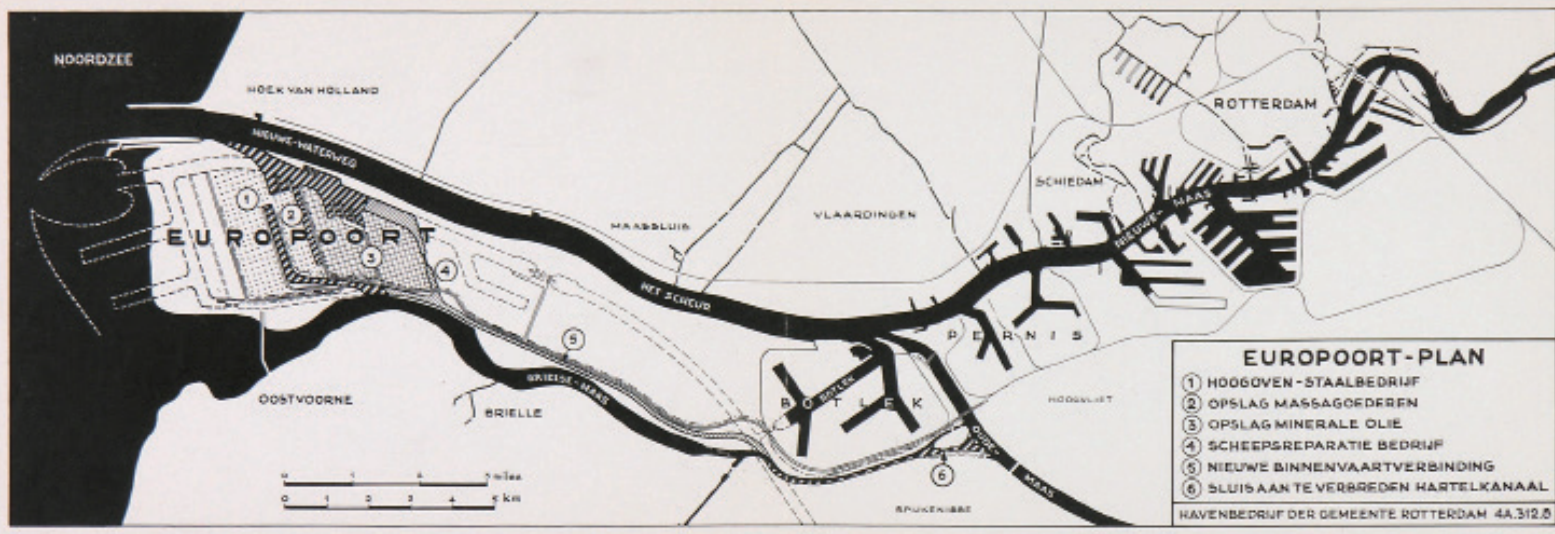
latest insights in modernism, architecture, and urban planning. After 1945 the city gave priority to the restoration of the harbour, which was destroyed by the Germans in September 1944, rather than to rebuilding of the city centre.

After 1945, Rotterdam developed an industrial port cityscape that created a city without a port. In 1947 the time was considered ripe for the development of the Botlek, but the development went much slower than expected. The expansion of Rotterdam was made possible by the rapid growth in international trade, especially in oil and oil products. The multinational oil companies no longer wanted to transport the crude oil to the hinterland by tanker along the Rhine, but through a pipeline to the Ruhr area and this idea led to merging the Botlek plan with that of Europoort (1957) into one single gigantic harbour area stretching from the sea to the Oude Maas. Europoort would procure Rotterdam the position of gateway to Europe and consisted of five petroleum docks, two general cargo and two bulk docks. It would increase the port area to 25,000 (10.000 hectares) acres in size, fifty times bigger than in 1880. The city was convinced that heavy industries were the basis of a mature urban

economy. The eye-catching part of the plan was the Maasvlakte where the largest industrial firms, especially the future steel works of Rotterdam, would be installed.

In 1960 the first tanker entered the provisional new sea mouth of Rotterdam. Two years later Rotterdam celebrated the fact that it had become the biggest port in the world. Europoort was still under construction but at that time more than 100 million tons had already been distributed to the hinterland of Europe. Oil had become the most important bulk good. In 1963 the share of oil shipped to Rotterdam had increased to 58%, and since a major part of it was transhipped to the German hinterland, the port still depended on the growth potentials of the Ruhr-area.

After 1970, however, Rotterdam lost its primacy as the economic engine of the Netherlands. Once the proud city of the post-war era, Rotterdam became a place of distress, a reputation it shared with other European ports. It remained an important port, thanks to the oil and petrochemical industries. However, the port's noise, pollution, and other environmental problems have strained the relationship with the city.



Map of Plan Europort 1957. (Source: Collection City Archives Rotterdam).

A city in doubt

Because of the economic depression, Rotterdam witnessed a severe set-back in trade and goods distributed through the gateway of Europe. Between 1950 and 1973, the annual average growth rate had been 9.5%. Just before the oil crisis Rotterdam handled 300 million tons of bulk and general cargo. In the early sixties it had won the 'battle of the bulk' and the city hoped to benefit from containers and wanted one of the European container ports, from where feeder ships could carry the containers to smaller European ports. In 1965 the first containers arrived and in the following year the E.C.T. (European Container Terminus; in 1989 reorganised in Europe Container Terminals) was established. This partnership of Rotterdam stevedore companies, Dutch Railways and Nedlloyd was stimulated by the new challenge of container technology. The Maasvlakte, once designed as an industrial outpost, was transformed into a high-tech service centre, where the largest European bulk transshipment and container centre would be in the eighties.

The major post-war harbour development outside the centre meant Rotterdam became a city without a working port. By the nineteen-seventies, the romantic, steam-whistling, and aromatic harbour with the transatlantic ships of the Holland-America Line was a thing of the past. Many of the docks that had been constructed in the late nineteenth and early twentieth centuries for transshipment lost their original purpose. The Kop van Zuid (Head of South, named after the nineteenth century port development on the south bank) became the first part of an extensive waterfront regeneration programme that went hand in hand with

a new post-modern skyline, accentuating the new image of a world port city. The Erasmus Bridge, not simply a bridge but a symbol of the cultural élan of the early nineties, would link maritime heritage across the river with the inner-city redevelopment. The New York Hotel, the former head office of the Holland-America Line, became the first landmark of a re-imagined port city, Manhattan at the Maas.

New port city futures

The construction of the Second Maasvlakte (2008-2012) was the first new major expansion of the port since the 1970s. 2000 hectares of newly created land allowed the port of Rotterdam the possibility of doubling the transshipment of containers. Rotterdam's Port Authority and the maritime business lobby-groups, supported by the city government, defended Rotterdam's newest port expansion because of the new jobs it would create. However, the sophisticated, high-tech, and capital-intensive container terminals would generate less job opportunities, particularly for less-qualified workers. In this respect, since the 1970s the port economy has been losing its importance as a job engine.

The Second Maasvlakte is in fact an extension of the port-philosophy that depended on the Rhine-transit model, that had been developed 150 years ago. Containers became the new growth factor, instead of oil, but even though containers are looked upon as part of the emerging global network of the 1990s, the container business has not changed Rotterdam's dependence on the Rhine. Since the Port of Rotterdam published its vision document in 2011 the world has changed rapidly, because



Maasvlakte 2. Will there be a Maasvlakte 3 in the future? (Source: Port of Rotterdam Authority).

of geo-political, social, technological and climate change impacts. This will be the major challenge for Rotterdam since the port's regime is still based on scale and volume and its success is measured in throughput. New port scenarios are aimed at safeguarding Rotterdam's future position as a major port and Europe's most sophisticated energy hub. In order to do that, the port city region of Rotterdam has to develop an imaginative and creative vision which is intimately connected to that of its surrounding region.

The fixation on growth will make it difficult to break path-dependencies and revise existing economic policies. New imaginative scenarios accordingly need to be developed. Softer values of society, cultural or ecological or community-driven strategies, with an unbiased approach to port city futures' development, including designing for serendipity, unplanned or unexpected outcomes. Perhaps Rotterdam smart port will mean, eventually, a smaller port.

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ANALYZING THE PETROLEUMSCAPE OF ROTTERDAM



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She trained in Hamburg (Diplom-Ingenieurin) and Brussels (Architecte) and earned her doctorate at the Hochschule für bildende Künste Hamburg in 1995. Among other major grants, she received a Guggenheim Fellowship to pursue research on The Global Architecture of Oil and an Alexander von Humboldt fellowship to investigate large-scale urban transformation in Hamburg in international context between 1842 and 2008. Her current research interests include transmission of architectural and urban ideas along international networks, focusing specifically on port cities and the global architecture of oil.

Her (co-)edited books and monographs include: Oil Spaces (2021), Urbanisation of the Sea (2020),

Adaptive Strategies for Water Heritage (2020), The Routledge Planning History Handbook (2018), Uzō Nishiyama, Reflections on Urban, Regional and National Space (2017), History, Urbanism, Resilience, Proceedings of the 2016 IPHS conference (2016), Port Cities: Dynamic Landscapes and Global Networks (2011), Brussels: Perspectives on a European Capital (2007), European Brussels. Whose capital? Whose city? (2006), The Capital of Europe. Architecture and Urban Planning for the European Union (2004), Rebuilding Urban Japan after 1945 (2003), and Cities, Autonomy and Decentralisation in Japan. (2006), Hauptstadt Berlin 1957-58 (1991). She has also published numerous articles in peer-reviewed journals, books, and magazines.



View of the Port of Rotterdam. (© Luchtphoto; Source: Port of Rotterdam Authority).

Petroleum – its extraction, refining, transformation, and consumption – has shaped our built environment in visible and invisible interconnected ways around the world over the last 150 years. Industrial structures, buildings, monuments, urban forms, and infrastructure stand as material witnesses to the ubiquity and power of petroleum [1].

Many people will orient themselves in space referring to gas stations, others will point to oil headquarters as local urban icons, and a select few will be aware of local oil industry facilities or the educational, housing or leisure facilities of the petroleum industry employees. But while observers recognize the connection to oil in select buildings, they do not picture the enormous collective presence of oil in the built environment, its impact on production processes, financial flows, and associated social and cultural patterns in our everyday environment, or the long history of oil's impact on our lives.

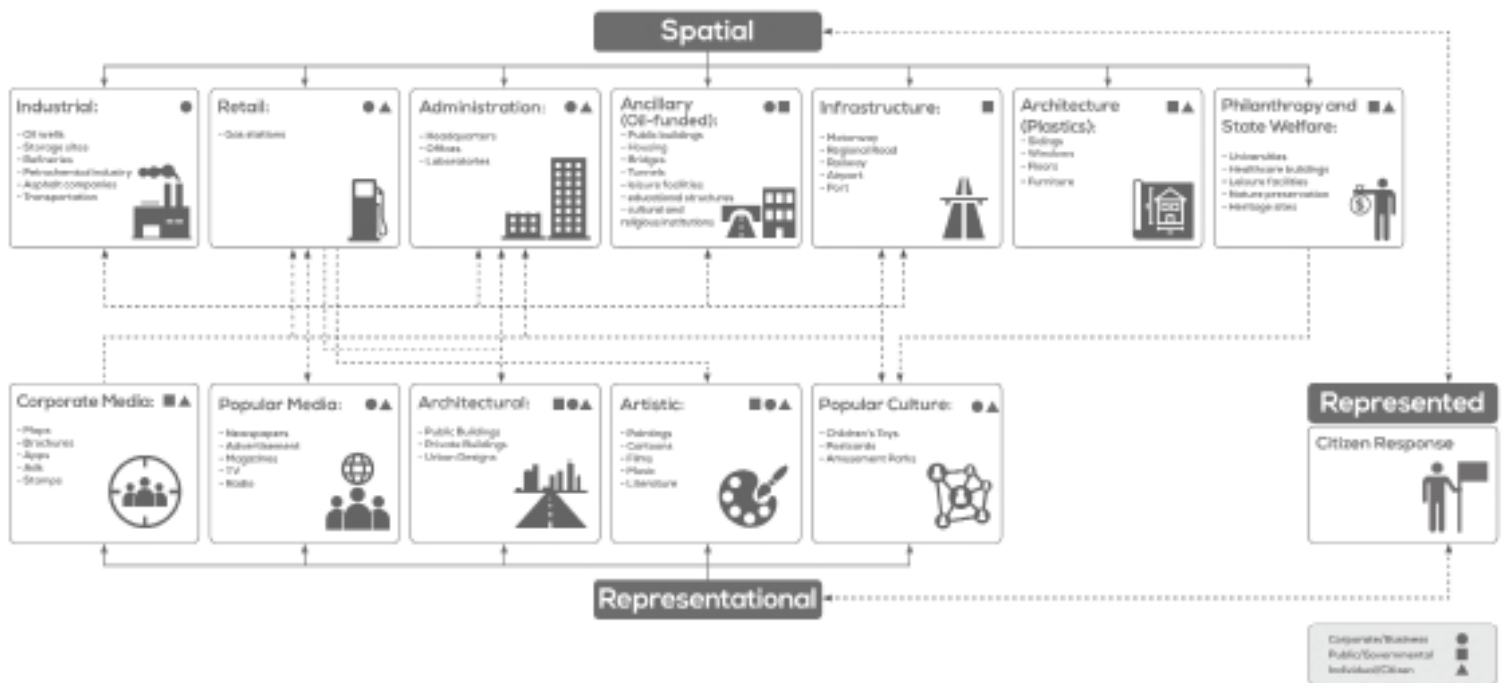
This research starts with the insight that the diverse architectural emanations of oil – including refineries and storage sites, office buildings and gas stations – are connected through their relation to a single commodity and a select group of corporations. Each layer has similar functions and typologies (even if they differ in use, style, location, or architectural form) and these layers interconnect to form a single landscape – a palimpsestic *petroleumscape*. The built environment serves the physical and financial flows of the oil industry and, in part through its representations, carries cultural meaning. The goal is thus to understand how petroleum has been written into architectural and urban practice and representations, and how these forms shape future

design and heritage decisions. This will not change the capitalist underpinnings of oil in large parts of the world, but awareness of the impact of oil can help us rethink those arrangements.

Oil companies, together with public and private actors, have made historical decisions on location and design that have translated into urban patterns and built forms, shaping the long-term development of many cities over the last 150 years [2]. Physical structures, social relationships and cultural practices, some of them established over one hundred years ago, continue to inform contemporary spatial decision-making and our spatial representation. They are also part and parcel of our everyday use of cities and regions and they shape our perception and representation of the petroleum industry (following image).

The petroleumscape of the Dutch Randstad

The area around Amsterdam, Rotterdam, and Antwerp includes some historic medieval trading cities and it is also one of the original places of petroleum storage, transportation, and consumption. Today, the Amsterdam-Rotterdam-and Antwerp area is home to the ARA oil spot market that includes Amsterdam, home for refined petroleum products; Rotterdam, the center for crude; and, crossing the Belgian border to the South, Antwerp the petrochemical hub, the latter being the second largest petrochemical industrial complex in the world after Houston [3]. This area comprises the Randstad, the polycentric conurbation in the northwest of the Netherlands; it has evolved over centuries under the influence of diverse and shifting actors, including oil companies.



The palimpsestic petroleumscape: the hybrid, multiple, shifting, and uneven ways in which many actors collaborate to create the global petroleumscape. (Author: Carola Hein).



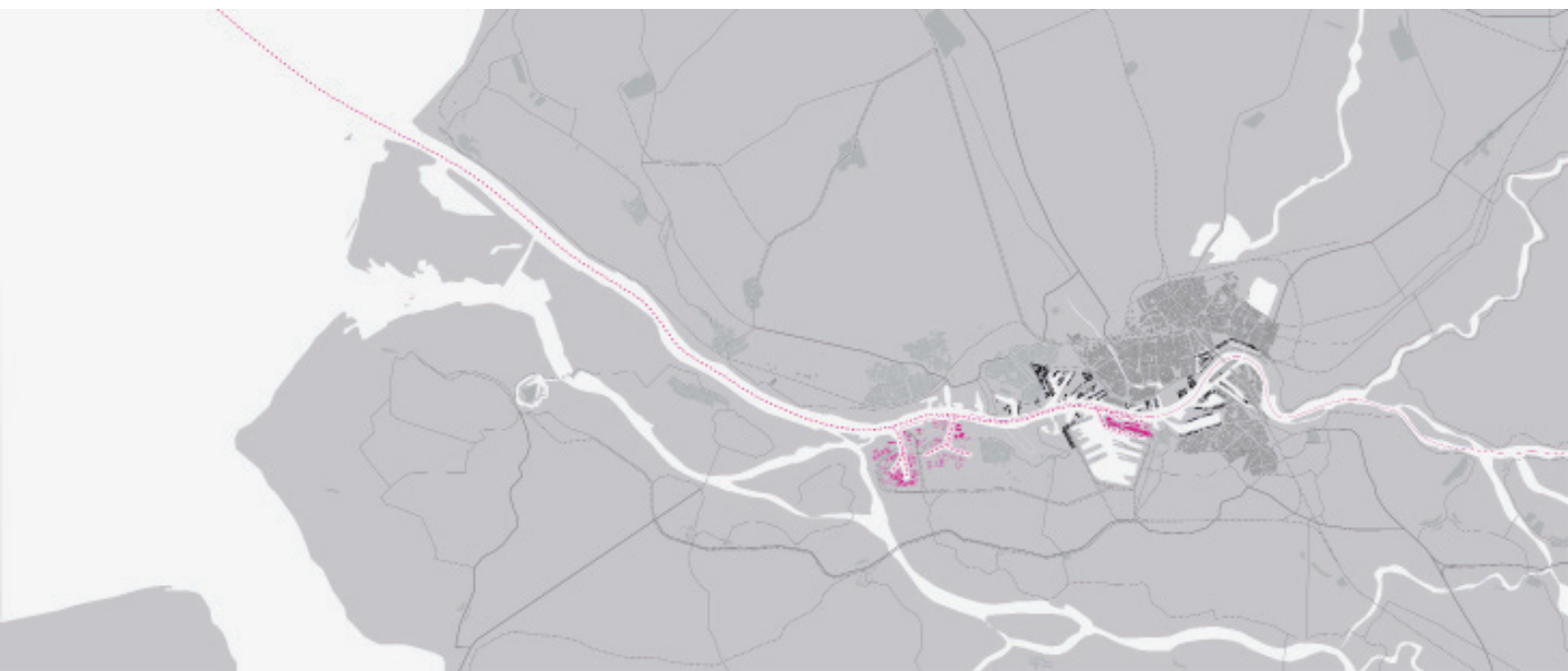
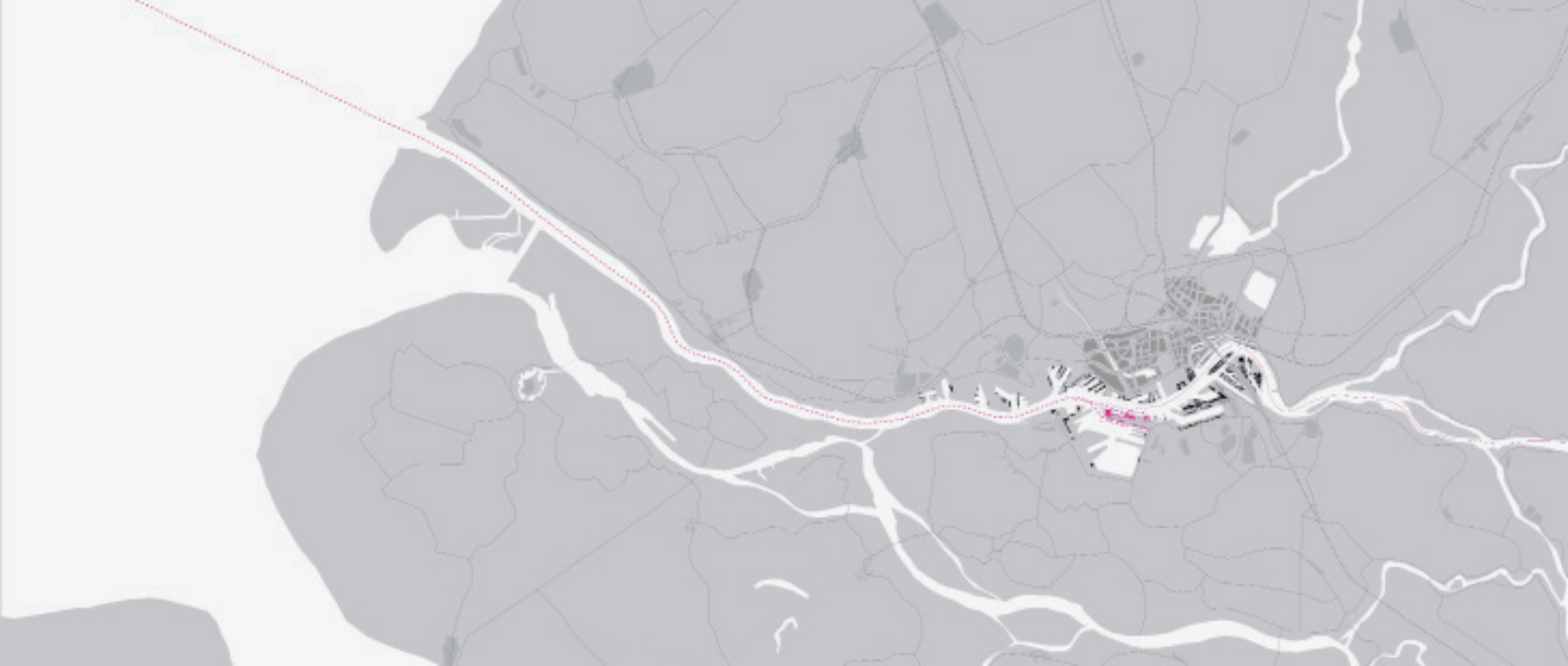
Aerial view of the oil installations in the Port of Rotterdam. (©Carola Hein, 2015).

The industrial footprint of oil is clearly visible from the air in the port of Rotterdam: port facilities, storage tanks, refineries, pipelines, and other infrastructure span from the inner city to the tip of the port, the Maasvlakte II (previous image). The production sector is huge in scale (with some 5,300 ha for industrial sites and 1,500 km of pipelines within the port) and very costly. Its impact on planning decisions is high, but its visibility for the general public is low and mostly hidden from everyday experience. Some of its infrastructure, notably pipelines, is underground; not visible to the bare eye unless a careful observer studies maps, discovers pipeline markers, or detects patterns of melted snow across agricultural areas. Other parts of the infrastructure, such as important rail and highway networks, are shared with general

users and are not easily identifiable as part of oil networks either.

Oil companies and the public sector established the foundations for the Randstad oil cluster in the early years of the industry (from 1862 to the Second World War). It is in the port that American oil entered the European market. The use of kerosene to light lamps was growing, creating a market for newly available petroleum. Oil firms were small at the time and, in Rotterdam, they focused on transport, storage, and resale. The company Pakhuismeesteren stored the first shipments of oil that arrived in Rotterdam in 1862 in the heart of the city, paying little attention to its explosive qualities (following images).







The transformation of the Rotterdam port during the oil revolution: 1862, 1882, 1930, 1936, 1950, 1964, 1972, 2015. (© Oil and the Rotterdam Port, by Carola Hein, Bernhard Colenbrander, Alexander Koutamanis, CC BY NC SA 4.0).

Competition among the port cities in the Randstad and Belgium was fierce in this early period. In 1865, Rotterdam received 533,000 gallons, but this was less than half the amount shipped to Bremen or Hamburg, and much less than the over 4 million shipped to Antwerp. But demand in the German and Swiss hinterland spurred the import of oil through Rotterdam in competition with these other ports. The amount shipped to Rotterdam increased rapidly. The opening of the shipping canal, the Nieuwe Waterweg, connecting Rotterdam directly to the North Sea in 1872 facilitated access for the growing number of steamships that transported petroleum and brought about the request for a petroleum port with rail and road connections to the industrial areas of the Ruhr in the German hinterland.

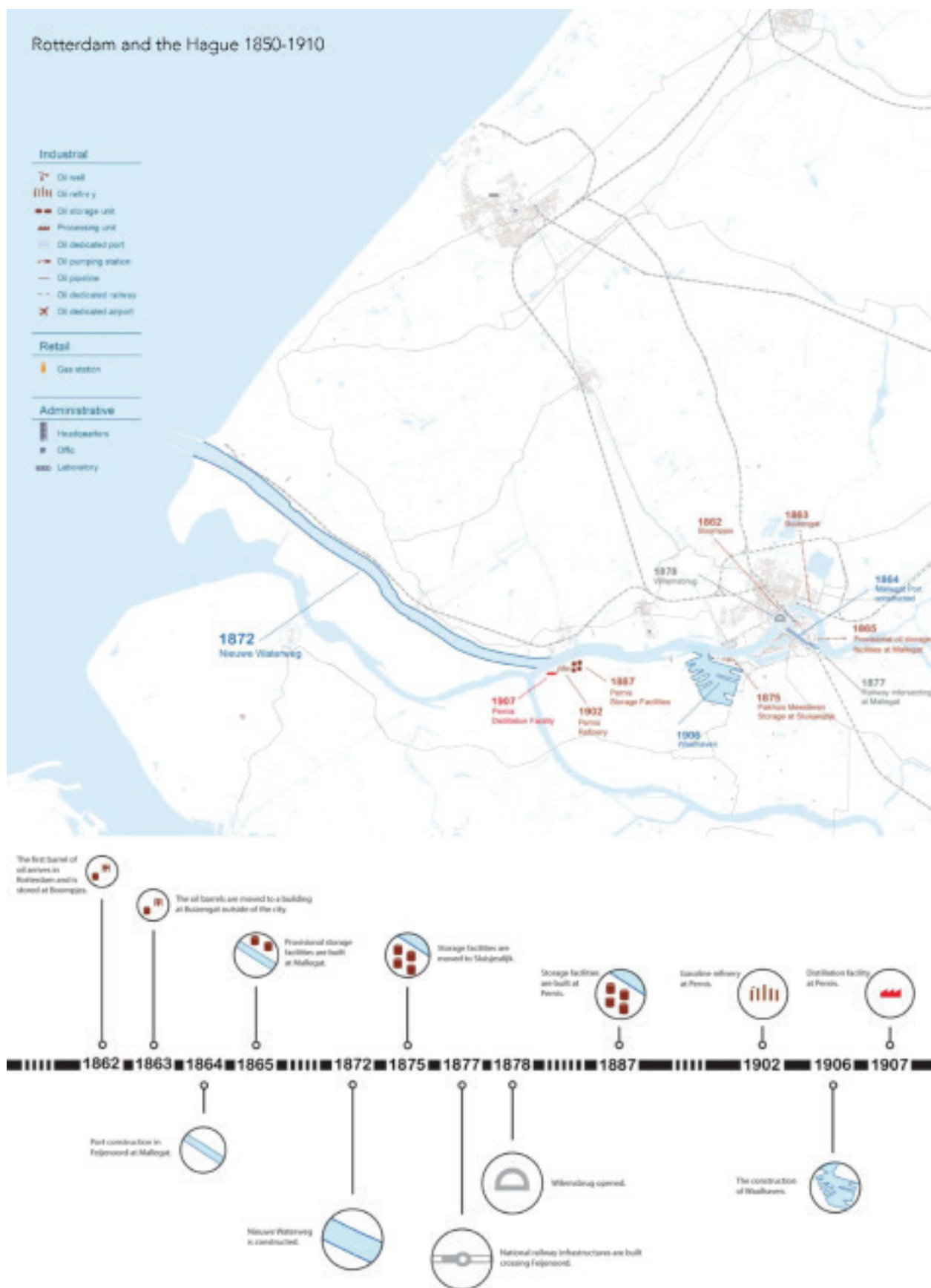
The quick growth of the petroleum trade and the need for dedicated facilities necessitated a close collaboration between elite merchants and the municipality. The economic elite was closely associated with the main political forces, including those driving Rotterdam's annexation of the neighboring municipality of Charlois in 1895, which would become the core of the oil storing and trading. By that time, the Randstad, where railways had first connected the main cities on the Western shore of the Netherlands, saw the construction of railway lines towards the border, lines that would also come to serve the oil industry. These choices created the foundation for Rotterdam's development as an oil node just at a time when new global players in oil emerged.

Advances in shipping, transportation, and refinement, as well as the advent of major companies that gained control of the entire production and distribution chain extensively reshaped the port and the oil business. Their interests connected various parts of the world through their commodity flows, putting their imprint also on the Randstad. These companies, at the example of the American Standard Oil Company that monopolized oil interests at the end of the nineteenth century, intervened also in Europe. The foreign companies challenged the 23-year monopoly of Pakhuismeesteren and started to compete for land allocation in the Rotterdam petroleum port. By 1891, several major oil companies settled in the port, including in 1901, the Koninklijke Olie – one of the predecessors of the Royal Dutch Shell. The city on the Maas had emerged as the main Dutch petroleum center, outpacing Amsterdam.

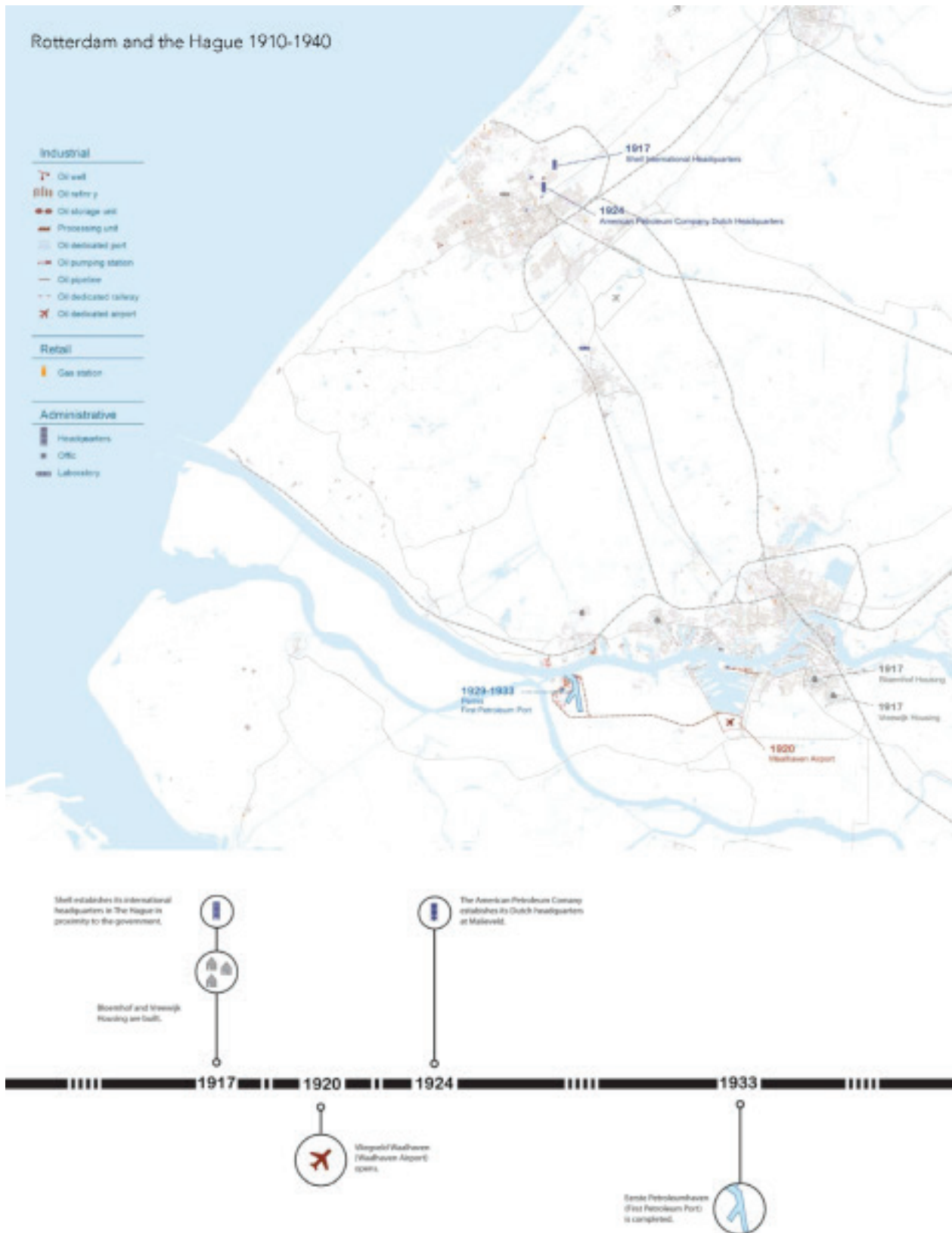
If demand for lighting oil established Rotterdam as a major oil port, the rapidly growing new demand for benzene as a car fuel triggered its explosive growth. Royal Dutch quickly picked up on the new oil age geared towards cars and built a gasoline refinery in Pernis in 1902. But it took more than a decade and pressure from the Royal Dutch to finish what would be called the first petroleum harbor. By 1940, Rotterdam was the third largest port of the world, after New York and London. The oil storage was a major price in the Second World War. The warring parties tried to keep

the German enemy from getting their hands on oil, destroying storage tanks that hadn't been bombed. In the postwar period, the oil industry brought new demands and opportunities to Rotterdam as the port expanded with the city. The Rotterdam port grew rapidly thanks to its geographical advantage, seaport infrastructure, collaboration among its corporations, subventions promoting investment, a sufficient labor market, as well as growing demand. Meanwhile new types of refining processes created diverse novel products and further demand for them, notably in the field of plastics. Since the 1960s, the chemical industry blossomed, indicating another major change in the petroleum industry. In 1961-62 the three existing refineries produced 24 million tons of oil per year.

The Rotterdam port grew in size and Pernis, Botlek, and Europoort stood out as the main areas under control by six multinational oil companies. The United States lost its status as primary oil supplier; with decolonization in Asia and Africa, oil companies (and their home countries) no longer had access or control over oil resources and had to rearrange their business. Most of the oil started coming from the Middle East. Demand in Europe increased, but with nationalization of oil in the Middle East and the creation of OPEC in 1960 supply was reduced, and prices rose. Nonetheless, the port development took the expanse of oil to a new scale.



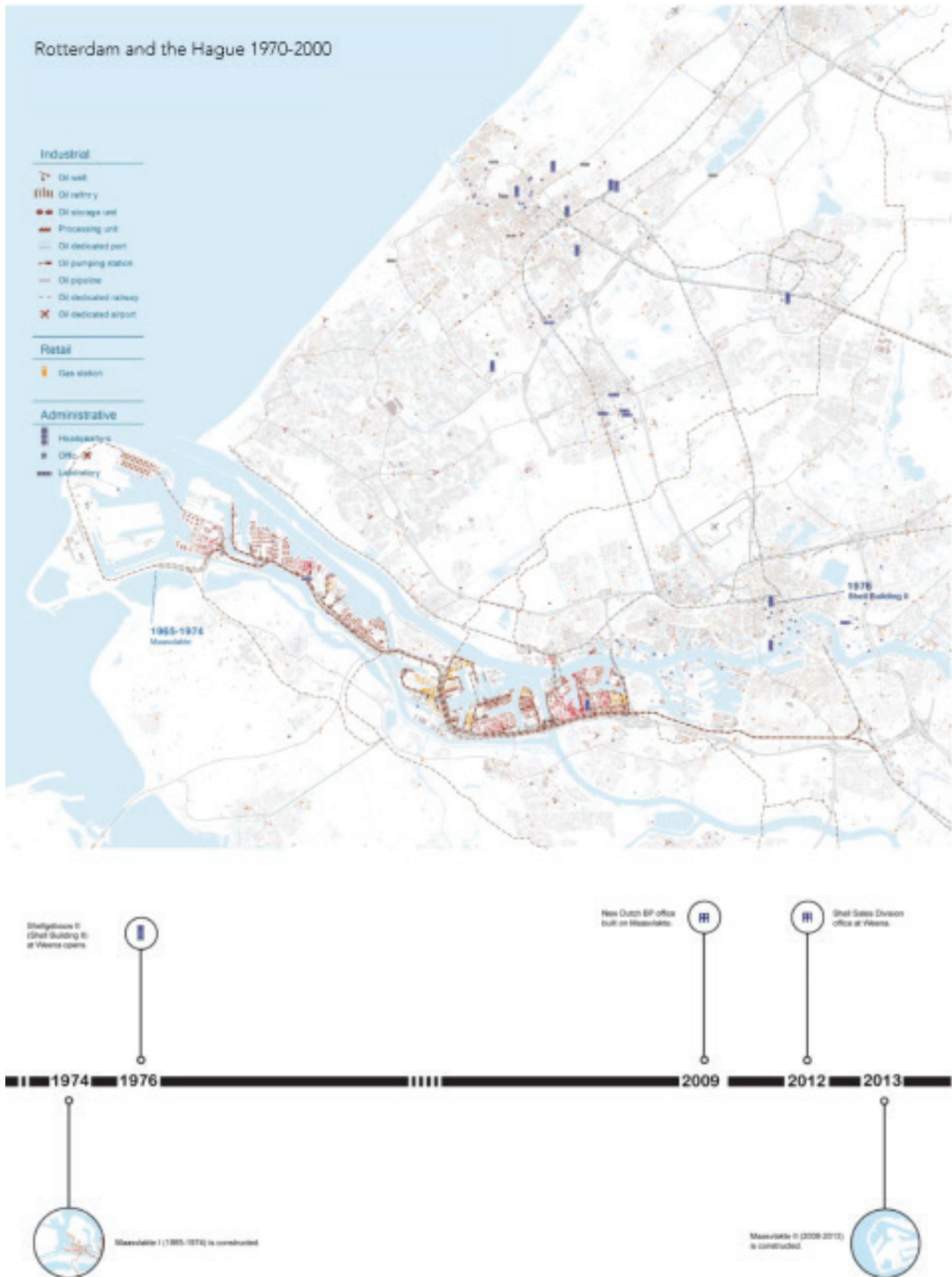
Analytical maps show how petroleum transformed the Rotterdam/The Hague area between 1850-1910.
(Source: Carola Hein and Arnoud de Waijer).



Analytical maps show how petroleum transformed the Rotterdam/The Hague area between 1910-1940.
(Source: Carola Hein and Arnoud de Waijer).



Analytical maps show how petroleum transformed the Rotterdam/The Hague area between 1940-1970.
(Source: Carola Hein and Arnoud de Waijer).



Analytical maps show how petroleum transformed the Rotterdam/The Hague area between 1970 and 2000.
(Source: Carola Hein and Arnoud de Waijer).

The demands of the oil industry continued to be key to planning and land allocation in the Rotterdam area. A regional plan for West Brabant established around 1969 allowed for a new Shell refinery in Moerdijk and provided space for future expansion. The port continued to grow, separating it from the city and several studies document the overlapping interests of Shell and the Rotterdam Port Authority. Cargo ships grew in size and some ports, such as Antwerp, accessible only through an estuary, could no longer accommodate them, much unlike Rotterdam, which had direct access to the sea. From the 1970s, pipelines became the main carrier for oil, notably crossing borders towards Antwerp in Belgium and the Germany Ruhr area long before the Schengen agreement provided for the free circulation of people.

Today, the BP refinery in Rotterdam, which started production in 1967, includes facilities at Europoort and Pernis. Its production capacity of 400,000

barrels of crude per day with a storage capacity of 4.5 million cubic meters illustrates the growth of the industry. Three other refineries for ExxonMobil, Koch HC Partnership, and Q8 Kuwait Europoort are situated in the port. Climate change and growing popular interest in renewable energies, as well as (European) laws on air pollution, and its aging refining facilities will influence the consumption of fossil fuels and its distribution. Nonetheless, an end of the oil era doesn't seem in immediate sight. The existence and "staying power" of the Rotterdam oil port may mean that fossil fuels from other locations will be directed there unless the port players opt for a different strategy.

Only in appreciating the power and extent of oil can we engage with the complex challenges of sustainable architectural and urban design and policymaking, develop heritage concepts, and meaningfully imagine future built environments beyond oil [4].

Notes

[1] First published in Global Urban History Blog <https://globalurbanhistory.com/2016/09/28/analyzing-the-palimpsestic-petroleumscape-of-rotterdam/?shareadraft=57ea1be60f8271/5>, Posted on 28. September 2016.

[2] Research on the petroleumscape of the Randstad, available as an open-source web site and an augmented reality tool, was displayed in the exhibition "*Oildam: Rotterdam the oil era 1862-2016*", at Museum Rotterdam (18 July 2016-2 November 2016) maps and visualizes the extent of oil's impact in the creation of the city.

[3] World Port Source: http://www.worldportsource.com/ports/review/BEL_Port_of_Antwerp_25.php (last accessed November, 2021).

[4] For additional research on the global petroleumscape see also: Hein, C. (2018). "Oil Spaces: The Global Petroleumscape in the Rotterdam/The Hague area". *Journal of Urban History* 44(5): 887–929. See also: Carola Hein (ed), *Oil Spaces: Exploring the Global Petroleumscape*, New York: Routledge, 2022.

CALAND AGAINST THE TIDES: THE TURBULENT HISTORY OF THE NEW WATERWAY



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Diorama Nieuwe Waterweg: overview waterway area with the port of Rotterdam. Wall painting made by Jaap Gidding for the World Expo in 1930. (Source: Collection Museum Rotterdam, 78609, CC BY-SA 3.0 NL).

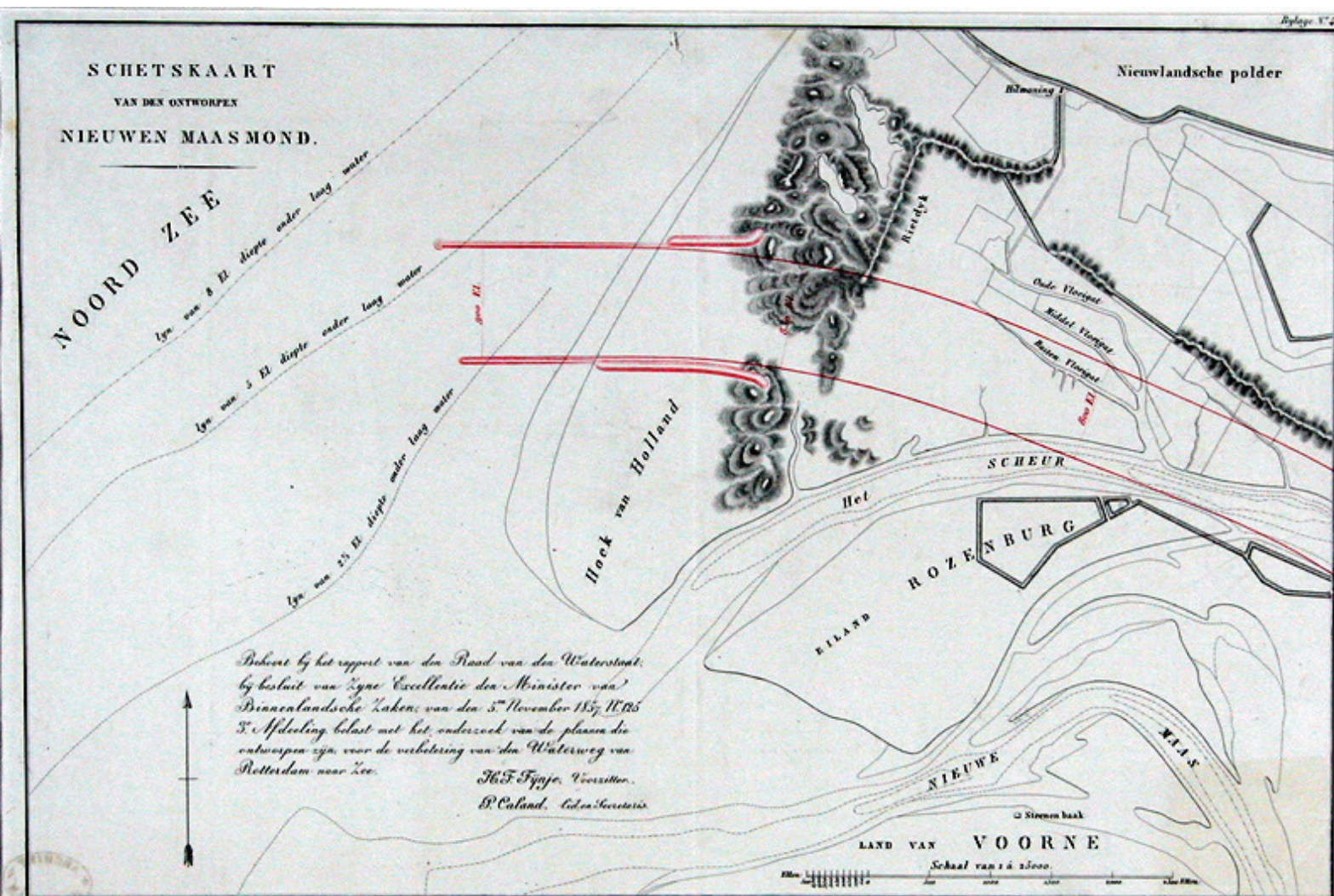
A simple plan for a complicated problem

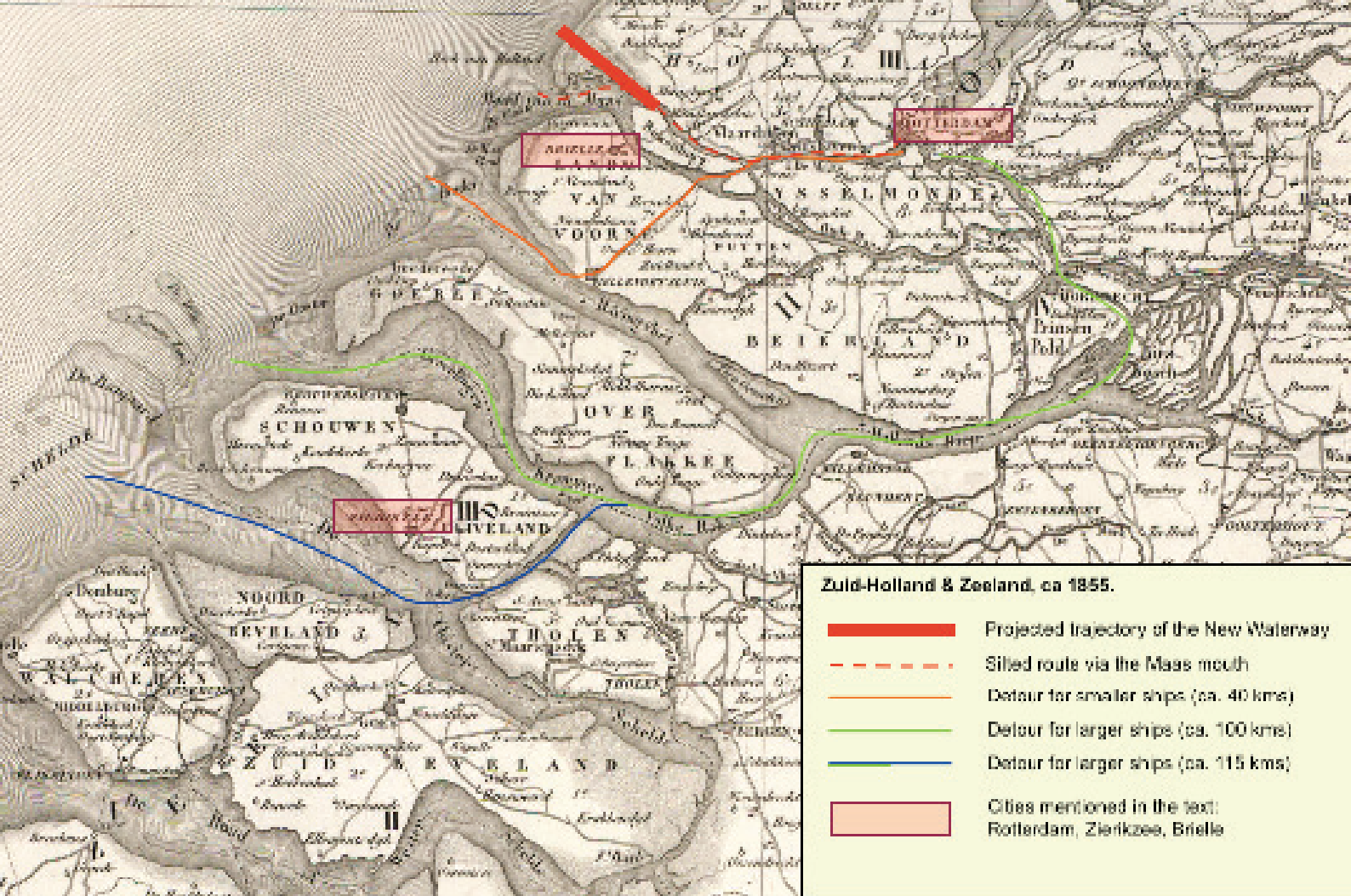
When the idea for a new waterway from the North Sea to Rotterdam was devised, the port city had already been hard to access for over 100 years. Because the river Maas - a tributary of the Rhine in the delta of South Holland - was silting up, ships were forced to take detours to enter and exit the port. For the largest ships, this detour was as long as 115 kilometers, leading all the way through the Oosterschelde sea arm

in the province of Zeeland. In 1853, a state committee asked the young engineer Pieter Caland to study how local authorities in the UK and France were keeping the river mouths of the Clyde (Scotland), Seine and Rhône (France) deep enough for shipping traffic.

Born and raised in Zierikzee in Zeeland, Caland was the son of the head engineer of the provincial water authority. He studied at the Dutch military academy to become a cadet for the *Waterstaat* (the national

Design for the new river mouth of the Maas as the start of the New Waterway, 1858. (Source: Collection Municipal Archives Rotterdam, number 4001 / RI-90D).





Map with alternative shipping routes and a projection of the trajectory of the New Waterway, c.a. 1855. (Source: Topotijdreis.nl).

water authority), which provided him an engineering education [1]. Caland worked at several posts throughout The Netherlands and settled in Brielle, which was close to both the port of Rotterdam and his native Zierikzee.

His position in Brielle and his knowledge of local water works made Caland suitable for the research into a solution for a faster waterway to and from the port of Rotterdam [2]. The report he wrote, however, was put aside and Caland was asked to be the secretary for the *Raad van Waterstaat*, a committee installed to come up with a final decision about the plans that had been made so far. To the surprise of the committee, Caland presented his own plan: a deceptively simple design that cut through the Hook of Holland (from the Dutch *Hoek*, meaning corner or angle) and that would reduce the distance between the port of Rotterdam and the North Sea to 30 kilometers. According to Caland's calculations, the fluctuation of the tides would keep this new waterway open and at a berth that was deep enough for the newest steam vessels.

The national character of the plan meant that it had to be confirmed by the two chambers of Parliament. At first, the plan for Caland's New Waterway was criticized

as being too expensive and unfairly beneficial toward Rotterdam, leaving the nation's capital of Amsterdam behind. Once the law included a counterpart to the Waterway - the *Noordzeekanaal* (*North Sea channel*) from the North Sea to Amsterdam - it stood a chance of passing. In a dramatic plea before the Senate, the liberal minister of internal affairs Johan Rudolf Thorbecke tried to balance the risks of starting two major national water works against the economic benefits and their importance for the nation: "I say again that it is a daring work, but a work that we must venture. It is what one does, when one embarks on an unequal struggle for one's freedom and independence. If we stay what we are now, we will be passed by and decay; it therefore seems to me an unavoidable duty to seize the resources that may save us" [3].

In January 1863, the law for two waterways was promulgated. Members of the local business elite, however, still worried that the Waterway would become too expensive: while the State would pay for the construction, the municipality of Rotterdam would have to bear the costs for any overrun or maintenance. Still, most local businesses figured they could benefit from this national feat. The Waterway was Rotterdam's last hope to latch on to the

development of steam shipping, especially since the Royal Netherlands Steamship Company had chosen to settle in Amsterdam instead of Rotterdam in 1856.

Construction and criticism

On October 31st, 1866, the heir apparent dug the first spade in a ceremony in the presence of Caland, by then the director-engineer overseeing the project. This ceremony was, however, not the end of the controversy. During the years of digging, the Waterway remained a topic of discussion between believers and non-believers in Caland's tidal plan. Rotterdam seemed to reap the benefits, for example, with a steam liner company that was established in 1871 by the merchants Otto Reuchlin and Antoine Plate. Meanwhile, newspapers reported widely on all the setbacks. Even after the first ships had passed the Waterway in 1872, Caland's design was criticized. A

satirical cartoon showed prime minister Thorbecke overlooking the Waterway, which had almost entirely been overtaken by sand.

The criticism was not baseless. While Caland's idea of the tides maintaining the Waterway's berth worked for the most part, they were not strong enough to preserve the fairway at sea. Critics suggested it was high time to add sluices to the Waterway, a solution that opposed Rotterdam's ambition to remain a free and open port. The committee that was appointed to find a solution did not include Caland, who consequently withdrew from the whole project. Caland did reach the position of head inspector of the national water authority, but not finishing his brainchild was a bitter ending to his work. His father brought some consolation when he wrote to him that all great men had to suffer some degree of "offense, misjudgment, and sometimes vilification", but afterwards were praised, and even had "statues erected for them" [4].

The start of the work on the New Waterway: the construction of the north pier into the sea. (Source: Collection Municipal Archives Rotterdam, number 4187 / XXVIII).



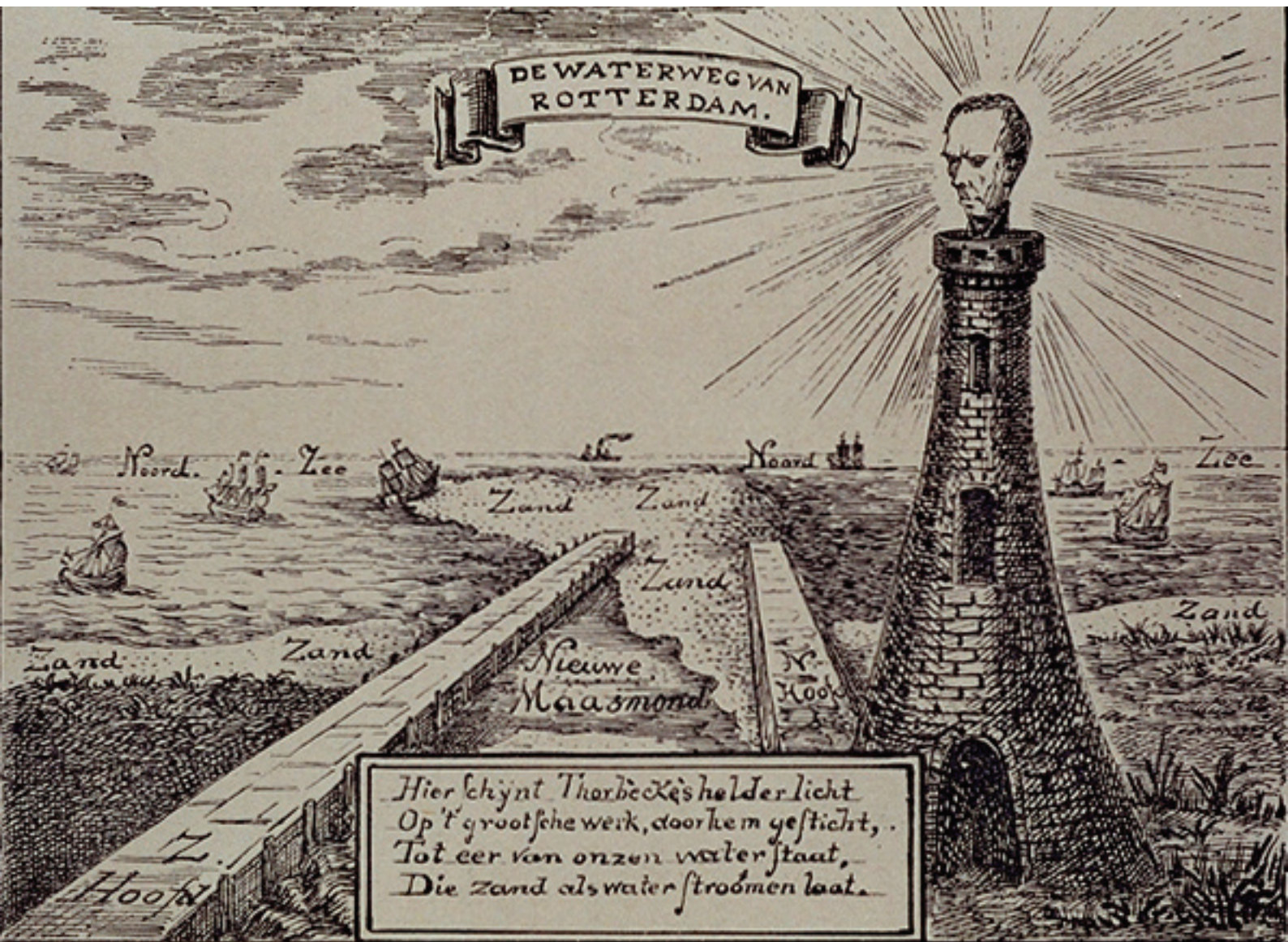
Commemorating Caland

His father turned out to be right. Improving dredging techniques made it easier, quicker and cheaper to remove sand banks and deepen the berth, so the growing steam ships had the quick access to the port of Rotterdam that Caland envisioned in 1858. In 1902, the year of his death, 6755 ships entered Rotterdam via the Waterway - almost triple the number of ships that entered in 1866. He was not praised for these successes during his lifetime, however. Only in 1906 did mayor Frederik Bernard S'Jacob of Rotterdam use

the money he received for his retirement to erect a monument for Caland. It was the start of a process in which the Waterway slowly became appropriated as an icon of Rotterdam's efflorescence.

During the Great Depression of the 1930s, the *Stichting Havenbelangen* (association for port interests) used the 1936 anniversary of the Waterway to look back on the vigor and courage that Caland, Thorbecke and the Rotterdam elite had shown in the 1860s. In a speech, the president of the Chamber of Commerce W.A. Engelbrecht interpreted the meaning of the New

This cartoon in De Nederlandse Spectator (1871) shows the head of prime minister Thorbecke as a beacon of light near the piers, surrounded by sand instead of water. The satirical poem reads: "Here shines Thorbecke's clear light / On the great work he established / To honor our state of water affairs / Which lets sand flow as water". (Source: Collection Municipal Archives Rotterdam, number 1972-491).



Spotprent op de verzanding van den Hoek van Holland. Uit: De Nederlandsche Spectator, 1871 n°. 46.

Waterway as a "...strengthening of civic power and confidence in times of adversity, moreover, an ever more deeply rooted awareness of the tight bond of our port city with our country in its global relations [5]". His speech illustrated how Rotterdam saw the Waterway as a result of local civic power that was crucial for the Dutch economy, and therefore needed renewed attention and investment from the national government [6].

After the Second World War, in which both the port and city of Rotterdam suffered heavy losses, the economic significance of the New Waterway again appeared in cultural representations. In 1941, a children's play about the Waterway reminded the audience of Rotterdam's resilience and innovativeness, while a 1947 stadium spectacle was named *De Waterweg Heroverd: the Waterway reconquered* [7]. In 1952, the former minister of Reconstruction J.A. Ringers wrote a small book on Caland and the meaning of the Waterway of Rotterdam. Yet again, he drew the comparison between an urban spirit of reconstruction

which nevertheless required national investment in order to safeguard the "blessed effects" for Rotterdam and the whole of the Netherlands [8].

In 1966, Rotterdam became the busiest port in the world, a position it held until 2006. Meanwhile, the Waterway still needed dredging every once in a while. This had become easier due to new dredging techniques, but with the rapidly growing petrochemical industry and the introduction of the container in the 1960s the demands for the depth of the Waterway increased as well. In 1979, Alderman Jan Riezenkamp argued with the Dutch state to invest in its "artery" and bring it to a depth of 75 feet [9]. A huge investment of the State was once again necessary when the New Waterway had to be adapted for storms and spring tides, as a capstone for the Delta works that were initiated after the devastating flood in 1953. The flood barrier "Maeslantkering" opened in 1997 and consists of two large "arms" that allow the Waterway to remain open when there is no threat. It cost approximately 1 billion guilders [10].

The Caland Square in Rotterdam with the Caland monument. Caland's face is depicted in a small profile right above the cherubs. (Source: Collection Municipal Archives Rotterdam, number 4029 / PBK-1988-334).





The New Waterway facing east with a closed Maeslantkering, the flood barrier in the New Waterway that was finished in 1998. (Source: Image repository Rijkswaterstaat / Afdeling Multimedia Rijkswaterstaat; <https://beeldbank.rws.nl/MediaObject/Details/334490>).

A new way?

In March 2022, it will be 150 years since the first sea steamer crossed the New Waterway. The municipality will again celebrate this anniversary, but more than ever the question arises whether the Waterway is indeed still the artery of the Netherlands. While the port of Rotterdam remains the busiest in Europe, the port city is lagging behind with its counterparts in Hamburg and Antwerp when it comes to maritime services [11].

More than the ability to host ever larger ships, the

success of a port city is measured by the amount of headquarters, the quality of life, and the “smartness” of a port: the ability to connect to digital rather than physical flows. At the same time, the port city region of Rotterdam needs to adapt to the threat of rising sea levels. In order to tackle this multifaceted problem, it is not enough to dredge an even deeper fairway, as an angioplasty to unblock the “artery of the Netherlands”. Rotterdam needs the innovation and vigor that over 150 years ago led to the simple but brilliant design and the collaboration on several governance levels to execute it.

Notes

[1] "Waterstaat" means both the state of affairs concerning water, and the department or authority that arranges water works and water ways on the provincial and national levels in The Netherlands. It is sometimes referred to as a "state within the State" (see for example Teychiné Stakenburg 1972), alluding to the integrality of water governance to the Dutch political system.

[2] F. den Houter, *Rotterdam En de Nieuwe Waterweg*, Schip En Haven 3 (Amsterdam: C. de Boer jr., 1956), 40.

[3] Johan Rudolf Thorbecke, *Parlementaire Redevoeringen*, vol. 2 (Deventer: A. ter Gunne, 1867).

[4] M.P. de Bruin, "Pieter Caland," in *Encyclopedie van Zeeland*, accessed October 11, 2021, https://encyclopedievanzeeland.nl/Pieter_Caland.

[5] W.A. Engelbrecht, *Rede Ter Gelegenheid van Den Aanvang van Het Werk Der Doorgraving van Den Hoek van Holland* (Rotterdam: Kamer van Koophandel en Fabrieken, 1936), 3.

[6] *Stukken m.b.t. de tentoonstelling 'Nieuwe Waterweg 1866-1936 in de Rotterdamse Kunstkring* (52), Archive of Stichting Havenbelangen (318), Stadsarchief Rotterdam.

[7] See for an analysis of the representations of the Waterway in the city of Rotterdam: Hilde Sennema and Paul Van De Laar, "Rotterdam's New Waterway: The Iconification of an Infrastructure (1860-1947)", *European Journal of Creative Practices in Cities and Landscapes* Vol. 4 No. 1 (August 2, 2021): 77-94, <https://doi.org/10.6092/ISSN.2612-0496/12389>.

[8] J.A. Ringers, *Caland En de Betekenis Van Zijn Werk Voor Rotterdam*, Rotterdam in Verleden En Heden 10 (Rotterdam: Ad. Donker, n.d.).

[9] "Access Channel to Europoort Will Be Deepened - and Fairly Soon Too," *Barid Hollanda*, 1979, VI F 93, Stadsarchief Rotterdam.

[10] Corrected for inflation: circa 650 million euros. (IISH Historical Prices and Wages tool, <https://iisg.amsterdam/en/research/projects/hpw/calculate.php>).

[11] Ann Verhetsel and Steve Sel, "World Maritime Cities: From Which Cities Do Container Shipping Companies Make Decisions?," *Transport Policy* 16, no. 5 (September 2009): 240–50, <https://doi.org/10.1016/j.tranpol.2009.08.002>.

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REPRESENTATIONS OF A WORLD IN FLUX: THE PORT OF ROTTERDAM IN FIN-DE-SIÈCLE POSTCARDS



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In this postcard the Rotterdam panorama from the 10-storey White House (Witte Huis) which was built in 1898. At the time, this height was remarkable for Europe. The powerful imagery of large-scale infrastructure, such as the iron bridge and new steamboats, signalled an industrializing port. (© Source: Collection PortCityFutures).

Why do old postcards matter for the understanding of port cities such as Rotterdam?

Old postcards, such as the ones presented here from the late 19th and early 20th century are important visual representations of urban space of the past. Publishers and photographers viewed and featured a world in flux. People bought and shared these views and disseminated them through the post.

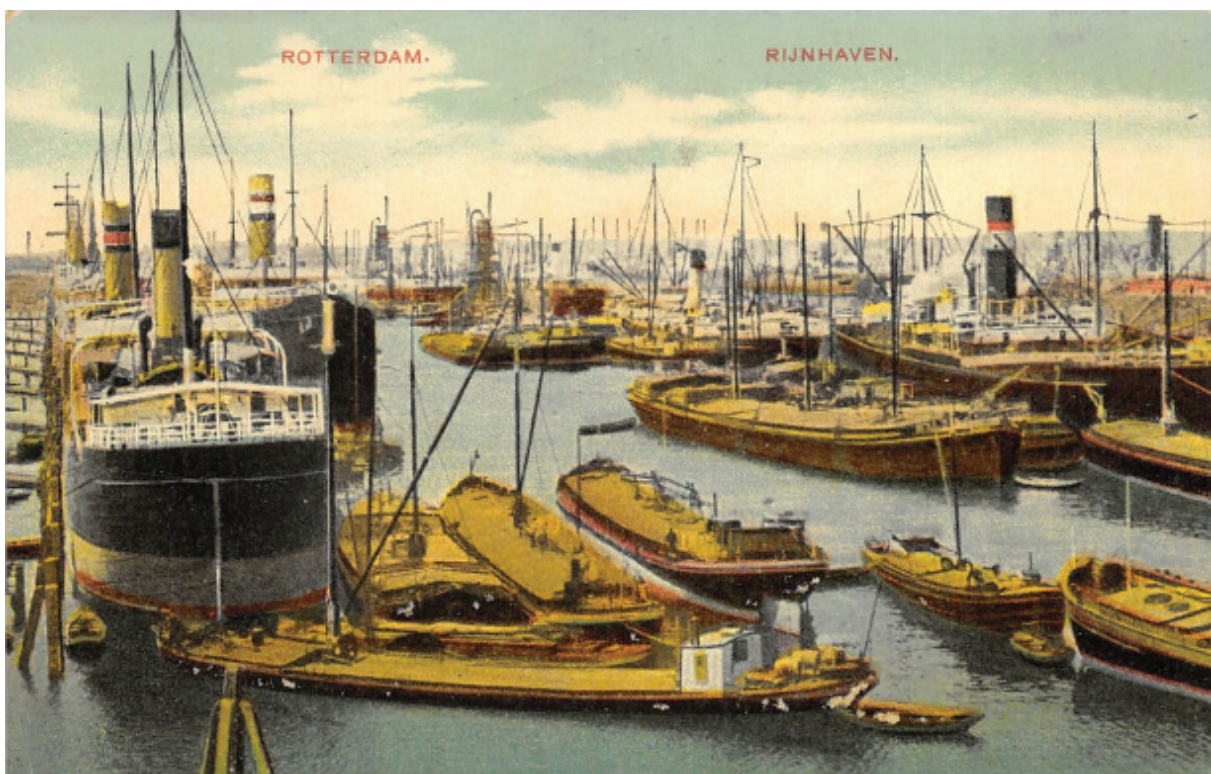
The postcards are not simple visuals produced from a neutral stance. Each visual narration tells a different story of spatial change. They capture romantic maritime myths and ideas about industrial progress. These fin-de-siècle postcards from Rotterdam, with their contingent and conflicted character, offer a window from which to view the dynamics of modernization of the port city and its representation over time.



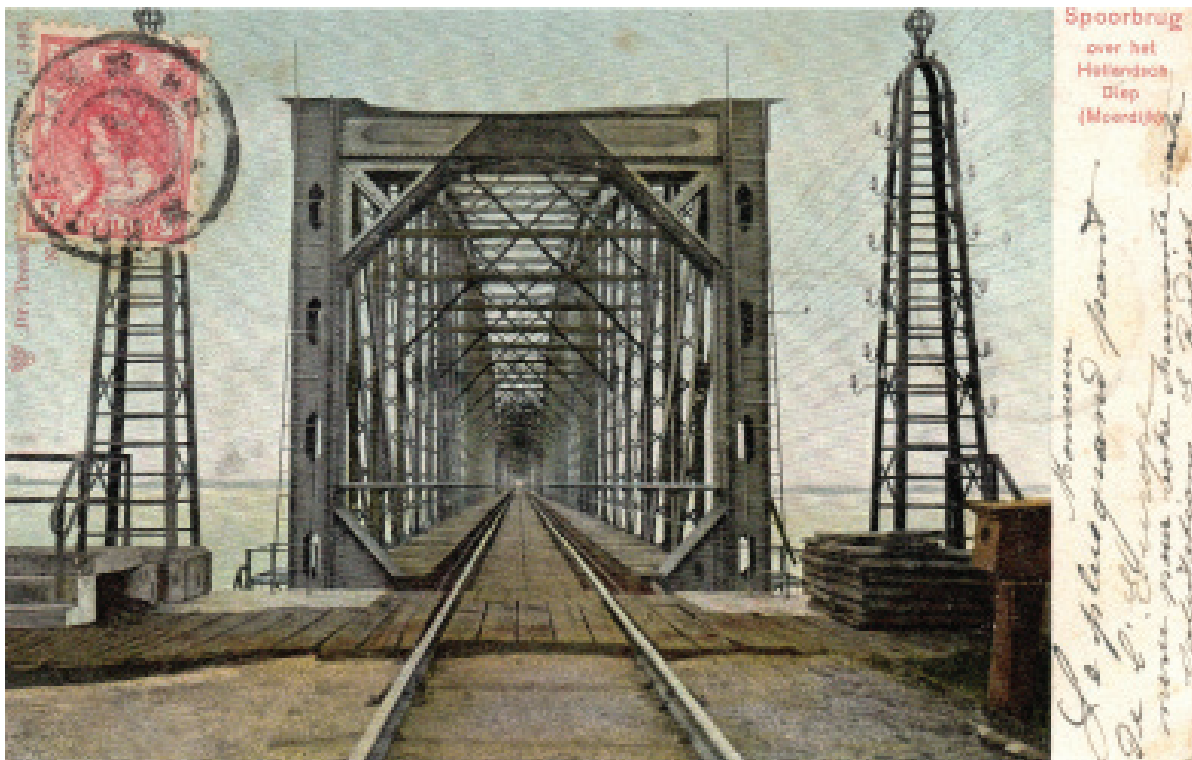
Historically, ships were unloaded in city centers. The streets were used by pedestrians and people using vehicles to move around, but they also allowed goods to be transported. Small-scale and multifunctional buildings stood alongside the canals, as shown here in the case of Schiekade. (© Source: Collection PortCityFutures).



Radical improvements in the technology of transportation were one of the hallmarks of the 19th century. The shift from sailing ships to steamships lowered the cost of transportation and increased the amount of circulation between ports. In this postcard from Oude Hoofd, a single sailing ship, in the left corner, presents a contrast with much larger steamships. (© Source: Collection PortCityFutures).



Since the industrial revolution, the increasing size of ships led to the construction of larger ports at greater distances for city centres. This postcard shows the density of maritime traffic in the Rijnhaven, completed in 1895. (© Source: Collection PortCityFutures).



The industrial revolution eroded the romantic character of port cities, and instead encouraged awe for machinery. This Spoorbrug railway-bridge postcard has no trace of human beings. It shows the new use of iron and its capacity to span much larger distances than wood or stone. (© Source: Collection PortCityFutures).



Grain was traditionally transported in bags. During the mid-19th century, the Black Sea region was the main grain supplier of Rotterdam. In 1907, the unloading of ships was facilitated by the introduction of floating pneumatic elevators in Maashaven. This postcard shows two of these elevators at the busy waterfront. The grain elevators still occupy an important place in the collective memory of the port of Rotterdam. (© Source: Collection PortCityFutures).



This postcard captures a tranquil day in Haringvliet and Oosterkade, with many ships moored at urban quays. The numerous electric street lights, shown in this postcard, helped reduce nighttime crime in the city centre. They became icons of safety at the very beginning of the 20th century. (© Source: Collection PortCityFutures).



This view of Hofplein captures radical change in urban transportation. A handcart, a horse-drawn vehicle, a bicycle and an electric tramway appear in the same street space. The electric tramway enabled faster circulation and changed the speed of life. The people depicted here on the street appear to be in a hurry. The iron bridge and factory chimney are physical reminders of the changes induced by the industrial revolution. (© Source: Collection PortCityFutures).



This postcard shows the modern shopping district Hoofdsteege, with its diverse shops and institutions. The advertising signs announce the presence of a life insurance company, a bank, and the office of a textile trade company. (© Source: Collection PortCityFutures).



Port and city were closely connected. The harbour bordered the street next to the majestic post office of Rotterdam. The black-and-white photograph is coloured to show the crowded harbour basin and urban buildings alongside. Post offices (Postkantoor) were important part of the busy daily life of residents who looked for ways to communicate with other (port) cities. (© Source: Collection PortCityFutures).

The postcards presented here document a rapidly changing world. They circulated through post offices, including large structures like the monumental Rotterdam Postkantoor. The postcards survived in the places where they were sent, leaving a trace of changing Rotterdam around the world.

Many of the places and functions that were featured as novel, innovative and on surprising new scales have disappeared today. As we engage with yet another transition, the postcards remind us of technical, urban and cultural transformations of the past.

Notes

[1] All the postcards are from the Collection of PortCityFutures (Leiden-Delft-Erasmus).

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SUSTAINABLE PORTS: MOVING TOWARD RESPONSIBLE CARGO FOCUS



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AMPT Terminal by night. (© Danny Cornelissen; Source: Port of Rotterdam Authority, 2020).

Ports have a relationship with their urban environment; they transship goods that are destined to the local market and that are consumed by inhabitants of the nearby cities, they help create employment and economic activity directly and indirectly [1], but they also burden their environment with external costs including emissions, noise and use of scarce space. Merk argues [2] that ports have a positive impact on their hinterlands, which can reach inland hundreds of kilometers, while most external costs are borne by the direct environment, the city.

While considering the balance between (external) cost and benefits of the port for the city, the sustainability of the port comes into play. Ports can be referred to as "sustainable" for various reasons, including that port operations and industrial activities in the port are more environmentally and socially benign, that the connecting seaside (foreland) and landside (hinterland) logistics networks make use of environmentally friendly modes of transportation, or that the production and use of energy in and around the ports is based on renewable sources. The port may even seek an active role in the circular economy by hosting industrial or logistics activities that contribute to circular processes such as environmentally conscious recovery of materials, components and products [3].

Sustainability of ports recognizes roughly two types of scopes. The first type of scope refers to the nature of the external costs or benefits in play, the second type of scope to the system boundaries taken into consideration. For GreenHouse Gas (GHG) emissions, for instance, the GHG protocol [4] specifies the emissions that are referred to as GHG and that are expressed in carbon-equivalent units, while the second scope identifies the system boundaries, such as company, supply chain, product, project, and port area or city. The outcomes of a Life Cycle Analysis for products often depends on the system boundary taken into consideration; when emissions of production are considered, cane sugar consumed in Europe may have a lower footprint than locally produced beet sugar, despite maritime transport required to bring the product from South America. For ports, the scopes under consideration may vary. For the second type, a narrow scope would involve external costs that originate from processes in the port area, thus excluding transportation from and to the port area. Including transportation from and to the port has even a global coverage, and is currently progressed by a number of ports. For instance, the Environmental Ship Index (ESI), initiated by a number of global ports, scrutinizes vessels that call upon ports on their global emissions [5], while also the IMO is developing its strategy toward 50% emission

reduction worldwide for seagoing vessels by 2050 [6]. These scopes do not include the complete life cycle of products which are being transported and transshipped through ports.

For containerized cargo, such scope may be argued to be irrelevant to ports. When containers, i.e., the standardized loading units used in maritime transport, are transshipped in the port, the nature of the cargo inside is known only to a few parties. Port operators, who handle the containers at their port terminals, for instance, are usually not informed about the contents of the containers. One can argue that for such parties, there is not an immediate need to be provided with the bill of lading specifying the goods, and they may even choose not to be burdened with it for liability reasons in the case of cargo theft. Also, port authorities are happy to publish the amount of steel boxes that have handled in their port area on a yearly basis, together with tonnages of the main commodities that have been transshipped. Detailed statistics on the various types

of containerized cargo is usually not published and is apparently either deemed not relevant, considered sensitive information, or simply unknown. There are signals that this is changing, and perhaps rapidly. Port operators seem progressively interested in the nature of the cargo and seek customer intimacy with shippers. For example, global port operator DP World has initiated "Digital Freight Alliance", leveraging its asset base by providing a global freight forwarding network on a platform, supported by its freight forwarding partners. Its platform service "Cargoes Flow" provides cargo tracking and tracing capabilities to shippers. Also, deep sea liner Maersk, together with digital solutions provider IBM, developed "Tradelens", a blockchain powered platform on which supply chain visibility solutions are offered. Although focus is on containerized trade, the ultimate value of such information services is reaped at the cargo level.

Enforcement agencies, such as customs and consumer product safety authorities, always had a

Container ships and cranes during maritime operations in the Rotterdam port area. (Source: <https://www.pxfuel.com/en/free-photo-jiwsg/>).





Waalhaven, the centre of the maritime and offshore cluster in the Port of Rotterdam. (Source: <https://pixabay.com/it/photos/waalhaven-rotterdam-rotterdam-2975676/>).

keen interest in imports and exports in ports at the cargo level. The introduction of the maritime container as a standardized loading unit for cargo created a higher dependency on information systems for surveying goods upon import and export. Confidence in the information about the contents of a steel box is created by supply chain intelligence. Inspection of all cargo that goes through a port is impossible, so profiling container data informs the blocking of a small fraction of containers for closer inspection by means of x-ray scan or ultimately by opening the box. To avoid false positives (legitimate trade is inspected) or false negatives (illegitimate trade is not inspected), the reliability of data used for profiling is key. One way to achieve higher levels of confidence in data from import and export declarations is by having corroborating evidence that the supply chain at hand is in control by legitimate parties. Customs proposed supply chain parties to organize a data pipeline, a supply chain visibility system, where operational data from supply chain systems could provide such evidence [7].

Making sure that illegitimate trade does not cross borders is an important societal interest and in the

interest of citizens, which is obvious for drug and human trafficking. Interestingly enough, the definition of illegitimate trade has shifted. The importation of hardwood for which no sustainable harvesting certificates can be presented, is illegal. This requires importers to check whether the sourced product originates from a legitimate source, i.e., logging not associated with deforestation. But for legitimate trade, there are also restrictions with regard to the validity of certain sustainability claims. Importers that claim their product to be organic and are labeled with the EU organic logo need to follow guidelines, which are enforced by the appropriate authorities.

Validation of sustainability claims is closely related to supply chain visibility. The imported or exported product itself may not reveal its sustainability footprint: inspection of the product characteristics is not likely to reveal whether the product is produced under admissible working conditions, smallholder farmers have sufficiently been compensated for their harvest, the actual carbon footprint coincides with the reported one, and so on. Such sustainability claims need validation through reliable and accurate information generated throughout the supply chain.

In other words, supply chain visibility (information is available to the relevant supply chain partners) and transparency (relevant information is provided to external stakeholders) is required.

Information technologies such as Blockchain are oftentimes put to the forefront as killer applications that allow supply chains to be visible and transparent. In most cases, product provenance, for example, is said to be achieved through tracking and tracing solutions throughout the supply chain. Such technologies indeed provide interesting opportunities, but the structure of the supply chain plays an important role here. Supply chains can be very complex, for instance when there are many tiers of suppliers involved (multiple-step outsourcing of production steps to contractors), when some of the supply chain processes and supply chain relationships are not well-defined (informal trade in harvested produce upstream the agricultural supply chain), or when products get mixed (certified with non-certified products can be mixed at facilities to achieve economies of scale). Complex supply chains may not admit straightforward tracking and tracing solutions, so in such cases, other so-called Chain-of-Custody options are to be considered. For example, in case one cannot avoid mixing of certified and non-certified produce, chain-of-custody type "Mass Balance" can be applied which does not track and trace produce, but ensures that the amount of product with sustainability claims is offset by produce that is sourced and processed in a sustainable fashion.

It turns out that connecting sustainable production to consumer willingness to pay for sustainable products is difficult. The understandability and credibility of product logos is problematic, as incidents reveal [8].

Also national authorities are struggling with enforcing sustainability requirements on imports [9]. This has a lot to do with supply chain visibility and transparency: How can the buyer of a product downstream the supply chain acknowledge that the purchased product is sustainable? How can sustainability claims be validated? These questions need answers when products enter the market and this happens at the port. The port is the gateway of the world to local markets and vice versa. Its activities, vital to the local economy, also cause external costs borne by the port-city. At the same time, products consumed by local citizens cause external costs elsewhere in the world, usually at the places where the products are produced. The port has thus a role to play in overseeing import and export of products that are transshipped in the port, as currently done by Customs and other authorities. Sustainable ports have been able to better balance the pros and cons of its activities, and the ability to scrutinize its throughput at the cargo level for sustainability aspects will bring this to the next level.

It will require ports to better understand the supply chain they are involved in, namely at the cargo level. For commercial reasons, port players have already started to grow their interest in global trade at the cargo level, either to create value in the corresponding supply chains or to commit the cargo flows to their assets. With the increasing interest in sustainability aspects by governmental and non-governmental organizations, investors, shippers and consumers, such value will be expressed progressively in terms of social and environmental responsible activities. This puts these values at the core of port performance, and ports that are able to demonstrate sustainability of their throughput at the cargo level create a competitive advantage.

Notes

[1] Bart Kuipers (2018) Het Rotterdam effect: De impact van de Rotterdamse mainport op de Nederlandse economie, UPT Erasmus.

[2] Olaf Merk (2013) The Competitiveness of Global Port-Cities: Synthesis Report, OECD Regional Development working papers 2013/13.

[3] Several of these sustainability aspects are highlighted in the Port Vision 2030 document of the Port of Rotterdam, accessible via <https://www.portofrotterdam.com/en>.

[4] See: <https://ghgprotocol.org/>.

[5] See: <https://www.environmentalshipindex.org/>.

[6] See: www.imo.org/en/MediaCentre/PressBriefings/pages/DecadeOfGHGAction.aspx.

[7] See for example: David Hesketh (2009). Seamless electronic data and logistics pipelines shift focus from import declarations to start of commercial transaction. *World Customs Journal* 3(1): 27-32.

[8] There are quite a few cases in which high-end brands are confronted with malpractices in their supply chains, among which the Rana Plaza collapse of an illegal textile factory where items of leading fashion brands were found on site) or in which certifying organizations are confronted with malpractices associated with their certified product (Better Cotton is struggling with its Mass Balance chain of custody after certified product had been associated with Uyur forced labor in China).

[9] For example, import of illegal timber by Dutch importers did not result in prosecution, which caused the Dutch Food and Consumer Product Safety authority to be scrutinized by NGOs; see: <https://www.nrc.nl/nieuws/2020/01/28/doet-nvwa-genoeg-tegen-importeurs-illegaal-hout-a3988479>.

ROTTERDAM PORT AND ITS INNOVATION ROADMAP



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Thialf Heerema location Calandkanaal. (© Kees Torn; Source: Port of Rotterdam Authority, 2020).

Port generations

Beginning as a first generation cargo port, the Port of Rotterdam has developed through several generations of innovations [1] by adding logistics services (2nd), connecting to supply chains through production and distribution (3rd) and creating modern information systems linking it to other ports and its hinterland (4th). Today, it is a typical 5th generation port – a dynamic and user-centric community port that has strong interfaces with local industry, from goods processing and logistics services to maritime production. The port is now looking forward to becoming a 6th generation port – a development taking place in a context of automation and integration in the global logistics system, known as the Physical

Internet. Next to its economic development, the port has embraced the objectives of environmental and social sustainability as innovation challenges.

Here, we address these key innovation stages of the past decades and highlight organizational factors that have made these developments possible.

A key innovation that kick-started Rotterdam's strong position as a European container hub was when it introduced the first fully automated container terminal in the world, with automated guided vehicles and automated stacking cranes. This was opened in 1993, at a time when the trade in manufactured goods between the far East and Europe was accelerating. Around this time, Rotterdam became the largest



Generations of port development. (after Lam et al., 2016).

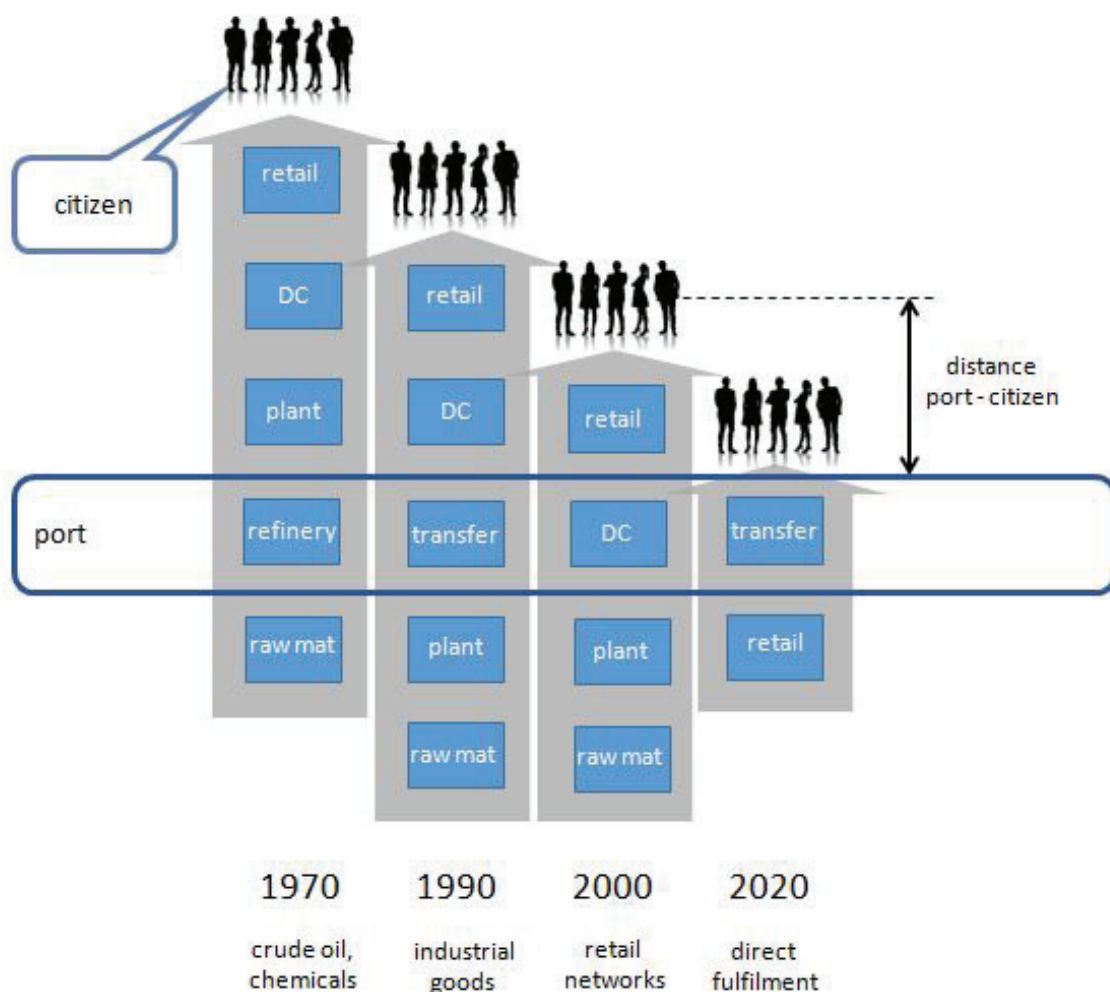
container port in the world and main gateway to Europe for manufactured and fresh produce.

Next to the terminal activities, hinterland modes have known their share of innovations. The Rotterdam port authority supports individual modes of hinterland transport through dedicated policies for road transport (the Container Exchange Route - an internal connection between the 5 main deep sea terminals); rail (the dedicated rail freight Betuweline, a 5-billion Euro investment, opened in 2007) and inland waterways (the Nextlogic information system supporting coordinated planning of terminal visits). Because of the dense road and river system in the immediate hinterland of the port, there are more than 30 inland terminals in an area of around 100 x 100 km². Together, these function similarly to a city's subway system with dense schedules, allowing the port to optimize container movements across modes and synchronizing different modes around terminals and destinations. This system, known as

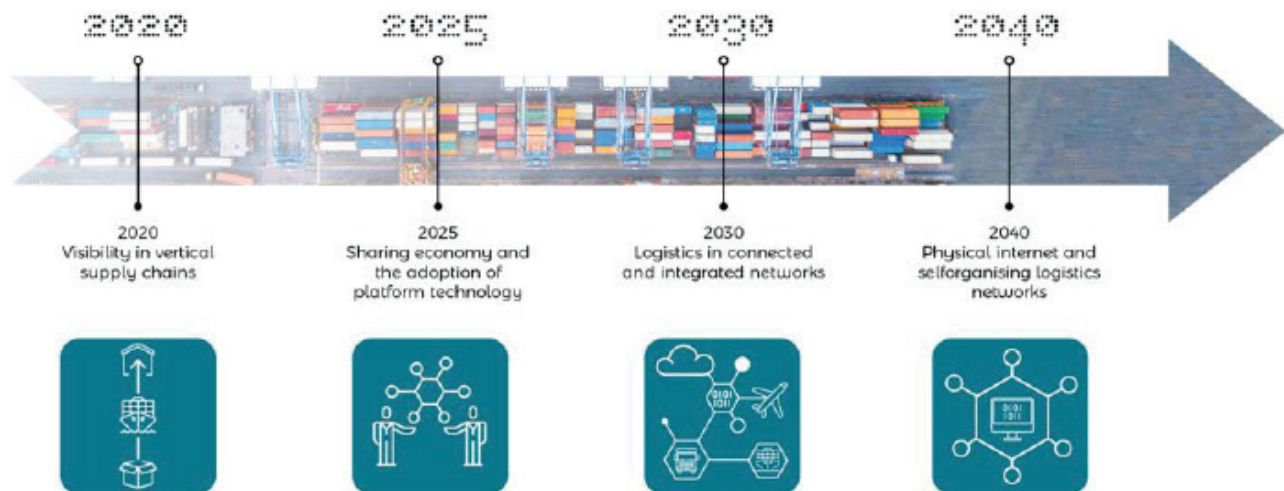
"synchromodality," was pioneered by the ECT terminal in the port of Rotterdam.

Improvement in cargo transport services has also spurred the development of Rotterdam as a logistics and supply chain port, including the establishment of European, national and regional distribution centres in the Netherlands. We have seen almost a doubling of warehouse capacity in the last 20 years. Rotterdam has thus evolved into a true supply chain port, supporting the heartland of the Dutch manufacturing industry in the 200 km long South-West corridor towards Venlo and the German Ruhr area.

Rotterdam's customer centricity has been a gradual evolution, with an increasing emphasis on consumer-ready products and shipping bypassing European wholesalers or retailers through direct sales and shipment to consumers by global Internet platforms like AliExpress. The port has never been as close to the citizen as today.



Evolving customer centricity of the port. (© Lóri Tavasszy).



Digitalization as a starting point for a new phase of port development. (Source: TKI Dinalog, Dutch Institute for Advanced Logistics).

As with consumer product platforms, information systems for trade and transport are also developing fast. Modernization of information services is key for a fast turnaround of ships. European ports offer a “single window” interface for arriving ships, a clear entry point for all obligatory information services that surround the port call, like arrival registration, bunkering requests and, in Rotterdam, customs. Once fully operational and harmonized across Europe, the time spent on administering port calls should be cut by 50%. Recent innovation projects like the EU project CORE were looking into the possibility of creating data pipelines for customs at global level. For the logistics services industry, digitalization of services and the platform economy mark the start of the new wave of development of the port towards a Physical Internet port. Together with the automation of transport management and execution, this will support the development of the port towards an autonomous or self-organizing system.

Port futures

The Physical Internet (PI) is a vision for the long-term development of the global logistic system as an open web with fully standardized assets where freight movements are continuously optimized in a coordinated fashion [2]. The PI vision describes how many seemingly independent innovations in the freight logistics systems can work together productively. Due

to the major efficiency jump created by the system, it will exert less pressure on the environment. And because of the open collaboration between networks, the freight system should also become more resilient. Recently, a group of experts developed a roadmap [3] for the future evolution of transport networks in the PI. It includes 5 main lines of alignment for all stakeholders, which will give direction to future port innovation:

- **Services:** from separated subnetworks of services of individual service providers, modes and regions, towards one integrated global service network
- **Access:** from the current situation of protectionism and constrained pooling of resources towards open sharing of assets and free access to the network
- **Governance:** from a mixed bag of regulations, trade terms and non-standardized agreements towards harmonized arrangements across modes of transport
- **Networks:** from mode-based services to fully autonomous synchromodal transport networks
- **Freight hubs:** from the current focus on container level physical services towards autonomous, shipment-level administration and handling of cargo.

These lines of development will allow the Port of Rotterdam to develop its capabilities to grow inside the PI, connecting to other hubs and integrate its services more deeply into supply chains. Research is ongoing to map these developments and formulate strategy recommendations for the port [4].

Notes

[1] Lee & Lam (2016). Developing the fifth generation ports model. Palgrave Macmillan, London.

[2] Montreuil (2011): The Physical Internet Manifesto.

[3] ALICE (2021): Physical Internet Roadmap, etp-logistics.eu.

[4] Fahim, P., et al. (2021). The Physical Internet and Maritime Ports: Ready for the Future. IEEE Engineering Management Review.

MAPPING THE DISTRIBUTION CENTRES IN THE ROTTERDAM PORT REGION



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Distribution centre in the South of the Netherlands. (© Merten Nefs, 2020).

Government officials and companies have branded the Netherlands a *distribution country*, or Gateway to Europe, since the 1980s, building on a rich history of trade and transportation and focused on the *Mainport* Rotterdam and its hinterland connections to Germany and Belgium. The slogan has been backed up by large investment programs and business strategies, increasingly in the hinterland regions east from Rotterdam (Kuipers e.a., 2018). With around half a million jobs linked to logistics, it is now a key sector of the Dutch economy. This makes it hard to believe that four decades later there is still no detailed overview available of the Dutch logistic complex, especially regarding logistic buildings such as distribution centres [1].

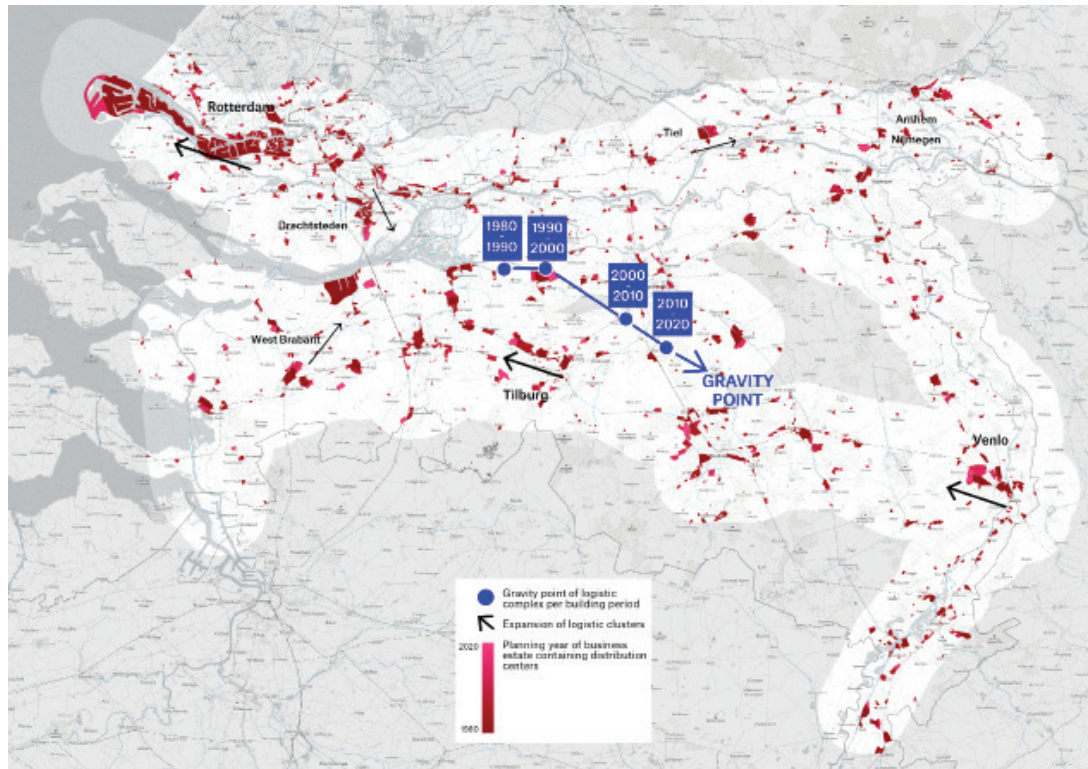
Reports from the Dutch real estate brokers association (Bak, 2020) aggregate the growth of logistic buildings per region or province, making the information too abstract for design and policy decisions. Geo-spatial mapping is a good way to identify planning gaps (Hein & Van Mil, 2020) in what we might call the expanding *logistic-scape* of the port of Rotterdam. Therefore, one of my first tasks in the Ph.D. research *Landscapes of Trade* [2] was to produce such a map and make it available to the broader public through an online viewer [3] and to researchers, designers and policy makers as an open access spatial dataset (Nefs, 2021). This enables citizens and stakeholders to see patterns, raise concrete questions about 'boxification', congestion and other negative impacts of logistics (Aljohani & Thompson, 2016), and elevate

the debate beyond the anecdotic NIMBY discussion of a single distribution centre. A first glance at the zoomable map already provides several items to discuss. In this article I focus on clustering, categories and context.

Clusters – growing west, shifting east

Since the 1980s, large clusters in the logistic complex have emerged, often strengthened by national and local policies. At the same time, the space in between such clusters has witnessed logistic sprawl, or fragmented developments that often piggyback on the success of the clusters nearby (Heitz e.a., 2017).

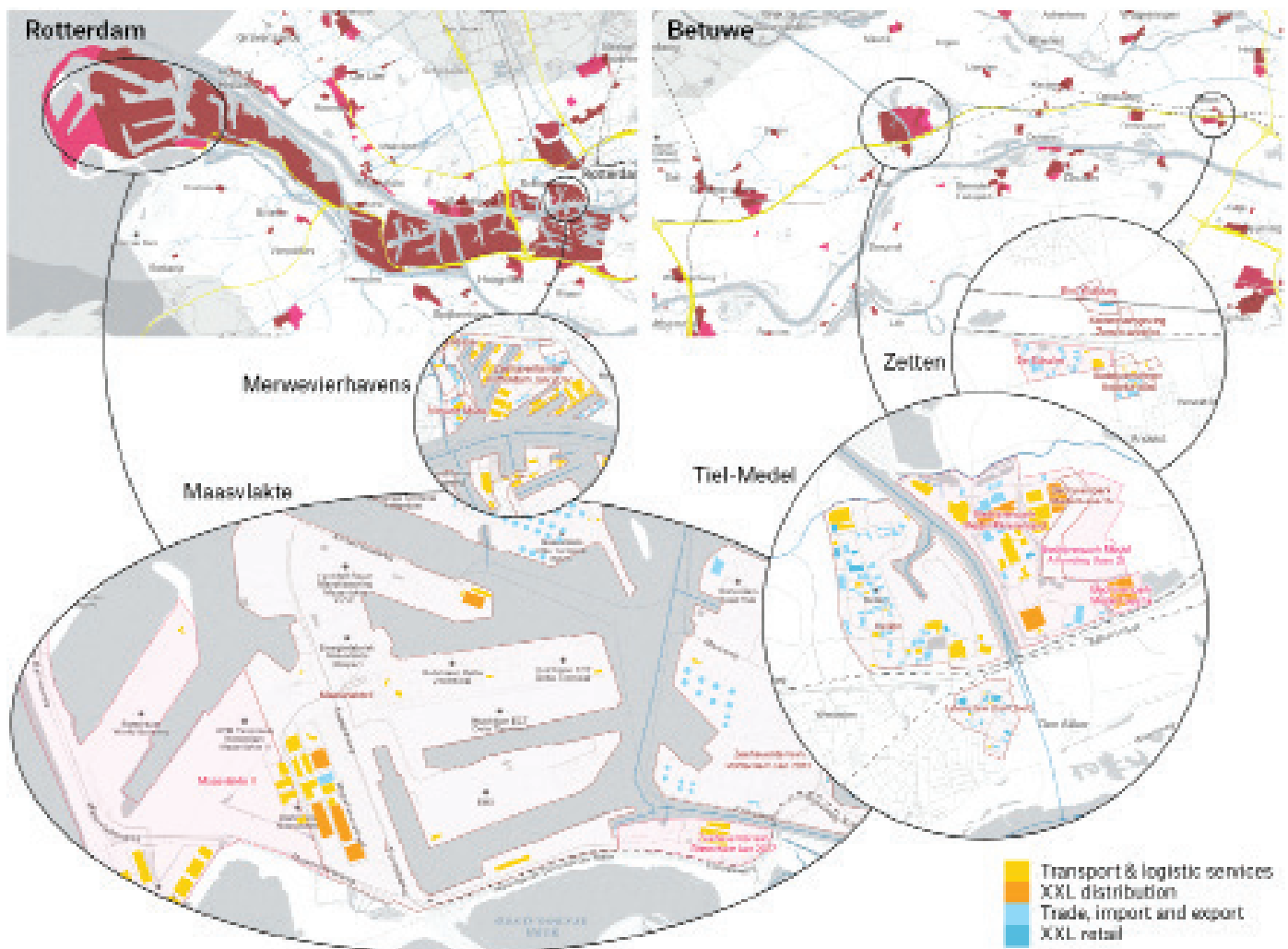
While the largest logistics hotspots (Tilburg, Rotterdam, Venlo) have expanded several kilometres westward in the last decades (see the Anyport model [4]), the gravity point of the entire logistic complex is clearly moving east. The average distribution centre built between 2010-2020 (weighed by size) is located 30 km more to the East than the average in the period 1980-1990. Besides demonstrating the process of port regionalization, or the emerging logistic delta, this eastward movement also shows the growing importance of the hinterland – companies choosing to be closer to customers instead of the sea port. And it points at the partial flipping of the entire complex, since goods increasingly arrive from the East over land. The Chinese Belt & Road initiative might be turning the port of Rotterdam from Gateway to Europe into the endpoint of the Silk Road (Frankopan, 2015).



Logistic business locations in the Port of Rotterdam and part of its hinterland – the East-Southeast Freight Corridor. Large logistic hotspots expand westward, while the entire complex is shifting to the East. Bright red areas are more recent. (© Merten Nefs, 2021).



All 4,347 logistic buildings larger than 2,500 m² in the East-Southeast Freight Corridor, separated in size classes to show the trend of economies of scale. (© Merten Nefs, 2021).



Distribution centres in business estates of the Rotterdam and Betuwe regions. Expected congestion (2023) in yellow. (© Merten Nefs, 2021).

Categories – a grey area

Distribution centres come in a variety of sizes, shapes and types, although recent ones are increasingly following international standards. A clear trend is the increasing building footprint, which for the whole corridor East-Southeast has grown from 8 to 38 million square meters since 1980. The average building also quadrupled, from 5 to 20 thousand m². In practice, many recent distribution centres are built up of several of those buildings very close or ‘glued’ together into corporate complexes that can reach 300 thousand m². Besides scale, there is a functional grey area of logistic-type buildings for activities that are a mix of logistics and manufacturing or farming. Examples are the buildings of the Tesla Motors automobile assembly and service plant in Tilburg, and various crop farming and agro-logistics firms near Rotterdam. Due to their registration as manufacturing or farming companies at the Chamber of Commerce, instead of logistics, Dutch company microdata [5] underrepresents logistic activities in the Dutch territory. This means that the logistic complex

is in fact even larger than it appears on the map, if one would include cross-overs.

Context – beyond the planner’s debate regarding hectares

Not only the distribution centres themselves, but also their location relative to population centres and infrastructure, determine their impact and sustainability (on the difference between footprint and area of influence, see Bélanger & Arroyo, 2016). Do they block the landscape view, contribute to local road congestion and have access to multimodal transport hubs? Can they source local workers and products or do they rely on migrant labour and global supply chains? These questions are too complex to answer in a single map, but without mapping there is no answer at all.

Let’s have a quick look at the chain of fruits in the Rotterdam port area and a region in the hinterland, the Betuwe. The Betuwe is known for its fruit products

(juice, jam) and much of its logistic system in 1980 was focused on fruit imports and exports. Recent XXL distribution centres in the area, however, use primarily the central location in the Netherlands, to distribute just about anything – except for local fruit. Some developments are clustered close to a multimodal hub in Tiel, which makes sustainable transport possible, while there is truck-oriented logistic sprawl in the east of the Betuwe. Moderate congestion is expected in the area.

The port of Rotterdam has tapped into the fruit chain since the 1980s, but in the form of large juice terminals and refrigerated containers [6] near the city centre and recently on the Maasvlakte port extension area, in between the oil companies [7]. Multimodal transport is possible, and advisable, since heavy road congestion is expected here. While these distribution centres certainly have a smaller landscape impact

than those in the Betuwe, emission levels in this area are among the highest in Europe, and workers at the remote Maasvlakte have a very long commute. In both areas, logistic operations require substantial migrant labour, which causes housing issues.

The societal complexity of logistic developments, briefly indicated above, calls for a multi-faceted focus in logistic planning, beyond the mere allocation of available space near infrastructure. Research by design can be part of such an approach. We have only just begun to understand the logistic complex of Rotterdam and its hinterland. The mapping of distribution centres shows that a spatial lens is necessary to shed light on the societal and strategic aspects of logistics. These include many dimensions, such as landscape, biodiversity, congestion and emissions, economic sectors, education, automation, migration and quality of jobs.

Notes

[1] I define the logistic complex as the inseparable combination of public transport infrastructures and private logistic buildings, which make supply chain operations possible. Comprehensive maps of logistic buildings are probably, at least partially, available at consultancy and broker firms. These are, however, never made public since they are part of the company's business model or strategy.

[2] See <http://landscapesoftrade.nl/>.

[3] See <http://mertennefs.eu/landscapes-of-trade/> for the map viewer and information regarding the used data. The data and map will be expanded to include a large part of the Netherlands, part of Flanders and North Rhine Westphalia until the end of 2021.

[4] The Anyport model by Bird (1963) and the Port-City model by Hoyle (1989) describe port expansion and urban growth processes of port cities, usually moving towards the sea.

[5] LISA data, a commercial dataset that cannot be shared publicly.

[6] As a 'reefer' hub, Rotterdam has become the second largest avocado export location in the world, without having any avocado producer nearby.

[7] Innocent recently built a large juice distribution centre at the Rotterdam Food Hub.

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ENERGY TRANSITION AND THE PORT OF ROTTERDAM. A DISRUPTIVE CIRCULAR ECONOMY OPPORTUNITY?



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Peter Luscuere was Professor at Delft University of Technology from 1991-2021 and is visiting Professor to Tianjin University in China. The research of the Building Physics & Services group he was heading is focused on: Energy transition, Exergy, Comfort, Building Physical properties of materials and Sustainability. As director at Royal Haskoning he was responsible for many of the company's projects in Health Care as well as the development of a companywide Cradle to Cradle inspired program on sustainability. In 2010, he established an independent consulting business Inspired Ambitions, while continuing his academic work. During 2016 he has been chairing, together with his son Wart Luscuere, the Transition Pathway Circular Economy within the Roadmap Next Economy, a project with Jeremy Rifkin for the Metropolitan Region Rotterdam The Hague.



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Wart Luscuere has been involved, in multiple projects, concerning sustainability, C2C® and Circular Economy issues, as a technology researcher and consultant within Inspired Ambitions since 2011. He became a member of the coreteam who built up 'The Ocean Cleanup' Foundation. He supervised expeditions as a field researcher within this volunteer's organisation, where he co-developed new research instruments. In 2016 he was secretary of the working group Circular Economy for the MRDH-region to identify a feasible transition pathway together with Jeremy Rifkin and his team in the project called: 'Roadmap Next Economy'. As of early 2017 he is founder of the sustainability consultancy company: 'Beyond Sustainability'. In august 2018 he was in the race as a top three candidate for the 'mayor of your Northsea' election where he could address the large potential of the hydrogen economy for the port area, The Netherlands and Europe. As a leader of the 'Circular Economy Club' The Hague he is aiming at positive impact by assembling initiatives.



Cranes in the RWG Terminal and Maasvlakte beach. (© Danny Cornelissen, 2020; Source: Port of Rotterdam Authority).

History intertwined with fossils

Rotterdam was the world's busiest port from 1962 to 2004 [1], growing steadily from 1910 onwards. Its harbor and oil-industry are strongly intertwined, as can be seen from analytical maps [2] showing industrial, infrastructural, retail, administrative, and ancillary spaces over a period of some 90 years. The result is referred to as the port's 'petroleumscape,' in

line with Carola Hein's definition of which the year-2015 version is shown in the following image [3].

Five large oil-refineries form the core of the petrochemical cluster in this port area. These oil refineries manufacture products such as gasoline, diesel, kerosene, heating oil and feedstock for the chemical industry [4]. One could say that oil built this port, the one would not exist without the other.



Study showing port and oil related buildings and infrastructure, year 2015. (Source: Carola Hein, Bernhard Colenbrander, Alexander Koutamanis, CC BY NC SA 4.0).

However, the Climate Act [5] adopted in The Netherlands prescribes a 95% reduction in GreenHouse Gases (GHGs) in 2050 combined with a fully CO₂-neutral electricity production. This means the inseparable connection between fossil energy carriers and the port becomes problematic if not a cul-de-sac. Especially when we consider how little time remains to achieve our non-fossil future (today-2050) and the need for urgent action.

Steering the Mammoth Tanker

Many initiatives are already underway to reduce our emissions, but the question is whether they are too little too late. As a country of consensus, the Netherlands require broad and intensive consultation. After the government accepted the Climate Act, all 352 (year 2021) townships were charged with executing near impossible goals through local interventions. These are all bottom-up initiatives which lack a shared, overarching 'Delta Plan' approach. The townships are supported in their planning by a variety of government-related organizations, with the goal of producing 30 Regional Energy Strategies. The question arises whether this will lead to the required national goals or to a broad patchwork of incompatible interventions and a loss of valuable time to act.

Another risk involved with the time pressure and bottom-up approach is the choice of proven over new technologies, leading to possible lock-in scenarios. An example of such a lock-in scenario might be the transport of (existing) waste heat from Rotterdam's cluster to, among others, the city of Leiden through a 'heat roundabout' over large distances. We cannot tell whether the future heat source will be GHG-free, what the costs for the end users will be, how secure the supply will be and how to scale the system. Nevertheless, local authorities are pressed to decide on such technologies now, potentially missing out on viable alternatives and committing to future stranded assets like the aforementioned roundabout. This artificial time pressure can mean rushing decisions and committing to 'less-bad' technologies at the expense of durable long-term policies, with current technology pushed at the expense of real lasting solutions which can contribute to climate goals. As prime-minister Mark Rutte stated: "Carbon Capture and Storage is a transition technology", meaning that the process of capturing CO₂ and just storing will only postpone the real interventions necessary.

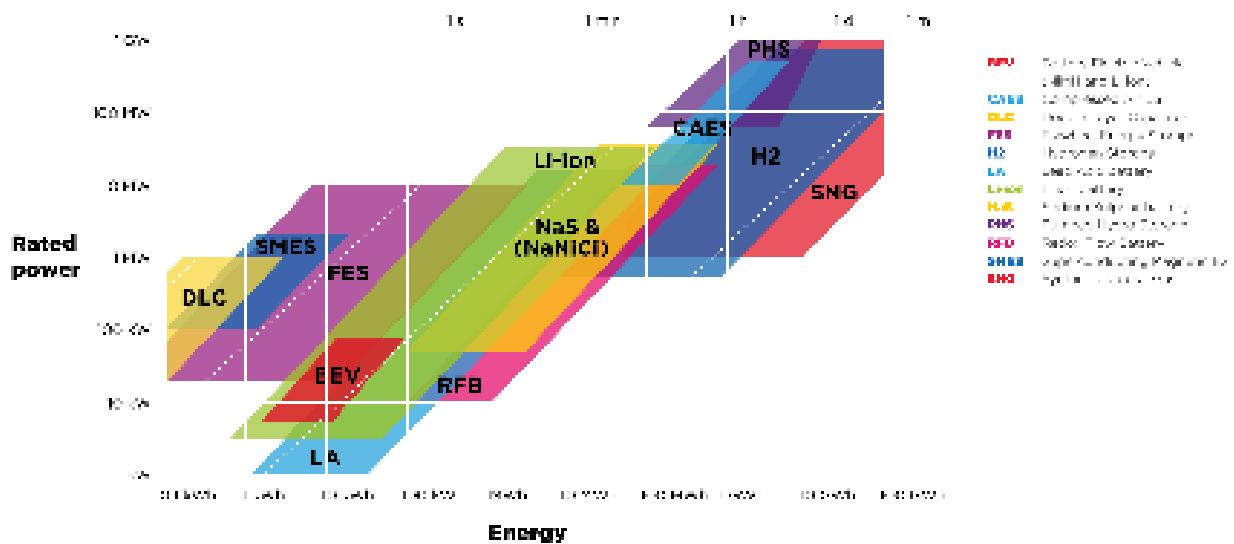
Other possibilities exist that are suitable for an intermediate phase. For instance, converting the oil-refineries to bio-refineries and using the nearby greenhouse industry for the needed biological feedstock production. These options were set out in

the transition pathway 'Circular Economy' within the 'Roadmap Next Economy'-study for this region, led by Jeremy Rifkin. A synergetic cooperation between adapted obsolete fossil based infra structure and new biobased agriculture as it is planned amongst others in Sardinia [6]. In addition to more profitable use of existing infrastructure and a possible reduction in GHG-emissions, time is bought to research new technologies and possibilities for cleaning up brownfield sites, the costs of which will be tremendous. In this way fossil-based companies, which have created large profits over decades, can display corporate responsibility and maintain a business case.

Hydrogen Rocks!

Another highly promising technology making a break-through is hydrogen. Daily, novel, often green hydrogen production plants and applications are being introduced. Basically, it is a logical way to go, from clean water and green energy via hydrogen to electricity, heat, and clean water again. The harvesting of sun and wind can take place anywhere, but preferably in sun and wind rich areas. From this point on it can be pressurized, liquefied, or otherwise converted to molecules (like NH₃) making renewable energy transportable. Then it can be utilised to power industry, or transformed into electricity, heat, and clean water using a fuel cell. Hydrogen (compressed, liquified or captured in molecules) is one, if not the only, possibility to store high levels of renewable energy and power in combination with seasonal time scales. This can be seen in the following image, in which Rated Power, Energy and Time Scale of energy storage are compared for different technologies.

An often-heard argument is that the various conversion steps, each with a certain efficiency, cannot add up to an efficient system. This argument overlooks the fact that the sun alone is delivering up to 10.000 times the amount of energy we consume [7]. In such a case the cumulative costs are what matters, not the cumulative efficiency. At this moment hydrogen is mostly produced by steam reforming, releasing large quantities of CO₂. This is why it is called grey hydrogen. An intermediate solution is to capture and store CO₂, producing blue hydrogen. The goal of course is to ultimately use renewable technologies (avoiding GHGs altogether), creating green hydrogen. The current cabinet agrees that this is needed to help make the largest polluters, of which quite a number from the Rotterdam industrial area [8], green. The challenge is to reduce costs and eliminate hidden fossil subsidies to the point where green hydrogen can compete, not only with grey (or blue) hydrogen but with fossil fuels.



Power, Energy and Time Scale of different power storing technologies. (Source: Help de energietransitie, Marco Bijkerk, ISBN9789491076107, p.78-79).

Today, we see large scale sun or wind powered renewable energy plants delivering renewable energy for as low as 1,7 €/kWh on 20-year contracts, which is already considerably lower than the fuel costs of our electricity generating plants. The source (sun and wind) provides thousands of times more energy than we need to power the world. If we can transform this near limitless flow of renewable energy into electricity at lower costs than burning coal, oil, or gas it is no question what to prefer [9].

Natural gas and electricity infrastructure

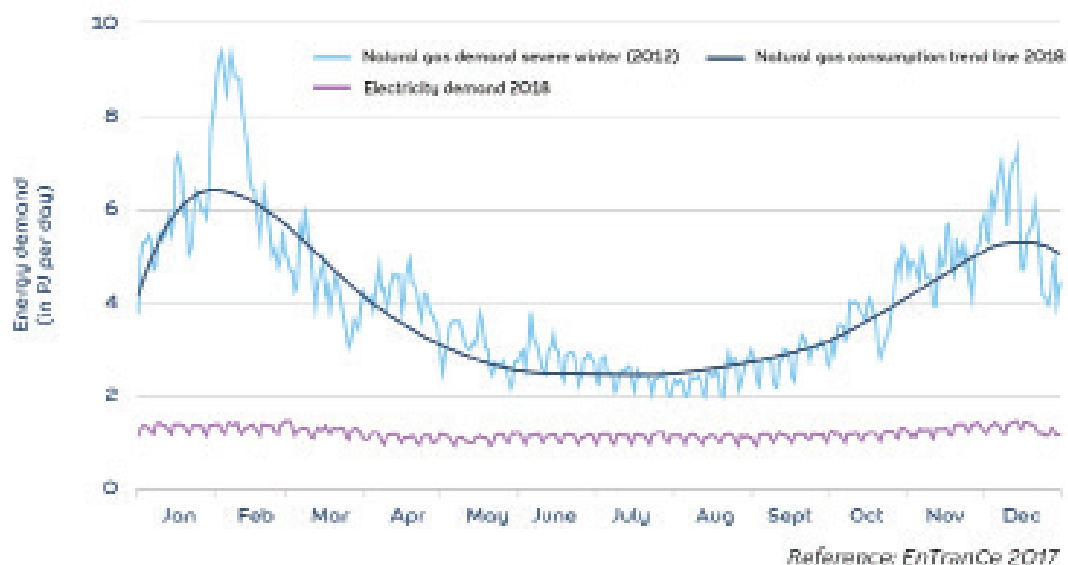
The port of Rotterdam has a rich history not only with fossil-based energy carriers but also with hydrogen. A high-pressure hydrogen pipeline running for over

30 years from the port through Belgium into the north of France connects to the natural gas infrastructure in the Netherlands. Here lies the great advantage for Rotterdam and The Netherlands. The total natural gas infrastructure in Europe can be converted into a hydrogen gas infrastructure for approx. 10%-25% of initial costs [10] [11].

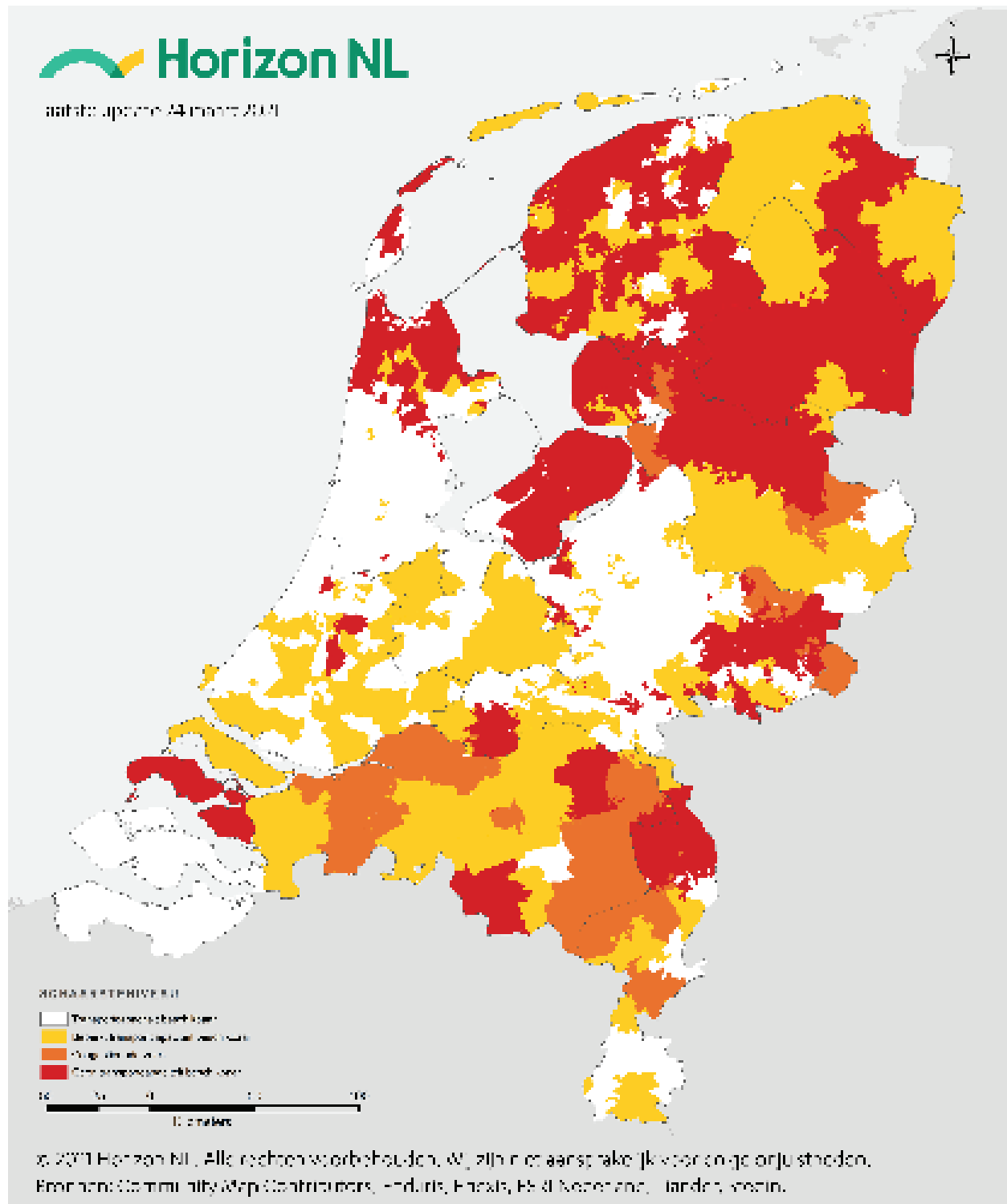
We will need to preserve this gas-infrastructure in any case, as the winter peak of energy delivered by gas is approx. 6 times higher than the energy peak delivered by electricity (see the following image).

Expanding the electricity grid to cope with demand is much more expensive, if not impossible as many regions are either congested or limited in their

YEARLY GAS AND ELECTRICITY CONSUMPTION IN THE NETHERLANDS



Energy consumption in the Netherlands divided into electricity and natural gas. (Source: Entrance, 2017).



Congestion chart of electricity infrastructure in the Netherlands. (© Horizon NL, 2021).

expansion capabilities, per the previous image. As such, an 'all electric' solution for The Netherlands is not only improbable but impossible.

Refurbishing and reusing an already paid-off asset avoids grid-congestion, energy/heat shortages,

potential price spiking and the need to remove the pipe grid, which would be a costly procedure. It further alleviates dependencies on the Groningen natural gas fields, current and future import from Russia, and can make the Netherlands a hydrogen-roundabout on the emerging European hydrogen-market, securing future

With Rotterdam port as a hydrogen hub, it is easy to see the opportunities for hydrogen throughput, both within the adapted natural gas infrastructure and into hydrogen mobility modalities such as cars, trucks, inland shipping, and aviation, all of which will contribute to reducing harmful emissions from CO₂ to NO_x and others.

Conclusion: Rotterdam's next level

A worldwide renewable energy transition is urgently needed. As wind and solar energy are abundant but not constant, we need long-term storage, a challenge where hydrogen can deliver a solution. Renewable energy generated in wind and sun rich areas already

produce guaranteed kWh-prices of 1,7 \$c/kWh for 20 years or more, with a trend towards 1,0 \$c/kWh in 2030 for these locations [12].

Renewably generated green hydrogen is a cost-effective energy carrier, which can be delivered to the port of Rotterdam through our economically re-used (inter)national natural gas infrastructure. In the meantime, obsolete oil-refineries can be transformed into bio-refineries using vacant greenhouse capacity to produce feedstock (like thistles), while thinking of a way to clean up the contaminated grounds when this fossil-based heritage will be decommissioned.

As such, the conversion towards a hydrogen-based energy system might be not that disruptive after all.

Notes

[1] Canon van Nederland, <https://www.canonvannederland.nl/havenvanrotterdam>.

[2] Hein, Carola. "Oil Spaces: The Global Petroleumscape in the Rotterdam/The Hague Area." *Journal of Urban History* (2018).

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NURTURING TALENT IN THE PORT CITY OF ROTTERDAM



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Shipping and Transport College at Lloyd Quarter. (© Maurice Jansen, 2017).

Rotterdam's education system has the wind in its sails, but at the same time it's all hands on deck for Rotterdam. To remain a maritime capital and meet its ambition to become the world's most sustainable port and an inclusive city, the port city is in need of human capital. As a port city that increasingly derives its competitive strength from smarter, cleaner and more efficient production and logistics, technology and talent development are of vital importance for innovation. Rotterdam is not unique in this ambition. Across the world, port cities are increasingly competing for the best talent. What can the port city of Rotterdam do to attract talent and realise its ambition to become a Maritime Capital while leaving no one behind?

The innovation ecosystem

To answer that question, we should look at what science has to say on how innovation ecosystems are emerging in cities. Explanations are found in various disciplines. Social geographers see the strength of a city in its agglomeration effects. Business scientists and economists see the densification of companies

as behind cluster formation. Sociologists and cultural scientists talk about the presence or absence of social and cultural capital. Ecologists and biologists, meanwhile, talk about ecosystems: the circular principle and 'nature' and 'nurture'.

We are increasingly seeing cities and companies adopting the principles of ecosystem formation. Often, they use the term in an abstract way, talking about an ecosystem of interrelated businesses, for instance. But in a port context, we see a tendency to also focus on the interplay between delta, society and economy. In times of climate change and pandemics, resilience is high on the agenda. Clusters of companies are more emphatically concerned about their environment, partly out of self-interest but also due to a need to join forces to tackle transition issues.

Businesses are making efforts to maintain and increase the livability of spaces, not only from a sustainability point of view, but also to be attractive as a location for talent. Other cities in the world express themselves as capitals of knowledge or talent, as shown by the Global City Talent Competitiveness

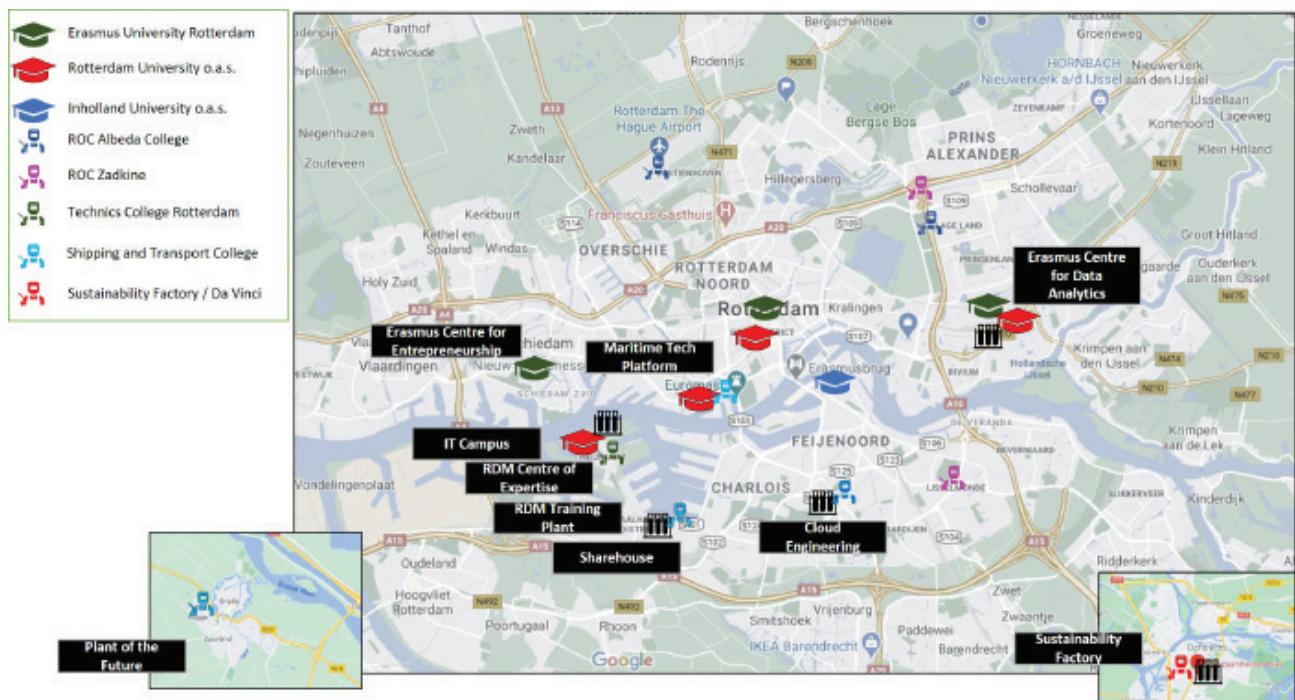
Index. Rotterdam occupies a modest 28th place, well behind Amsterdam (21) and Copenhagen (1). How are these cities competing for talent? There is a strong relationship between regional income levels and the presence of technology, talent and tolerance (Florida 2003, Florida & Mellander 2020). A human capital perspective on the innovation ecosystem has also been applied to 'smart cities', 'knowledge cities' and 'brainports' in such areas. In port cities such as Rotterdam, this means a shift from trade networks to neural networks (Edvinsson, 2006): talent and technology will become increasingly important for the competitiveness of the port and industrial complex. But there is also a danger when investments in education and innovation campuses do not spread evenly across the city or region. Where investments are made in talent, the surrounding neighbourhoods flourish, but the gap with the neighbourhoods further away also increases (Florida & Mellander, 2020). This may be one of the reasons why Rotterdam South is progressing as a result of the long-term investments, but other parts of the city are further accelerating their economic development, perhaps because the talent there is working even harder on innovation.

Evolution of technical education in Rotterdam over the past thirty years

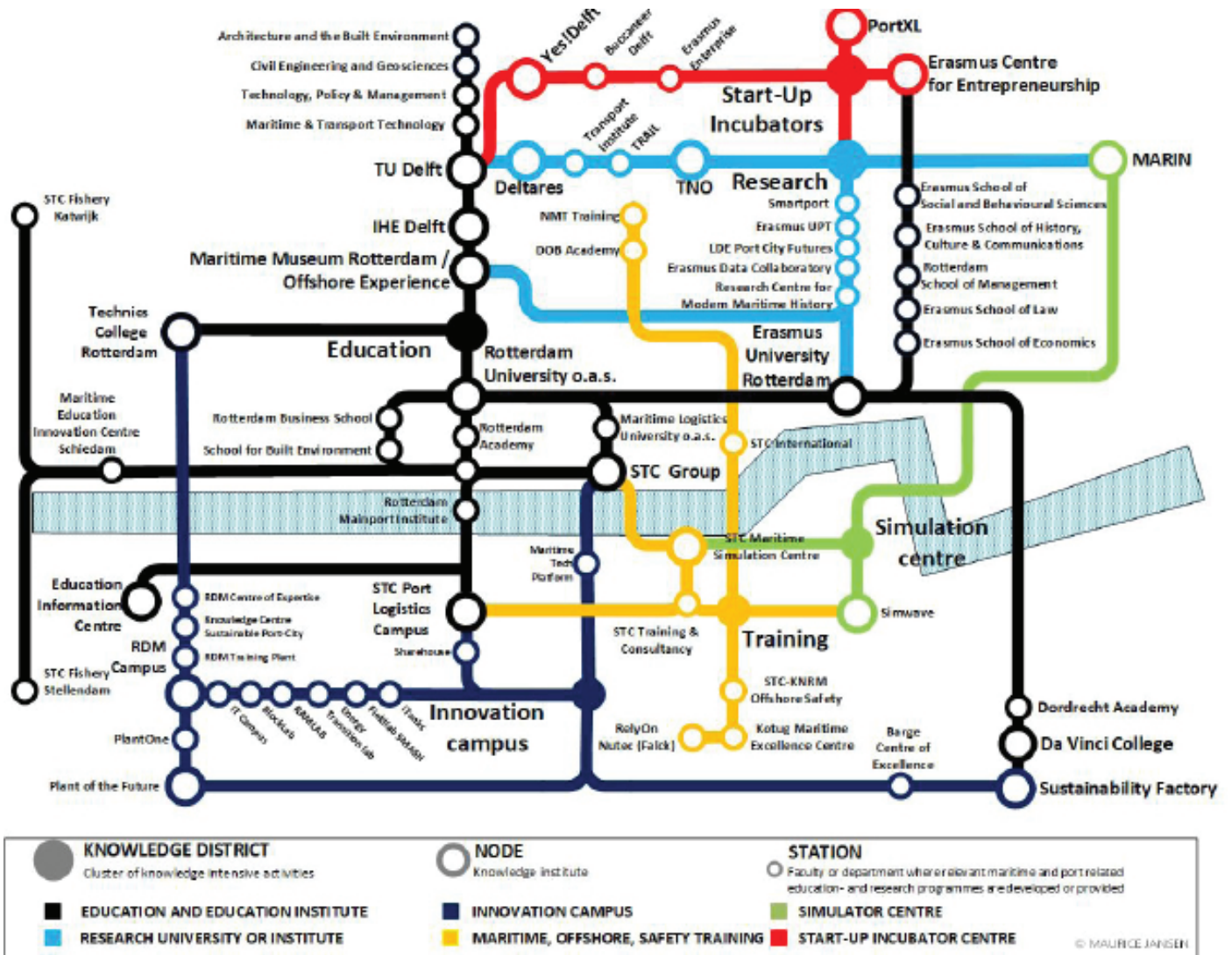
Rotterdam is a real student city, with almost 124,000 students, of which more than 50,000 are at vocational

education level, 46,000 at higher education and 28,000 in scientific universities [1].

The city is known for its very extensive education and innovation ecosystem for the port and maritime sector with approximately 60 courses at all levels. This extensive range has been created over the years following various system changes in education. Technology education is also on a long road to recovery from decades of excessive concentration on larger education institutes where numbers became more important than people. In the Netherlands, the 1980s and 1990s were dominated by bankruptcies and the demise of renowned industrial companies. Shipbuilding was on the brink of extinction, while Dutch transport technology companies such as Fokker and DAF went bankrupt and had to restart with only intellectual property as their cores. Philips, with home base in Eindhoven, moved most of its factories to Eastern Europe and China. In contrast, business services and internet services were said to form the new pillars of the economy. It seemed the Dutch economy had said goodbye to the industrial era for good. This also influenced technical vocational education, as schools merged into large scale regional education centres with technical programmes receiving less and less students. It was only in the early 2000s that businesses realised that the number of technicians now lagged far behind their demand.



Hybrid learning communities in Rotterdam. (© Maurice Jansen, 2021).



Maritime knowledge and innovation ecosystem in Rotterdam. (© Maurice Jansen, 2020).

In Rotterdam, in-depth investments were made in various places in the city to strengthen the education and innovation ecosystem, both by area developers such as the Port of Rotterdam Authority and the Rotterdam Development Company. The redevelopment of the RDM Campus, Merwe-Vierhavens, Lloydkwartier and Waalhaven-Zuidzijde were part of the CityPorts (in Dutch: Stadshavens) program by the Municipality of Rotterdam and the Port Authority of Rotterdam, with the aim to revitalize these port areas. Most buildings and infrastructure of the quays had lost their functions and had to be refurbished.

Already since the 1990s, the Shipping and Transport College has been investing in technical education for the port, shipping and petrochemical industries in various locations on the north bank (Lloyd Quarter), south bank (Waalhaven harbour) and Brielle, a port town close to Europoort and Maasvlakte. These large-scale investments in technical vocational education infrastructure were made possible under

the programmes 'Knowledge Infrastructure Mainport Rotterdam' and with European (EFRO) subsidies (Boivin et al. 2005, 2015). Meanwhile, the maritime manufacturing industry in the Netherlands had reinvented itself and required an increasingly larger number of graduates. The collaboration between Rotterdam University of Applied Sciences and the Shipping and Transport College in 2005 to revitalise Nautical Studies in Rotterdam was one of the first programmes in the Netherlands to restore the broken vertical connection between middle and higher technical vocational education that had arisen after the mergers of schools into the ROCs in the late 1990s. In 2011, this collaboration was further strengthened with the establishment of the Rotterdam Mainport Institute. Merging four port and maritime related higher education programmes under one roof gave a strong impulse to the learning communities at both Lloyd Quarter and the RDM Campus.

In the late 2000s, the technical vocational education system in the Netherlands got a new elan when the

Stichting Platform Bèatechniek - a Foundation to promote education in technics and technology - was created by the Ministry of Economic Affairs, Ministry of Education, Culture and Science and Ministry of Social Affairs and Employment. The aim was to raise attention to technical education and ICT skills among school children. New forms of cooperation had to be created between educational institutions and the business community in order to solve the mismatch between skills needed and curricula at schools and universities of applied sciences. Investment funds were set up across the Netherlands for this. Top sector policy and centres of expertise were also created, 16 in total. In 2014, the Regional Investment Fund MBO was also introduced for secondary vocational education, which made the centres for innovative craftsmanship possible. 13 pilots took part in the first phase from 2014 to 2017, most of which participated in the second phase (2018-2022).

Examples of public-private partnerships here include the RDM Center of Expertise, which offers modern 'context-rich' learning environments. These are not only used for learning, but also for experimentations, testing and piloting, always set up as joint projects between education, research and business. Shipping and Transport College continued to build its port logistics campus in two phases at the Waalhaven South Side. The Technology College Rotterdam was also created after a mandatory merger of the technology courses between the ROCs Zadkine and Albeda College forming the RDM Campus. On the north bank, Erasmus Center of Entrepreneurship moved into the Science Tower in 2015, with a view over the M4H Makers District, to stimulate education and research in the area.

These new partnerships between educational institutions are not only intended to adapt education to this age of rapidly advancing technology, but also to re-connect education and business and recreate continuous learning paths. This trend has been going on for several years in vocational education. Scientific education is also looking for new connections with the city from the point of view of 'societal impact'. One of the partnerships is Sharehouse, a unique learning environment where Erasmus University researchers test the collaboration between humans and robots in a warehouse environment. The IT Campus is also actively looking for these vertical connections aiming to raise the level of digital skills across all levels of education.

What's happening on the South Bank?

Approximately 205,000 people live in Rotterdam South, almost a third of the population of the city, with 70,000 under the age of 27 years. The population in South Rotterdam is growing, and so is the age group up to 27 years. In 2019, however, Rotterdam South was still lagging in education, on the labour market and on the housing market (RISBO/OBI, 2020). The educational level of parents is lower, the school recommendation in group 8 is lower compared to other neighbourhoods in Rotterdam and the G4 – the four largest cities in Netherlands – school absenteeism is highest. In so-called 'focus neighbourhoods,' the socio-economic position of children is even lower than the average in South Rotterdam. Relatively speaking, more mid-vocational students live in Rotterdam-South, while the number of university students living in the South is lagging far behind.

Education type	Focus neighbourhoods	Rotterdam South	Rotterdam Other	Rotterdam	G4
mbo-1	219 (23%)	474 (50%)	483 (50%)	957	3.138
mbo-2	814 (19%)	1,840 (43%)	2,404 (57%)	4.244	12.715
mbo-3	898 (18%)	2,124 (42%)	2,959 (58%)	5.083	13.173
mbo-4	1,747 (17%)	3,867 (38%)	6,307 (62%)	10.174	29,602
Higher Education	2,770 (15%)	5,590 (30%)	13,005 (70%)	18,595	69,651
University	985 (6%)	2,127 (13%)	14,010 (87%)	16.137	72.154
Total	7,433 (13%)	16,022 (29%)	39,168 (61%)	55.190	200.433

Students by type of education and residential area in 2018-2019, percentages = share compared to Rotterdam. (Source: Basic Monitor Education National Program Rotterdam South 2019, Risbo/OBI).

Talent is especially needed in IT and data sciences

Rotterdam can position itself more powerfully as a talent city. Recent research by Erasmus UPT shows that companies closely monitor technological developments: big data analytics, artificial intelligence, internet of things. Where technology and talent have to come together, the question arises whether a mismatch will arise between what the business community demands and what education can deliver, both qualitatively and quantitatively. The learning communities that have emerged since 2010 show a new form of learning that fits the 21st century. Learning takes place in a network and (personal) knowledge is related to the network of people, organizations and institutions in which the knowledge worker works and lives. This connectivist view of education is illustrated by the 'metro map' of Rotterdam maritime education, but it also applies to other sectors. Companies are still looking for craftsmanship, but digital and social skills are transversal, according to the talent survey. This research also shows that companies find it difficult to find IT professionals: data specialists such as data engineers, data analysts, data scientists, developers, and also talent with a business informatics education. In addition, technical vocational skills – such as seamanship, shipbuilding or maintenance technology – can provide a strong basis for developing talent. Learning professional communities and innovative learning environments offer opportunities to make crossovers between craftsmanship and data sciences. A target group-oriented approach to bind IT professionals more inclusively to the city will benefit the innovation processes in the present business community along this line.

Coming to conclusions

Attracting, retaining and growing talent is increasingly becoming a competitive factor for both companies and cities. Rotterdam can position itself even more strongly as a talent city and make use of its rich education and innovation ecosystem, but will have to make careful and balanced future investments in area development. On the South side of Rotterdam in particular, considerable efforts have been made for years to make the neighbourhoods more livable and attractive, but for young people on this side of the river, catching up is not easy. The question is whether Rotterdam South can ever measure up to 'north'. The river is not just a physical barrier. Several barriers create a gap between north and south for young people: primary school test scores, education level, dropouts, youth unemployment, disposable income. Across the board, these Rotterdammers are already falling behind early in their lives. For an integrated plan to succeed, perspectives from urban planning (architecture and the built environment), new business development, sociology and the maritime culture and identity converge. In this holistic perspective it is about reducing distance for young people, in physical proximity and in travel time, but also institutionally. There is enormous potential in the residents of Rotterdam South. In these neighbourhoods, young people look for inspiration, for a stepping stone. A hybrid learning community – perhaps a university for IT and Data Sciences talent - can provide horizontal connections between training programs as well as vertical connections that form learning pathways for the underprivileged. Rotterdam is up for the challenge and can make it happen in the spirit of the port city: stronger through stride.

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[1] DUO Database, participants and registered participants, reference date 1/10/2019

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MAKING THE FUTURE PORT CITY IN ROTTERDAM'S MAKERS DISTRICT



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Street art on the Keilewerf 2 building, Rotterdam M4H. (© Amanda Brandellero, 2021).

The Rotterdam Makers District extends to the west and south of Rotterdam city center, divided by the wide waters of the river Meuse. The district received its current appellation in a vision and strategy document published in 2017 [1]. The document sets out how the city's roadmap to the next economy will be anchored to and implemented in this particular territory. This vision – which embodies the joint ambitions of the Municipality of Rotterdam and the Rotterdam Port Authority – combines innovative manufacturing industry, circularity principles, and urban living and working environments, while maintaining a connection to port. Indeed, in the Makers District, the City and Port Authority claim to be exploring innovative connections and synergies between each other, specifically in areas that have experienced a retreat of port activities in recent decades. As the vision document states, these areas are seen as spaces of opportunity: “on the boundary between city and port, outdated port areas offer the perfect conditions for an innovation experiment” [2]. Before we delve into what this innovation experiment entails, let's take a step back and explore the district's rich history.

Before the Makers District

The Makers District's two constituting neighborhoods have strong historical ties to the city's port and industry. To the south of the Maas, the area called *Rotterdamsche Droogdok Maatschappij Rotterdam* (RDM) owes its name to a consortium that settled here in 1902 with the aim of addressing the city's seafaring fleets' repair and maintenance needs. The consortium soon branched out to cargo and passenger shipbuilding, and later submarines [3]. The RDM consortium was nationalized in 1983, and its downsized activities were recentered towards serving the Dutch Marines and the development of innovative maritime technology. To this day, the shipyard's legacy is visible in the area's morphology, its imposing warehouses and hangars, as well as in the nearby residential area, Tuindorp Heijplaat, which was developed in the early twentieth century to house RDM's workers.

Perched on the opposite side of the river, lodged between Rotterdam's city center and the city of Schiedam, *Merwe-Vierhavens* (M4H) completes the

Makers District. The M4H area – size-wise on a par with the city center – was formerly the city's “energy and transshipment port” [4]. The Citrusveiling and the Ferro Dome buildings are iconic references of the area's legacy as a fruit trade and gas handling and storage center.

Ambitions of the Makers District

The ambitions of the Makers District are set out in the vision and strategy document from 2017 and the spatial framework for M4H established in 2019. In developing the area, several key features are clearly valued, including: flexibility, mixed use, innovation, and creativity. Moreover, five objectives guide the area's socio-economic transition.

The first relates to attracting and enabling innovative entrepreneurship, especially in the field of making and manufacturing. This objective is supported by a technological transition, facilitating small scale, tailored and highly specialized production – making use of additive manufacturing, robotization and material science [5]. The Makers District should host collaborative and shared facilities and spaces for experimentation. The second objective focuses on offering a diverse range of employment opportunities for the wider region's population. Thirdly, there is the goal of stimulating an open innovation environment, with crossovers and synergies between educational, business and knowledge institutions. Fourthly, the urban residential fabric should be extended to the area's waterfront, particularly at the Merwe

The Ferro Dome, Rotterdam M4H. (© Amanda Brandellero, 2021).





A view of the Keilehaven, Rotterdam M4H. (© Amanda Brandellero, 2021).

piers. Finally, the Makers District is designated as a testing ground for the implementation of the circular economy in Rotterdam's city and port. Moreover, in the spatial framework for M4H, the City and Port Authority commit to eight sustainable development area principles to be upheld in contracts, tenders and construction projects in the area. Among these principles, we find the production and use of renewables, sustainable mobility, the valuing of waste flows and a resilient climate adaptive system [6].

City in the making, making in the city

As its designation suggests, one of the cornerstones of the vision and strategy of the Makers District is a transition to urban innovative manufacturing. The

development of the district fits within a wider policy movement advocating for new forms of urban manufacturing. Grodach and Gibson [7] for instance have noted how in the United States and Australia policies supporting the advancement of urban manufacturing grapple with a few related issues. In their analysis of public policy documents and plans relating to urban manufacturing, the authors noted that there are competing (higher value) land uses that can price out manufacturing or hinder it. An example of this would be when industrial operations come into conflict with other uses, such as residential or commercial. Another issue is the inaccurate – sometimes uncool or outdated – image which contemporary manufacturing often must contend with [see also 8]. Moreover, there is a discrepancy

between the available and accessible pool of labor on the one hand and the skills needed to underpin the advancement of urban manufacturing on the other, often signaling a mismatch between existing and necessary workforce policies and training.

Sydney's experience with policies for the promotion of urban (small-scale) manufacturing was analyzed by Kylie Budge [8]. In her findings, she points to the need for ongoing community and stakeholder consultation, as well as an integrative approach to making. Since urban making practices intersect with

many socio-economic domains, Budge noted how making "is connected to all these areas of city life, and to isolate them to a previous way of thinking about 'the arts' or 'culture' or 'manufacturing' does not do justice to this iteration of the maker movement and its generative and expansive capacity in cities" [9]. Such international experiences hold valuable lessons for Rotterdam's Makers District and its counterparts elsewhere, highlighting the importance of monitoring the development of mixed land use that integrates urban manufacturing, as well as accounting for place-specific pressures that the advancement of urban

Rotterdam Voedseltuinen, M4H Rotterdam. (© Amanda Brandellero, 2021).



Notes

- [1] https://www.rotterdammakersdistrict.com/images/RDM_makersdistrict_brochure.pdf.
- [2] Rotterdam Makers District (2017), *Visie en Strategie*. Rotterdam Makers District, p.4.
- [3] <https://www.rdmrotterdam.nl/geschiedenis/>.
- [4] Rotterdam Makers District (2019), *Spatial Framework Merwe-Vierhavens Rotterdam. Future in the Making. Summary*. Rotterdam Makers District, p.3. The area development plan for M4H can be consulted on <https://m4hrotterdam.nl/ruimtelijk-raamwerk-m4h/>.
- [5] Rotterdam Makers District (2017), *Visie en Strategie*. Rotterdam Makers District, p.10.
- [6] Rotterdam Makers District (2019), *Spatial Framework Merwe-Vierhavens Rotterdam. Future in the Making. Summary*. Rotterdam Makers District, p.18.
- [7] Grodach, C. & Gibson, C. (2019), "Advancing manufacturing? Blinkered Visions in the U.S. and Australian Urban Policy", in *Urban Policy and Research*, vol. 37, no.3, pp. 279-293.
- [8] Budge, K. (2018), "Making in the city: disjunctures between public discourse and urban policy", in *Australian Geographer*, vol. 50, no. 2, pp. 185-199.
- [9] Budge, K. (2018), "Making in the city: disjunctures between public discourse and urban policy", in *Australian Geographer*, vol. 50, no. 2, pp. 185-199, p.197.
- [10] For an in-depth discussion, see Grodach, C. & Gibson, C. (2019), "Advancing manufacturing? Blinkered Visions in the U.S. and Australian Urban Policy", in *Urban Policy and Research*, vol. 37, no.3, pp. 279-293.

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ROTTERDAM UNDERGROUND: IN-DEPTH HISTORY, PRESENT AND FUTURE



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Kop van Zuid. Wilhelminapier with World Port Center and Erasmus Bridge Skyline Rotterdam. (© Leon Willems; Source: Port of Rotterdam Authority, 2020).

Urban Undergrounds

The history of Rotterdam is marked by spatial expansion. Its initial location was on the north side of the Maas river, but from the 1860's onwards port developments leapt over the river (Meyer, 2016: 84) and continued along the south bank. Containerization in the 1960's led to further, rapid expansion westwards, where container districts and offshore ports further increased the separation between ports and cities.

These horizontal expansions were intertwined with issues of depth, as is easily illustrated by continued efforts to deepen and dredge the Nieuwe Waterweg after its construction in the 1870's, the carving out of new harbors from the polders on the south bank (Hein and van de Laar, 2020: 267) and later westwards in the new land captured from the sea, Europoort. With a surface of 310 hectares, the Waalhaven on the south bank is the largest dug harbor in the world today, and the Ertsoverslag Europoort CV (EECV) allows ships with a hull of 24 meters. In-depth dimensions of built infrastructure are thus key for thinking about the past, present and future of Rotterdam.

The importance of verticality has been emphasized in histories of urbanization more broadly. One reason

for this is that historically, cities have often been built on the basis of extracting from the underground. For example, Paris and its underground have taken shape through a long history of extracting limestone for building projects (Pike, 2018; Macfarlane, 2019: 138). From the late 18th century onwards, the resulting caverns became used as burial sites (catacombs) (Graham, 2016) and in the mid-19th century, during the great transformations led by the urban planner Haussmann, the modern sewer system was constructed underground (Gandy, 2014).

Underground Infrastructure

In urban terrains, the underground has become an important space for more than sewers and cables. Underground metro systems, tunnels under rivers, underground cruise terminals (Shanghai, Hamburg, Galata, Istanbul) and shopping malls are major examples of the other facilities located underground (Hein, 2016).

In Rotterdam too, the underground provides fertile terrain for public works. For underground infrastructure projects in Rotterdam, however, the relationship with water is pertinent. Situated in the polder landscape of the Western part of the Netherlands, Rotterdam sits

below sea level. It even includes the lowest place of the Netherlands – 6 meters below sea level – within its urban area. This could have been a reason to hesitate going underground, but water above ground played a role in deciding otherwise. The Nieuwe Maas divides Rotterdam in two, and the need for mobility raised the question of how (and where) to cross it: by ferry, bridge or tunnel. Tunnels are much more expensive and complicated to build, but a strong lobby promoted them in Rotterdam: the powerful shipping companies feared that bridges would either limit the height of ships or would cause delays in transport traffic on the river (Berkers et al., 2019: 17-18). The width of the Nieuwe Maas (ranging from 265 – 465 meters) also played a role in pushing underground solutions to cross-river mobility.

The project of building the Maastunnel started in 1937, and - despite the start of the German occupation and the bombing of Rotterdam on May 14th 1940 - the tunnel project was completed in 1942. This underground infrastructural work is interesting for its technological challenges, but also for how it highlights the social history of Rotterdam. It shows clearly which lobbies were involved; how the governors of the city negotiated with state authorities, notably Rijkswaterstaat; how the interests of laborers traveling to the harbors on the south bank were weighted; and how different forms of mobility – cars versus bicycles – were taken into account

and catered for. As the Netherlands' first underwater road tunnel, the Maastunnel was primarily built to facilitate car mobility (Ovenden, 2019:122). However, there was also a significant lobby, consisting of employers in the harbor and a Dutch interest group for cyclists (Algemene Nederlandsche Wielrijders-Bond, A.N.W.B.), promoting additional tunnels for bicycles. In the end, an option was chosen with two extra tunnel tubes, for bicycles and pedestrians, a solution car-lobbyists agreed giving their expectation that once cycling would become obsolete these tunnels could be adapted for car traffic (Berkers et al. 2019: 18).

In Rotterdam, as in other metropolitan areas, underground transport infrastructure often serves multiple purposes, as the metro-lines illustrate. Renovations of the Metro station of Wilhelminaplein, located at the 'Kop van Zuid', aimed to extend its functionality to include a business center, apartment buildings and recreation facilities (Durmisevic, 1999: 240).

Moreover, urban planners have started to prefer the integration of underground and above ground spatial functions. Despite the lowlands' challenges, high population density gave an important push towards going deeper in the Dutch Randstad. To build more compactly, the city's vertical line could be used more efficiently by fully integrating the underground with the aboveground lay-out and characteristics (Durmisevic,



*Bikers on the escalator
at the Maastunnel,
Rotterdam.
Photographer Pot,
Harry. (© National
Archives. Source:
Collection / Archive
Photo Anefo, 1953;
[https://www.
nationaalarchief.
nl/onderzoeken/
fotocollectie/
a909b436-d0b4-102d-
bcf8-003048976d84](https://www.nationaalarchief.nl/onderzoeken/fotocollectie/a909b436-d0b4-102d-bcf8-003048976d84))*



The shopping passage, referred to locally as the 'Koopgoot', that link two important shopping streets, Lijnbaan and Hoogstraat, via the Beursplein underground metro station. (Photo by Paul van de Velde. Source: <https://pxhere.com/en/photo/584292>).

1999: 239). Of course, building under an existing built environment necessitates integrated planning; a street-plan of a city is a major determinant for how subsurface infrastructure and surface worlds are tied together and vertical mobilities organized.

Beursplein is an excellent example of integrating underground and overground spaces for the purposes of mobility and shopping. Shopping underground in extended annexes of the tube station is brought

in sync with the shopping area above ground, significantly – or maybe better notoriously - called 'Koopgoot', the 'Buying gutter' [1].

In this area of Rotterdam, underground infrastructural works have been so prominent that an agreement was made in 2019 to leave the underground to rest as much as possible for the coming years [1]. The intensity of vertical developments in the city of Rotterdam are portrayed in an e-book published by the Municipality entitled 'De Ondergrond van Rotterdam'.

Cross-section Coolsingel in "De Ondergrond van Rotterdam". (© Gemeente Rotterdam. Source: <https://www.rotterdam.nl/wonen-leven/ibook-ondergrond/>).





The Markthal, landmark shopping market in Rotterdam. (Photo by Mike van den Bos. Source: <https://unsplash.com/photos/fbQv3cx--bM>).

Underground as Archive

In the landmark shopping market, the Markthal, vertical connections are highlighted explicitly. The unique horse-shoe-shaped structure, designed by the famous architect Winy Maas, has eleven stories housing offices and apartments.

On ground level we find the market stalls and shops, but the basement holds a large car park. The Markthal itself has been built on top of an eleventh

century village (near the river Rotte). Prior to the building of this infrastructure, archeological digs had been carried out, whose key finds are displayed in a museum called De Tijdtrap, The Time Stairs. The display follows the descending line of the escalator: the further down, the older the objects on display. Visitors literally walk back in time as they descend to their cars after shopping (Ovenden, 2020: 125).

This fantastic display exemplifies the temporal dimension of the underground of Rotterdam.



The Time Stairs. Visitors walk back in time as they descend the escalator to their cars after shopping. (© Sabine Luning).

The YouTube link presents the story of the exhibition and the archeological finds. On the lowest level, -4 of the parking lot, the story of the predecessor of Rotterdam, Rotta, is told. Some 950 years ago, the first farmers settled on the raised areas along the river Rotte, a bog river which flowed into the Nieuwe Maas. In the course of time, the land flooded more and more frequently and the farmers were unable to maintain their grounds for cultivation. Eventually, the site submerged temporarily, until the 13th century when new waterworks (notably the rotte-dam) were constructed, which mark the beginning of Rotterdam as we know it today.

The Tijdtrap demonstrates how a whole history of settling and farming lies hidden beneath our feet in Rotterdam.

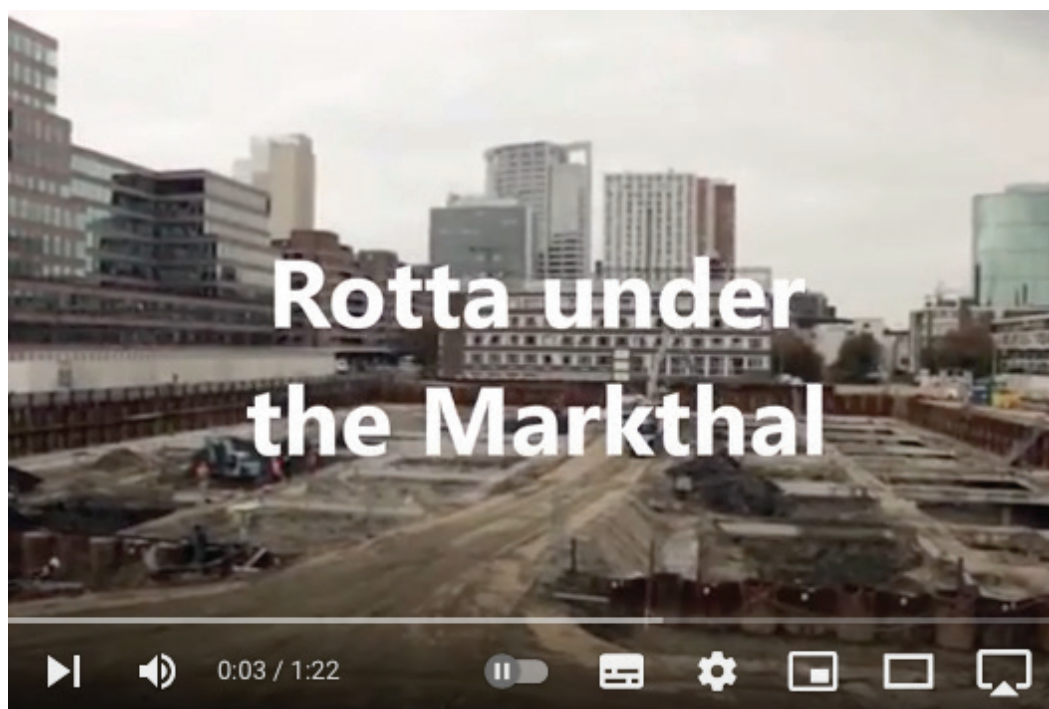
Nowadays, whenever large infrastructural works are envisaged and planned, archeological digs and research need to be carried out to inspect the underground for archeological remains [2]. In Rotterdam this is the task of the Bureau Oudheidkundig Onderzoek van Gemeentewerken Rotterdam (Office for Archeological Research of Public Works in Rotterdam) [3]. The acronym of this municipal service is BOOR, which means 'to drill' in Dutch.

The YouTube film mentioned above is one of the outputs of BOOR. So is the very nice book entitled "Ontdekt! Vijftig jaar archeologie in Rotterdam en Omgeving" (Carmiggelt and Trierum, 2010). Again,

the title contains a pun: the Dutch word for "discover" is literally un-cover (ont-dekt). The book details finds from fifty infrastructural sites, for instance the sluices found on the construction site of the underground railway, the Willemsspoortunnel, in the early nineteen nineties (idem: 86-7). The flooding in the 12th century detailed in the Tijdtrap was followed by (re)building of dykes along the Nieuwe Maas. The high dam which was built in the Rotte marks the beginning of the city of Rotterdam. The height of the dam provided protection, but also inhibited the necessary discharge of water from the Rotte into the Nieuwe Maas. Sluices, with doors which opened and closed in sync with the tides, were built to regulate water's entry and egress. These excavations detail how Rotterdam's past was marked by water challenges and notably the issue of finding the right levels.

Verticality and Futures

Vertical dimensions of water have defined Rotterdam's past and are also influential for its present and future. Han Meyer (Meyer, 2021) describes how the Rotterdam port region is part of the Rhine-Meuse delta, a system of rivers regulated by dikes, dams, locks and weirs. Dredging has been a central technique for creating this, which he calls a "hydraulic machine". Meyer (Meyer, 2016: 110-115) analyses the cultural values which became attached in the Netherlands to in-depth dredging, a key technology for digging canals and reclaiming land. He describes, for example, the



Screenshot of Rotta under the Markthal. This video is part of the Travel tour: Medieval Rotterdam Walk. (Source: Archeologie Rotterdam; <https://www.youtube.com/watch?v=UtS8eu7yUcA>).



Cover of the book *"Dredge, Drain and Reclaim: The Art of a Nation"*. (Johan van Veen, Springers, 1962).

book *"Dredge, Drain and Reclaim: The Art of a Nation"*, written in 1948 by the water engineer van Veen (Van Veen J., 2012).

The book aimed to provide an inspiring narrative for a nation coming out of war. The heroic description of how to work with water and reclaim lands would swing the mood from defeat into proud nation building. Canalization and controlling water became a metaphor for victory and mastery.

In the current situation, in which we are confronted with the sinking land and rising water, however, the value of dredging needs reconsideration. Meyer raises this issue in the light of the upcoming celebration of 150 years of the Nieuwe Waterweg in 2022. Together with architects and organizations for nature conservation, he argues that continued dredging of the Nieuwe Waterweg is not sustainable. The attempts to master nature have clearly occurred at the expense of it. Rather than artificial channeling and confining water surfaces on the basis of in-depth technologies, we should work towards more collaborative interweaving of natural and technological processes, he writes. And this leads him to a case for the un-deepening of the Nieuwe Waterweg.

This reconsideration of the values attached to the vertical digging of waterways resonates with new

currents in the study of navigation dredging, notably in geography and anthropology. These analyses interrogate the implications of deep harbor building for accommodating megaships.

The first focus of concern is place-based and looks into ecological effects for deltas, quite similar to Meyer's arguments regarding the Rhine-Meuse delta. Secondly, the concerns extend to larger global processes: since deep-water dredging projects aim to facilitate rapid worldwide developments in shipping and the logistics industry, localized dredging is bound up with global-political economic processes (Carse and Lewis, 2020: 3). In addition to serious concerns about localized ecological systems, this in-depth technology raises questions about global redistribution of economic benefits. How do deep harbor developments and shipping channels reshape global networks, and how is digging deep expressive of the belief in worldwide economic growth?

Clearly, redressing future values for people, planet and profit requires vertical perspectives on port regions and how these are implicated in wider in-depth geopolitics [4]. The case of Rotterdam brings home how a view from below is needed to understand and guide movements from past and present to the future of Rotterdam and also for other port cities around the globe.

Notes

[1] In this area of Rotterdam, underground infrastructural works have been so prominent that an agreement was made in 2019 to leave the underground to rest as much as possible for the coming years, a so-called Graafrust agreement (<https://www.evides.nl/over-evides/nieuws/2019/9-partijen-tekenen-voor-graaf-frust-coolsingel>; <https://www.rotterdam.nl/bestuur-organisatie/archeologie/>).

[2] A law introduced in 2007 obliges all Dutch municipalities to take care of its archeological heritage (Carmiggelt and van Trierum, 2010).

[3] <https://www.rotterdam.nl/bestuur-organisatie/archeologie/>.

[4] A term we originally coined for the study of gold mining practices in Ghana (Luning and Pijpers, 2017).

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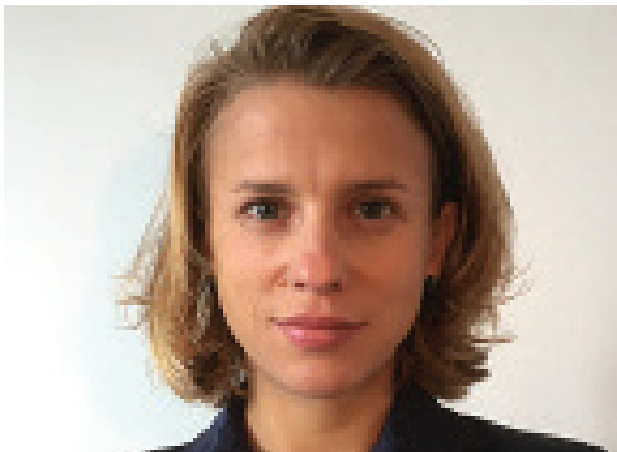
DRIVING FORCE FOR CROSS-BORDER COLLABORA- TION: POSITIONING PORT-CITY REGIONS IN THE EURODELTA



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View of Port of Rotterdam and Kop van de Beer. (© Danny Cornelissen; Source: Port of Rotterdam Authority, 2020).

The Eurodelta is a densely urbanised megaregion with approximately 45 million inhabitants. It is an area with a common history and mind set, i.e. the Rhineland model [1] (Roadmap SURE-Eurodelta, 2020). With shared challenges and urgencies within this territory on the subject of corridors and transport, it is important to commit towards improving the interrelationship between ports and cities.

The aim of the transport corridor development and high-speed rail network is to improve the synergy and connection between metropolitan regions in North-western Europe by realizing the concept of 'borrowed size' [2]. This is in line with finding new and sustainable ways to better connect and integrate the region.

Besides the larger and busier ports like the Port of Rotterdam, Antwerp and Hamburg, a variety of other hinterland and inland ports are equally important to this megaregion. Eurodelta brings forth an interesting combination and division of roles and responsibilities between the seaports and inland ports, addressing a shared sense of urgency. However, they lack a structural framework of collaboration. This article will explore the positioning of Rotterdam as a strong seaport that enables connections to other smaller ports, thus facilitating important port-city relations in the Eurodelta.

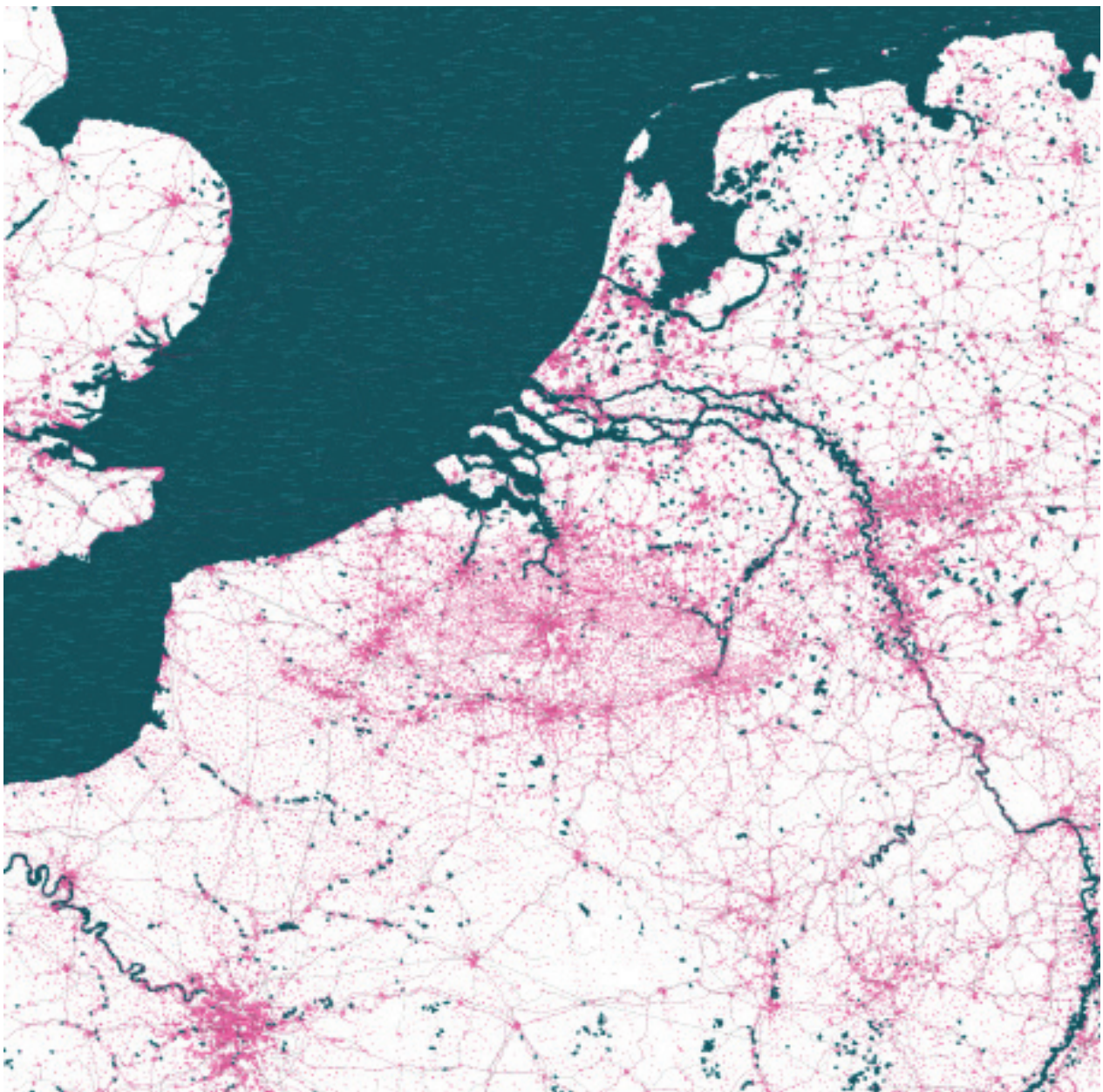
Context and urgency

Currently, the territory of the Eurodelta encompasses cities and regions from five countries. The borders of this territory are blurry and not sharply defined due to its vast connectivity of the European waterway-system. Rather than one major city, the Eurodelta is made up of a lot of medium-sized cities which are geographically, culturally and economically interwoven, forming an economic centre and entry way to Europe. About 50% of the total trade of the region goes between at least two of the three regions, making it an important scale to address the common challenges of the delta. It represents a core region in Europe with shared values and challenges and is embedded in a network of transnational transport corridors (TEN-T) [3]. Additionally, seaports are essential for the 'Blue Economy' and for maintaining global trade and development, with the port of Rotterdam at the forefront. The latter is a global hub for the trade of goods, services and knowledge, but at the same time, transport (particularly through the ports) is responsible for a large share of CO₂ emissions in the region. Therefore, decarbonising the maritime transport sector and ensuring sustainable and circular flows is crucial moving forward.

This is urgent not least because ports like Rotterdam are particularly exposed to various impacts of climatic hazards, such as rising sea levels, storm surges, waves and winds, riverine and pluvial flooding etc. due to their seaside location (UNCTAD, 2021).

These major events are expected to increase in intensity and frequency according to future climate predictions and scenarios. Increased sea-levels due to global climate change pose a critical threat to the sustainability of future port and port-city regions. Thus, the physical and economic damage of such climate-related extremes will adversely affect the functionality of ports and liveability in port-city regions.

Strengthening collaborations and economic instruments can help provide flexibility in addressing the negative environmental impacts of climate change - especially related to shipping and port activities. However, a lack of global framework, and transnational cooperation such as monitoring and enforcing (for example, a tax on the real SO₂, NO_x, or noise emissions from each ship) make it difficult for ports to take concrete actions in addressing climate change impacts (Woo et al., 2018.). Thus, regional cross-border collaboration particularly at the Eurodelta scale as well as cooperation between the inland ports is a crucial step in dealing with global climate change impacts.



Eurodelta agglomeration. (Map by Vereniging Deltametropool, 2020).



Trade of goods via Europahaven, Port of Rotterdam. (Photo: Frans Berkelaar; Source: <https://pxhere.com/en/photo/531641>).

Ports as drivers for urban and regional growth

Regional urbanization in the Eurodelta has produced economic growth and urban sprawl. This leads to spatial impacts on local development, which is undergoing severe stress due to lack of space, with irreversible impacts for port development.

Due to port regionalization, imbalances in port capacity and the competition in broader geographical regions form the key drivers of cooperation between ports. Congestion reduction in and around port areas is expected to enhance balanced multimodal transport solutions (Lonza & Marolda, 2016). Therefore, it can be argued that cross-border and inter-metropolitan cooperation between ports can contribute to achieving the targets for sustainable growth for 2030 and 2050 faster (Inception report, ESPON STISE, 2021). It is necessary to have policy and governance cooperation to develop future territorial policies regarding sustainable maritime transport infrastructure. Ports and port-city regions in the Eurodelta are key players in achieving sustainable growth (incl. air quality, climate and energy targets).

Green Ports: Efficient production contributes to a sustainable economy

The ambition of the European Commission is to develop sustainable transport in Europe by reducing

CO2 emissions by 60% between now and 2050 and by establishing a 30% modal shift to rail and waterways. The growth of electricity-powered operations in ports (e.g. green hydrogen) can be a key driver in bringing down emissions. Stakeholders in the port community are increasingly investing in greener technologies to run production more efficiently. Endorsed by the Dutch Ministry of Infrastructure and Water Management, the initiative RH2INE seeks to realise market-ready hydrogen applications along one of EU's oldest core network corridors, i.e. The Rhine-Alpine Corridor. To realize such transformational differences for ports, digital investments are necessary. Understanding the port's carbon footprint and how to reduce power and space consumption of all port stakeholders is key to a sustainable economy. Ports can make investments in 'Just in Time (JIT)' arrival by communicating relevant information, so that the handling of goods can be optimized. Broadly, it can be argued that the formation of regional port associations (joint ventures) along core waterways are on the rise because they offer tri-modal transport solutions which allow for bundling of capacities and operations and strengthen their position towards sea ports like Rotterdam, Antwerp and Hamburg.

Climate strategies enforce environmental sustainability in port cities

In terms of environmental sustainability, waterfront cities along the Rhine are experiencing growing



Carbon emissions from the Port of Rotterdam and the cityscape. (Photo: Frans Berkelaar; Source: <https://www.flickr.com/photos/28169156@N03/26613492231>).

challenges in relation to climate change. In the exemplary case of Deutzer Hafen, an old industrial harbour area in Cologne, Germany, the port area is planned to transform from industry to a lively and sustainable neighbourhood, integrated into the cityscape. By meeting the water design challenge, the new planning of the neighbourhood showcases examples of how water challenges and port infrastructure can be turned into water resources on an urban scale (COBE, 2021). Similarly, Liège Trilogiport, a tri-modal logistic area of 100 ha located along the

Albert Canal, forms a buffer between the logistic platform and inhabited areas. In this zone, community gardens, biking paths, and walking areas coexist through a state-of-the-art environmental approach which was developed in collaboration with residents' representatives (ConnectingCitizensPorts21, 2021). In this regard, it is important to emphasize the strong will and ambitions of project stakeholders (coalition of the willing), who are committed to combining economic development, citizen's well-being and preservation of the living environment.



The after-effects of the floods in the city of Cologne. (Photo: Frank Robben; Source: <https://www.hippopx.com/en/flood-cologne-tree-in-water-river-tree-water-309807>).

Conclusion

To conclude this discussion paper, three strong directions from a research and practice point-of-view are recommended:

- Laws and regulations tend to obstruct sustainable port-city relations and projects. The local and national government hold a tremendous responsibility towards the cross-border exchange as well as creating beneficial relations with the adjacent regions (Daamen and Vries, 2013).
- Innovation, knowledge transfer and exchange - Emphasize port development research and cross-border collaboration within Eurodelta. The main focus should be on creating the narrative, tools and community of knowledge.
- Collaboration at three scales, domestic (between

the port and the city/regions), horizontal (between port cities to port-city regions) and vertical (between seaports and inland ports).

All these directions answer to “How can collaboration of Eurodelta ports spearhead in taking actions to address climate change?” By sharing some of the inspirations and best-practice examples, the aim of this article is to create a sense of urgency among all Eurodelta ports. This is the first step to strengthen their identity as port cities and promote port-city-regions to shape their accessibility and visibility in the megaregion and in Europe. A strong collaboration between inland ports and seaports (such as Rotterdam) is necessary for the development of hinterland connectivity and regional networks, thus enabling the green transition in the Eurodelta.

Notes

[1] The Rhineland model is defined as a management approach based on concepts of cooperation, consensus, social justice, and serving the interests of multiple stakeholders with long-term sustainability of a main goal.

[2] 'Borrowed size' is an emerging policy concept in several European countries. It occurs when a city or metropolitan region possesses urban functions and/or shares economic/ spatial/ infrastructural benefits normally associated with larger regions. This is enabled through interactions in networks of cities across multiple spatial scales.

[3] The Trans-European Transport Network (TEN-T) policy addresses the implementation and development of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. The ultimate objective is to close gaps, remove bottlenecks and technical barriers, as well as to strengthen social, economic and territorial cohesion in the EU.

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IT'S TIME FOR A THIRD MIRACLE OF ROTTERDAM



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special attention to the search for a new balance between urbanization processes and climate change in vulnerable deltaic territories. More information can be found on www.deltastad.nl.



Aerial view of a possible future of the Rotterdam region, seen from the East to the West, with the New Waterway and port landscape as a central green-blue axis. (© Bureau Strooming).

At the end of the nineteenth century, a miracle took place in Rotterdam. Until then, this port city was slowly languishing. Elsewhere in Europe, the industrial revolution led to an enormous growth in economic activity and a need for more and deeper waterways. Rotterdam, however, could only watch

meekly as the river *Nieuwe Maas* (New Meuse), which connected the port to the sea, slowly but surely silted up (see following image). The port gradually became inaccessible to the ever larger seagoing vessels. The city's harbor basins had not been renovated and enlarged for over two hundred years.



Aerial view of the mouths of the rivers Rhine and Meuse ca. 1850, before the construction of the Nieuwe Waterweg, seen from the west. The percentages indicate how the discharge of the rivers Rhine and Meuse is distributed to the different distributaries of the Rhine-Meuse delta. (© H+N+S Landscape Architects).

But in 1872 **a miracle** happened. In that year the first steamship, the Richard Young, sailed through the *Nieuwe Waterweg* (New Waterway): an artificial connection between the sea and the port of Rotterdam designed by engineer Pieter Caland (see following image). The project was accompanied by much discussion and differences of opinion about whether this new, fabricated estuary would really improve the discharge of the river and the accessibility of Rotterdam. The then Prime Minister Thorbecke called the project 'a risky venture'. But the venture turned out

pretty well following a number of improvements made in the first decades. It gave rise to an unprecedented, explosive growth of port and city, making the port the engine of the Dutch economy. The construction of the *Nieuwe Waterweg* was not unique, however. New excavation and dredging technology made the digging of new shipping canals and the deepening of river estuaries possible all over the world during the same period. New navigation routes became possible because of projects such as the Suez Canal (1869) and a few decades later the Panama Canal (1914).



The Rhine-Meuse delta after the construction of the Nieuwe Waterweg, ca. 1900. (© H+N+S Landscape Architects).

A **second miracle** of Rotterdam took place after World War II, when the destroyed city rose like a phoenix from its ashes and became the symbol of the reconstruction and modernization of the Netherlands. Next to the reconstructed inner city, a new industrial port complex alongside the *Nieuwe Waterweg* became the beating heart of this modernization. Deepening the shipping canal and providing two secondary parallel canals (the *Calandkanaal* and Hartel canal) were key factors in this process. Moreover, the Delta works (constructed after a disastrous flood in the Rhine-Meuse delta in 1953) completed the *Nieuwe Waterweg* as the main discharge channel of the Dutch river system (see following image). These works also

created the large fresh water basins necessary for processing industries. Rotterdam became the second largest petrochemical cluster globally and was the largest port in the world during the period 1962-2004. Rotterdam owed this position in particular to the transshipment, storage and processing of fossil fuels, whose functions occupy more than 60% of the current port area.

However, climate change and the energy transition are forcing Rotterdam to reconsider its role in the national and international system of transporting raw materials and energy supplies. A new, **third miracle** is needed for the Rotterdam of the future.



The Nieuwe Waterweg after extension of the port area and construction of the Delta works, current situation. (© H+N+S Landscape Architects).

The *Nieuwe Waterweg* could once again hold the key to that miracle. Next to industrial development and economic prosperity, the construction and frequent deepening of this shipping canal has also led to problems that will only increase in the near future. The transformation from a natural estuary to an industrial shipping canal has led to the loss of the natural ecosystem of this part of the delta, which is essential as a breeding and feeding area for migratory birds and migratory fish. It has also led to a greater influence of the sea on the urbanized region of Rotterdam, resulting in higher water levels and greater salt intrusion. Because of an expected acceleration of sea level rise, this influence of the sea in the urban region will increase dramatically in the future.

From a spatial development perspective, the port complex along the *Nieuwe Waterweg* has started to

function as a 40-kilometre-long corridor that hinders a coherent and sustainable development of the Rotterdam – The Hague region.

As an answer to these problems, the proposal '*The Rhine mouth as an estuary*' was launched recently [1]. The central statement of the proposal is that the estuary character of this river mouth should be repaired by stopping the process of continuous dredging. Allowing the process of sedimentation will result in a shallower river channel with more gradual transitions from land to water. This will create new opportunities for a restoration of the estuary character of the river mouth, with more natural wildlife and biodiversity, more natural protection against high water and salt intrusion, and better conditions for new spatial coherences and attractive urban patterns (see following image).



A possible future: the Nieuwe Waterweg can be transformed into a shallow estuary, while the Caland kanaal can be maintained as a main entrance to deep-water port terminals. (© H+N+S Landscape Architects).

This nature-based approach, however, will indeed require a serious adaptation of the port and related industries. We argue that this adaptation is inevitable because of the urgency of the energy transition. This new approach to the river mouth can function as an accelerator of the necessary processes of the energy transition and the building of a more circular and sustainable port economy. Instead of considering economic development as the leading force to which the natural environment should be adapted, we should reason the other way around: for the sake of mother earth, we should give absolute priority to a sustainable natural system, and adapt economic development to this system.

‘The Rhine mouth as an estuary’ creates the possibility to combine different agendas concerning the natural environment, water management, economic development and urban planning. It states that a ‘nature-based solution’ is necessary and possible, also for this artificial river mouth. It will create the

start-condition for the third miracle of Rotterdam.

Because many port city-regions are struggling with similar problems, the project is relevant to international debates on the future of port cities and delta regions. The Dutch Delta Program, which is responsible for water safety in the Netherlands in the short and long term, has taken the proposal into consideration as one of the possible future scenarios for the Netherlands. With Rotterdam being the largest port of Europe and the Netherlands a frontrunner on water management, the New Waterway can, once again, become an inspiring example for port cities, deltas and estuaries worldwide.

Fall 2022, the 150th anniversary of the New Waterway can be celebrated. It is the reason for the PortCityFutures Center to organize a conference on the history and future of the New Waterway and comparable shipping canals all over the world.

Notes

[1] The proposal has been presented by Han Meyer, ARK Natuurontwikkeling, World Wildlife Fund and H+N+S Landscape Architects. <https://www.wwf.nl/wat-we-doen/actueel/nieuws/meer-natuur-ondieperingmonding>.

ARCHIPELAGO OF KNOWLEDGE: A DIFFUSE CAMPUS



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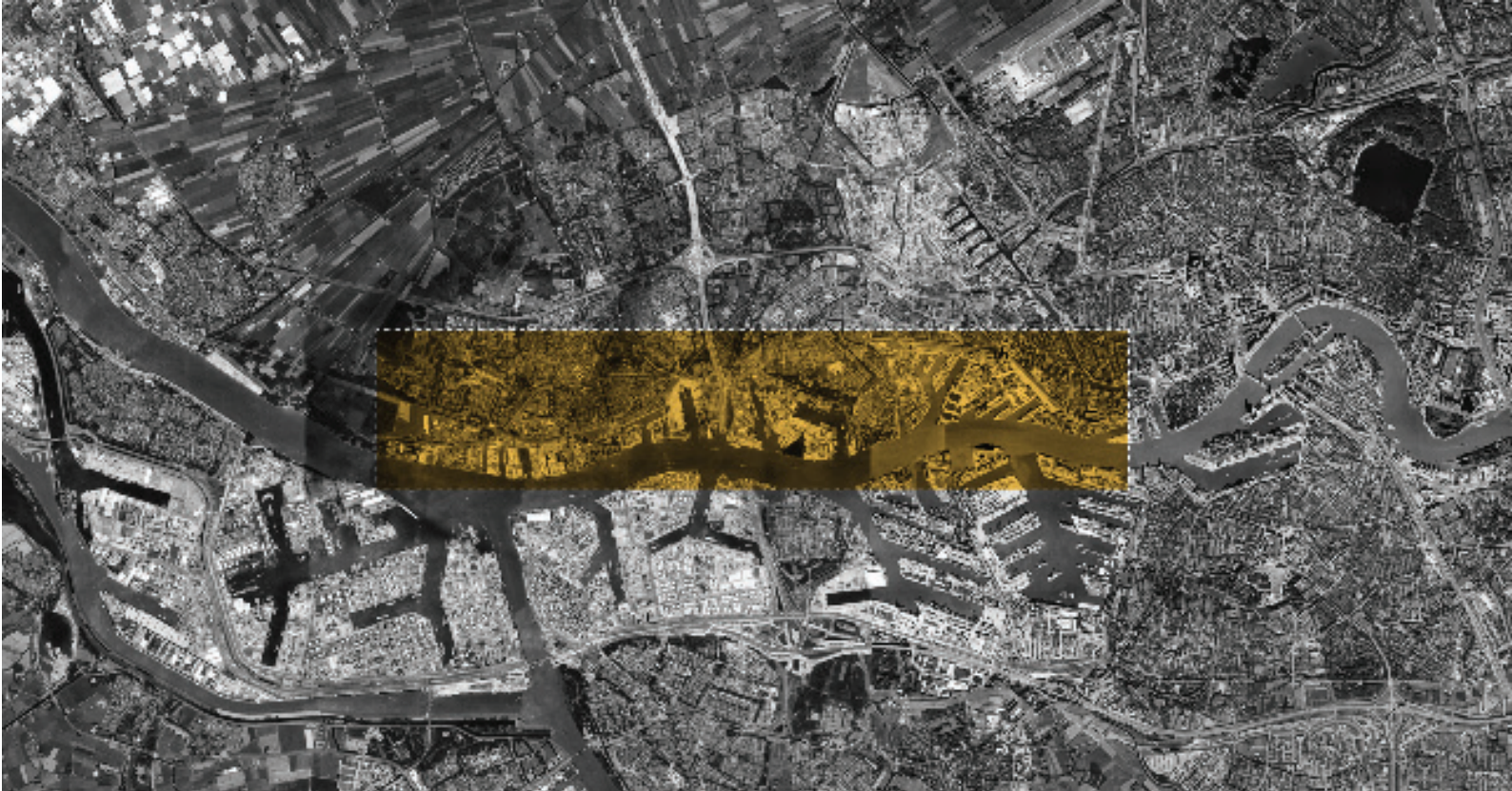


Port of Rotterdam. (©JGF/ph. Jacopo Gennari Feslikenian).

The Archipelago of Knowledge is a new spatial strategy for the Port of Rotterdam, the Netherlands, that aims to reconsider the relationship between harbor and city. Through the redefinition of areas within the port, our proposal aims to create a series of artificial islands by digging new canals, multiplying waterfronts and subsequently enabling the formation of a continuous, 100% public accessible, waterfront. The urban and ecological potential embedded in the direct relationship between city and water, is re-established and enhanced, benefitting both citizens and the maritime clusters. The new linear waterfront finally brings water back to the city – a city that often lacks a direct relationship with its largest water body, the Maas River, despite its close proximity and historical and cultural significance.

The waterfront can become a shared space where the interests and needs of various stakeholders are confronted and negotiated, in order to find points of

intersection and mutual interest that can be reflected in the new spatial configuration. In our vision, this port area becomes an archipelago, where new islands are spatially defined areas where economic and planning scenarios can unfold through time. Although their shape is fixed, their program, be it maritime, commercial, residential or recreational, can adaptively occupy the space according to future economic trends, political and logistic decision making processes, ensuring a new beneficial relationship between port and city. Port expansion has always implied dramatic transformations of the river landscape, of geographic proportions. As a matter of fact, the port has expanded and transformed through time, occupying more and more surface and reducing the public accessibility to the river. The time has come, now, with changing conditions of the port economy, to re-orient land transformations to the advantage of the city, people and biodiversity.



Area of the Spatial Strategy. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

Focus area | a condition rather than a location

The settlement patterns on the North and South bank of the Maas River are uniquely distinct. On the South bank of the Maas, the municipalities can be described as islands, largely isolated from each other

and surrounded by industrial land-use. The North bank of the Maas, our study area, is defined by a more continuous urban pattern, where municipalities are well connected on a local and regional scale by more efficient transportation systems. This area is characterized by co-existence of industrial with a continuous urban fabric, a robust water system and a higher degree of public accessibility to water.

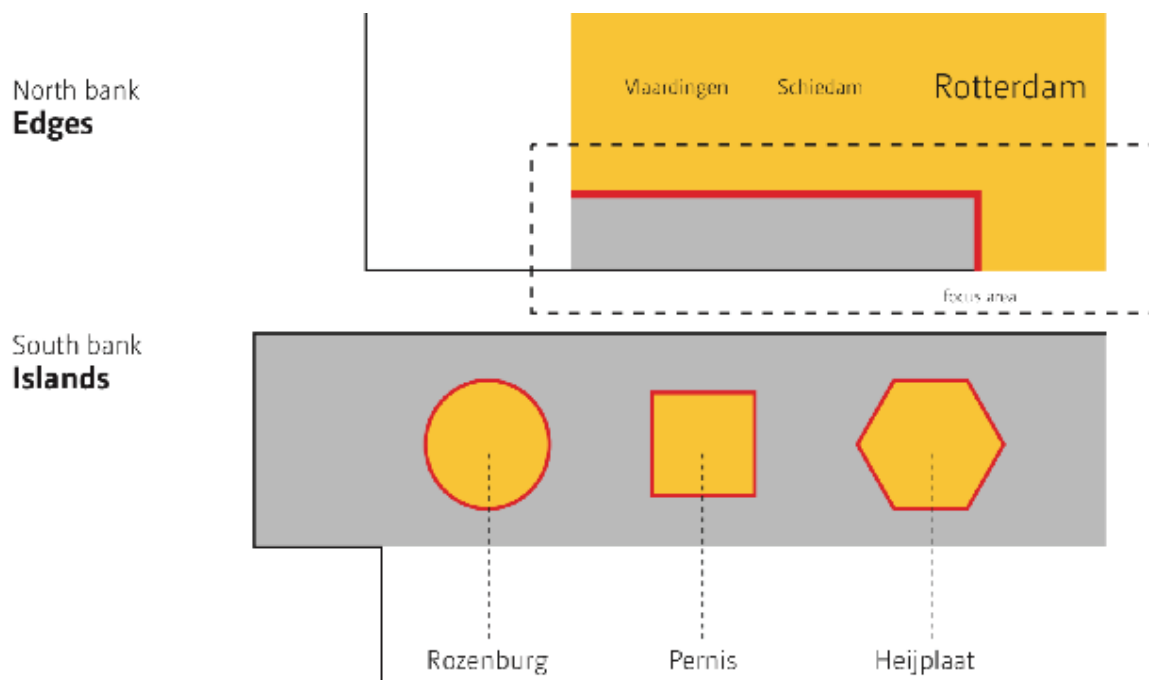


Diagram of diverse conditions between North and South bank of the Maas River. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

A Case | learning from Unilever

Studying existing cases of major spatial transformation within our study area, is important for understanding the dynamics of specific entities and how their past, present, and future operations and decisions relate to the attractiveness (or lack thereof) for the port of Rotterdam.

A relevant example is the company Unilever that has left the port area, perceived as industrial and disconnected. It has recently partnered with Wageningen University to relocate its global Foods Innovation Centre. It has recently partnered with

Wageningen University to relocate its global Foods Innovation Centre to the Wageningen in favor of the rich scientific environment of the campus and an area that is often referred as "Food Valley".

This decision raises several questions and serves to understand relations between a specific multinational company and the port, more in depth. Unilever left the port area, perceived as industrial and disconnected, in favor of the rich scientific environment of the campus. While the benefits from the newly-established proximity to the university are many, the benefits of its former connection to the port infrastructure and its unique identity, are lost.

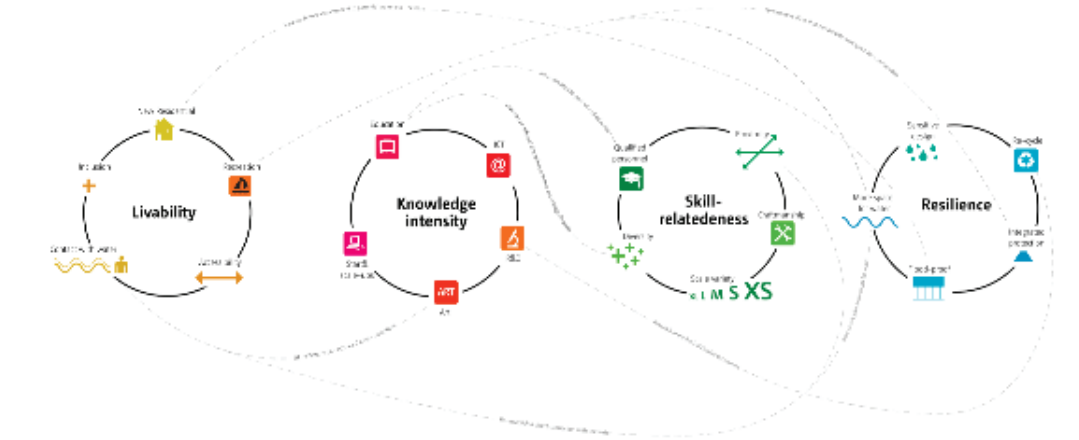
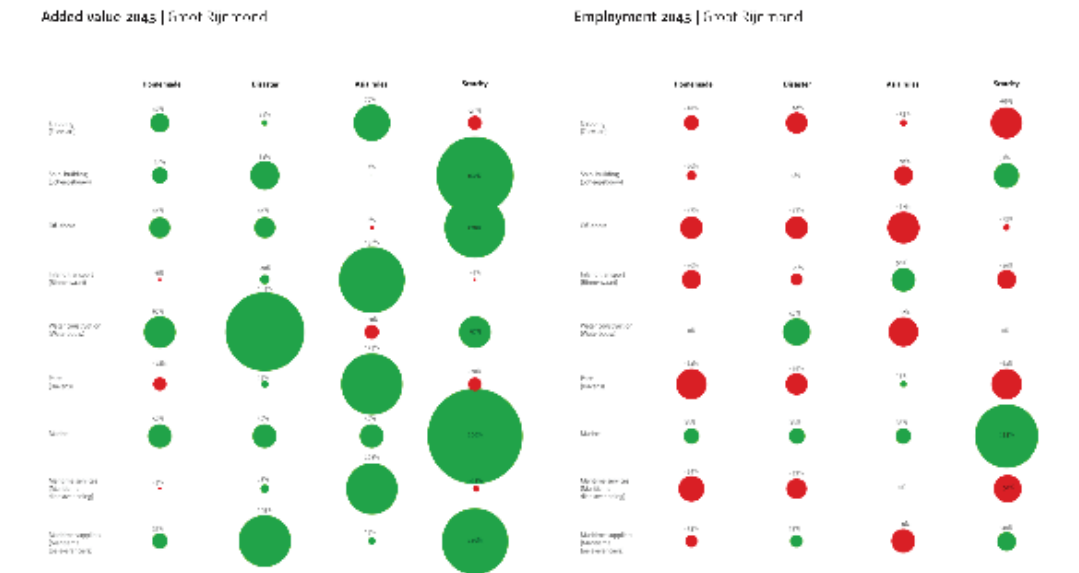
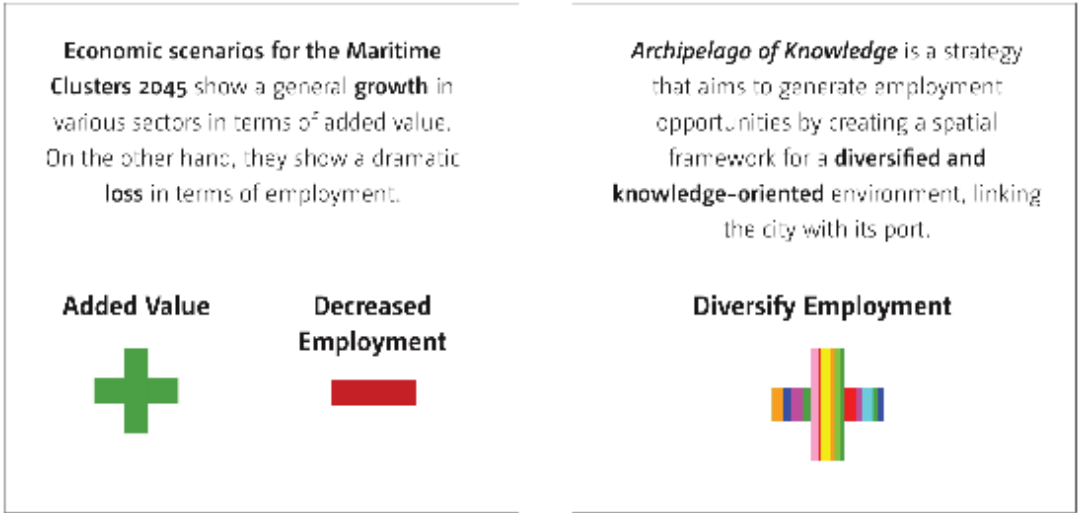


Former Unilever HD, Vlaardigen. (Photo: © JGF|ph. Jacopo Gennari Feslikenian).

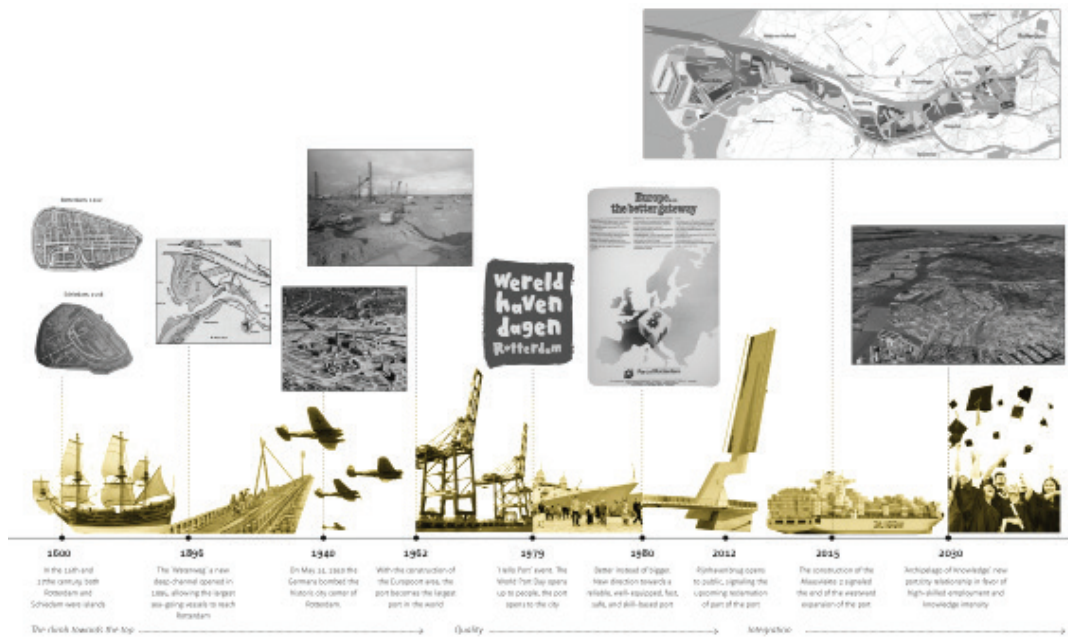
Goal | new and diversified employment opportunities

The departure of Unilever seems to align with a study on economic scenarios for the so-called maritime clusters in South Holland with a perspective of 2045 [2] that project a dramatic loss in terms of

employment (as well as a general growth in various sectors in terms of added value). Responding to those scenarios, our vision "*Archipelago of Knowledge. A diffuse campus*" is a strategy that aims to generate employment opportunities by creating a spatial framework for a diversified and knowledge-oriented environment, linking the city with its port.



Archipelago of Knowledge goals (top figure). Maritime clusters 4 Scenarios (center figure). Principles about people, knowledge and environment (bottom figure). (© Openfabric in collaboration with KartonKraft Mauro Parravicini, Noha, Move Mobility).



Port of Rotterdam Timeline. (@ Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

Path dependency | about time and decisions

Such a proposal engages with recent discussions in the field of port city research related to path dependencies and ways to initiate new path ways in order to define a new, stronger, spatial relation.

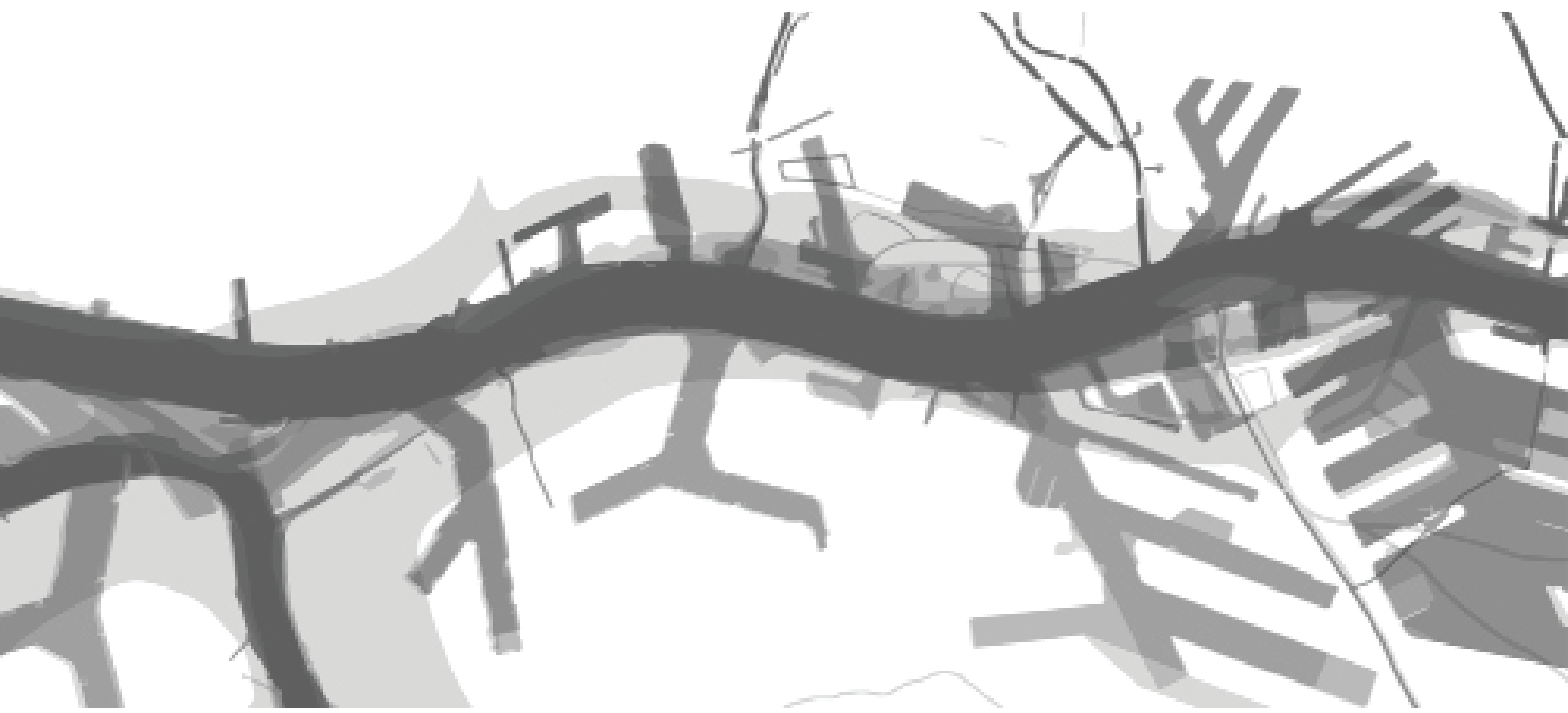
“Diverging interests of both the city government, Port Authority, and the regional and national governments lead to the emergence of two independent spaces (port and city) governed by separate sets of institutions, tools, methods, laws, ideas, and even different time frames” (Paolo de Martino) [3]. In the last few decades, though, there have been ideas and campaigns addressing the need for integration

between city and port. Now, the long- lived path dependence needs to be ‘broken’ in order to define a new, stronger, spatial relation.

A dynamic past

Port expansion has always implied dramatic transformations of the river landscape. The port has expanded and transformed through time, occupying more and more surface. The time has come, now, with changing conditions of the port economy, to re-orient land transformations to the advantage of the city and its people.

A dynamic paste, River Maas from 19th century to today. (@ Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

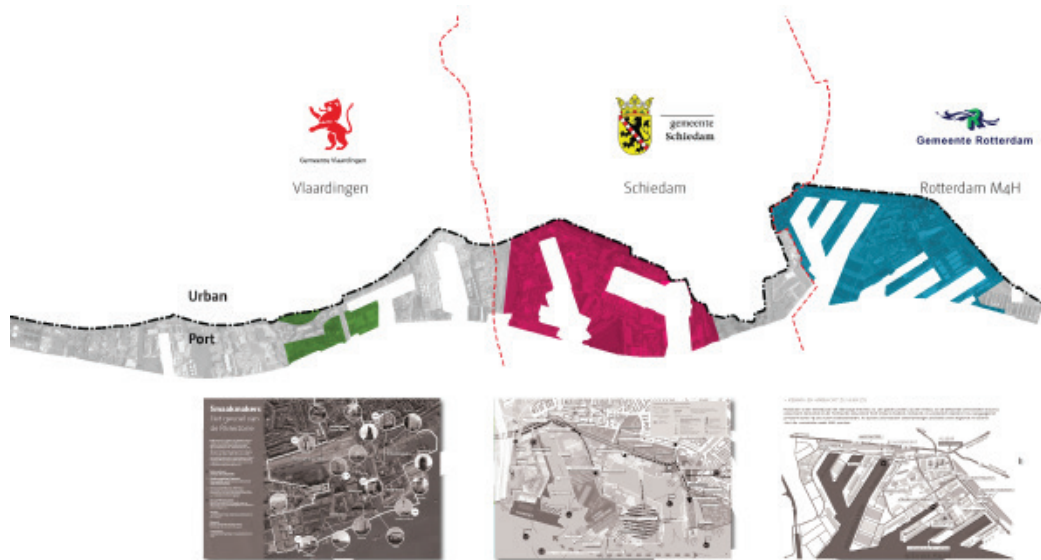


Fragmentation | lack of integration

The municipalities of Rotterdam, Schiedam, and Vlaardingen, despite being generally well connected in terms of urban fabric and transportation networks,

each have distinct plans and approaches that drive the future developments of their waterfront.

These plans can be considered 'balconies' to the Maas; they are independent, creating a fragmented edge.



Administrative boundaries in the study area. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

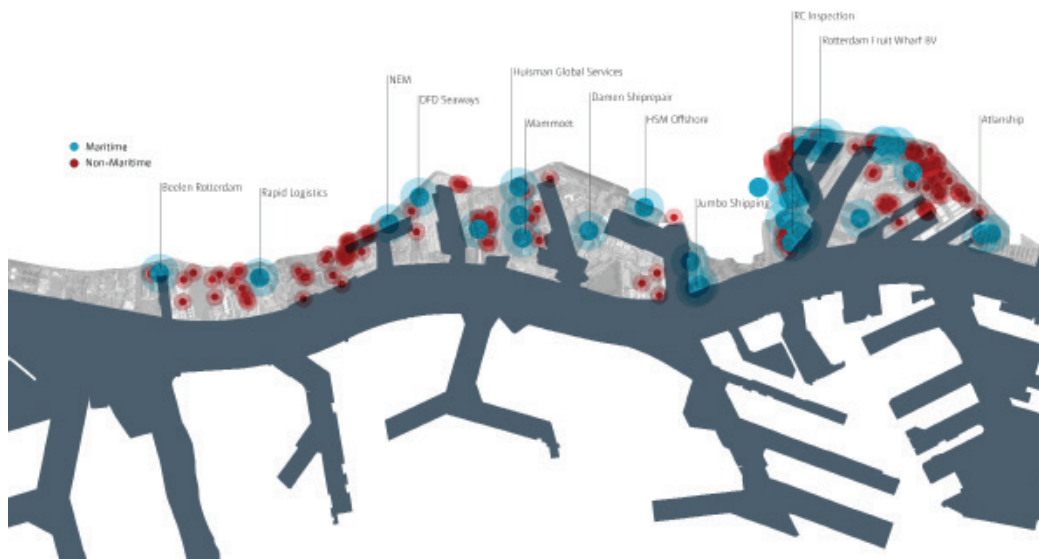
Mobility

Public transportation systems create strong connectivity in the port area. On the north side of the study area, the existing railway line has been

transformed in 2017 into a metro system linking Rotterdam, Schiedam and Vlaardingen. On the south side, the Maas is currently used by water-taxi and water-bus lines for public transportation on the river, and bears a great potential of being further developed.



Water accessibility in the study area. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).



Maritime and Non-Maritime companies in the study area. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

Access vs egregation

Access to the port is very limited and only 11% of the total water edge is reachable by the public, resulting in a segregated landscape. While several areas are incompatible with urban life and need to remain isolated from the city, many other bear the potential of retaining their productive capacity while becoming accessible to the public.

Companies | maritime vs non-maritime

The maritime clusters are spatially defined areas where partner companies are gathered.

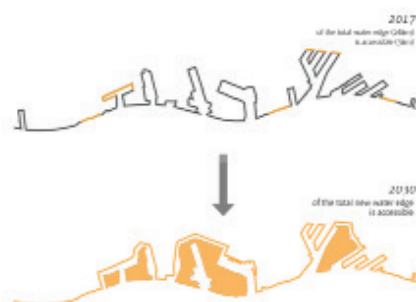
The scale of the enterprises varies dramatically: the large ones need water access, docks, and large scale infrastructures for transportation, manufacturing, processing, storage, and security, while the small ones do not. Currently maritime and non-maritime companies are interspersed, with smaller companies

isolated from the urban fabric.

A great potential exists for spatial reorganization to optimize relationships between the companies, the waterfront, and the city.

Archipelago of Knowledge | new port-city relationship

“Archipelago of Knowledge. A diffuse Campus” is a new spatial configuration that reconsiders the relation between port and city. In a speculative fashion, our vision proposes to create an archipelago of commercially active areas -islands-, resulting in the formation of a continuous, 100% accessible waterfront. The quality embedded in the direct relationship between city and the water is re-establish and enhanced, for the benefit of the citizens and the maritime cluster.



Archipelago of Knowledge concept.
(© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

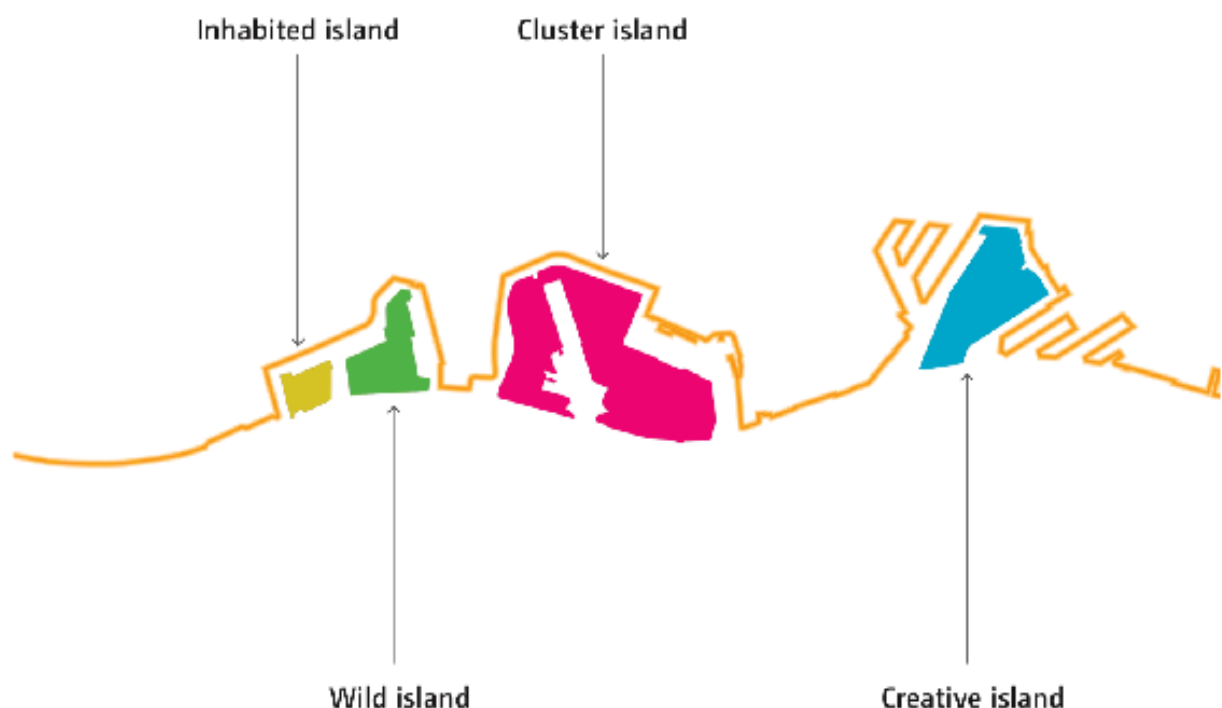
Waterfront | a shared space for negotiation

A new unfolded linear space, a continuous waterfront, is envisioned for the area. The new system can finally bring back water to the city that, although in close proximity to water, often lacks a direct relationship with its largest water body, the Maas River. The waterfront is a system that goes beyond administrative boundaries and fragmentation, but rather unifies the ongoing efforts of port revitalization into one, coherent urban vision. The strategy itself, before its implementation, can be seen as the tool to bring all the different actors together at the same

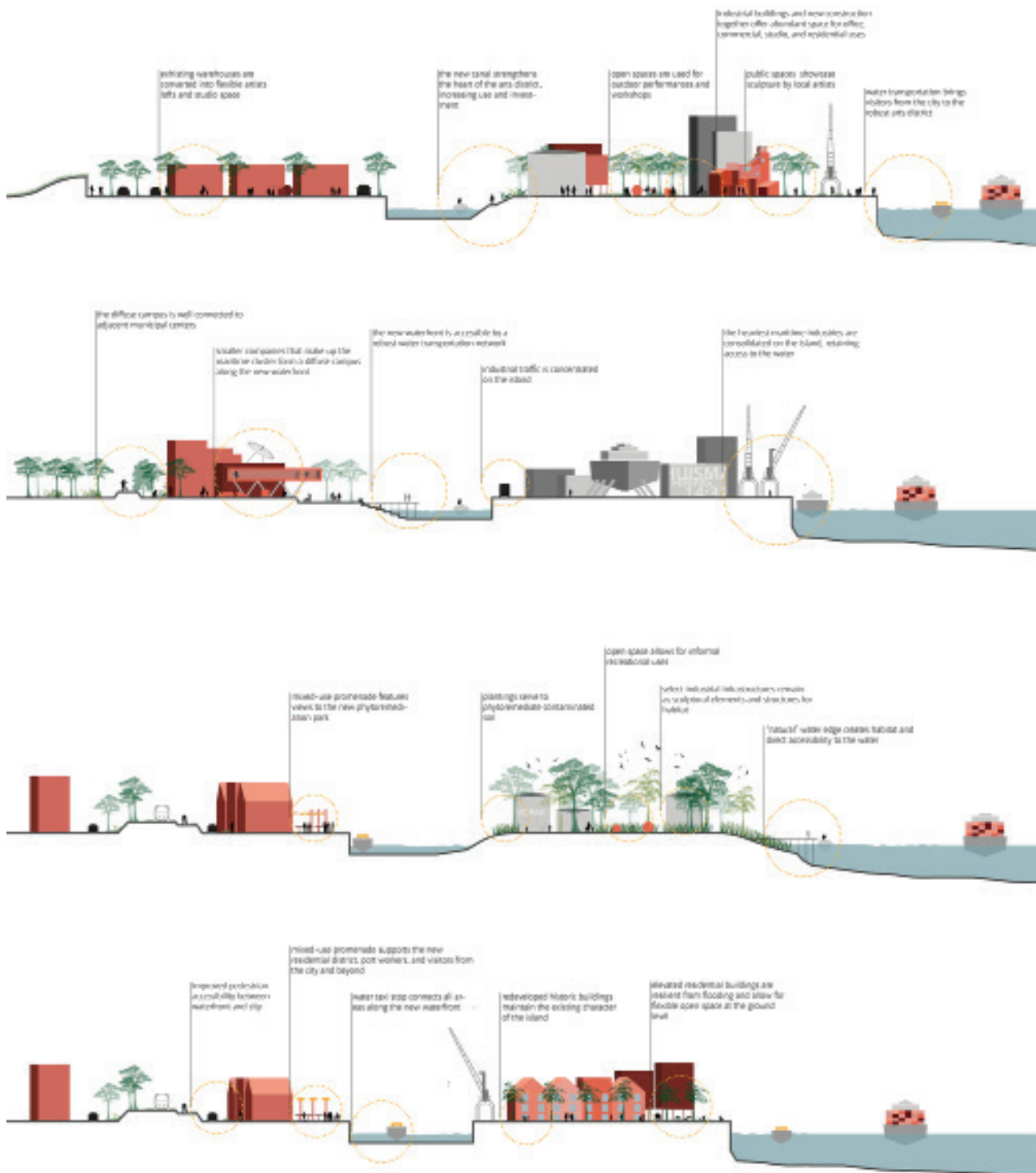
table; actors from the city, the maritime cluster, and the port.

Islands | spaces resilient to different economic scenarios

The islands are spatially defined areas where scenarios can unfold over time. Although their shape is fixed, in order to assure a new beneficial relationship between port and city, their program - be it maritime, commercial, residential or recreational - can occupy the space according to future economic trends, needs and decisions.



Concept of islands. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

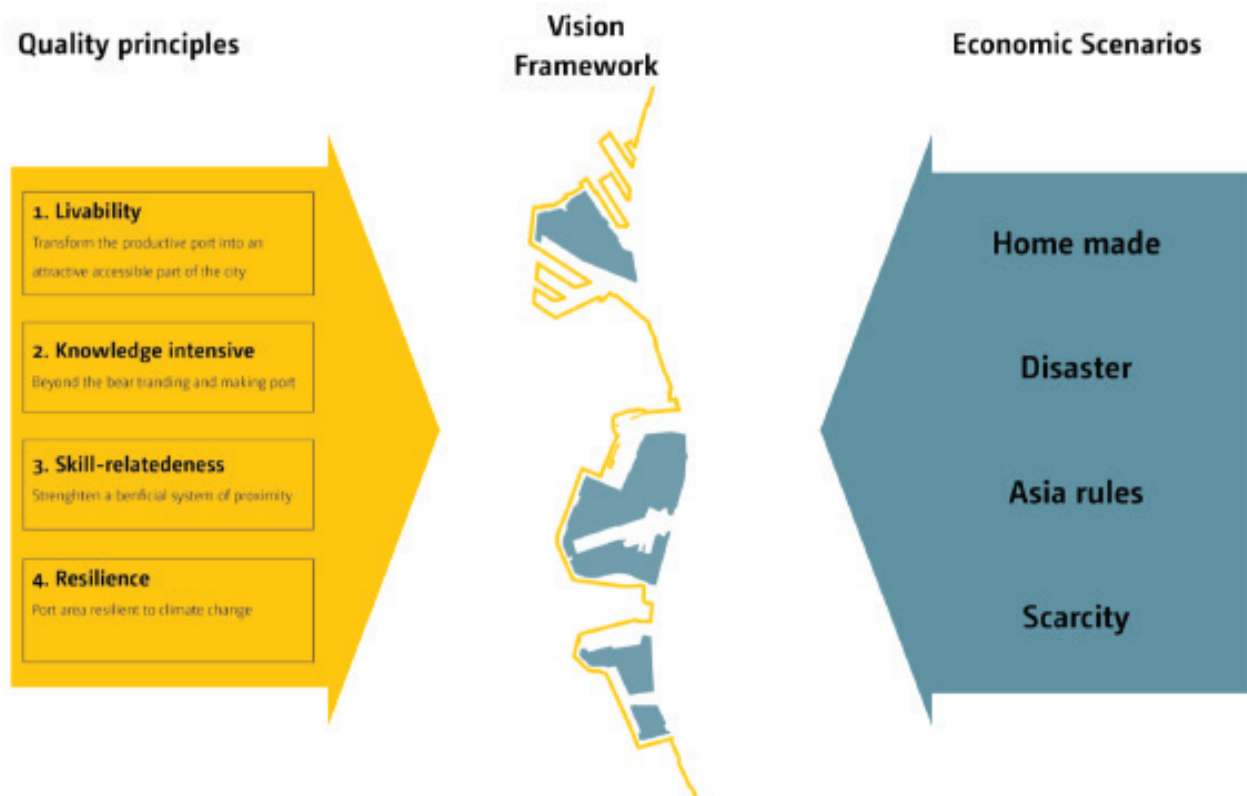


Concept of the new proposed islands. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

A proactive approach | planning is not a consequence

Port Vision 2030 [4], instead, a framework fixes main 'quality principles', which are guided by a primary spatial strategy that aims to prioritize the livability if

the city. The scenarios are not 4 separate options, rather, scenarios can coexist with different weight. A framework fixes the main 'quality principles', which are guided by a primary spatial strategy that aims to create high quality urban space and allows scenarios to develop flexibly.

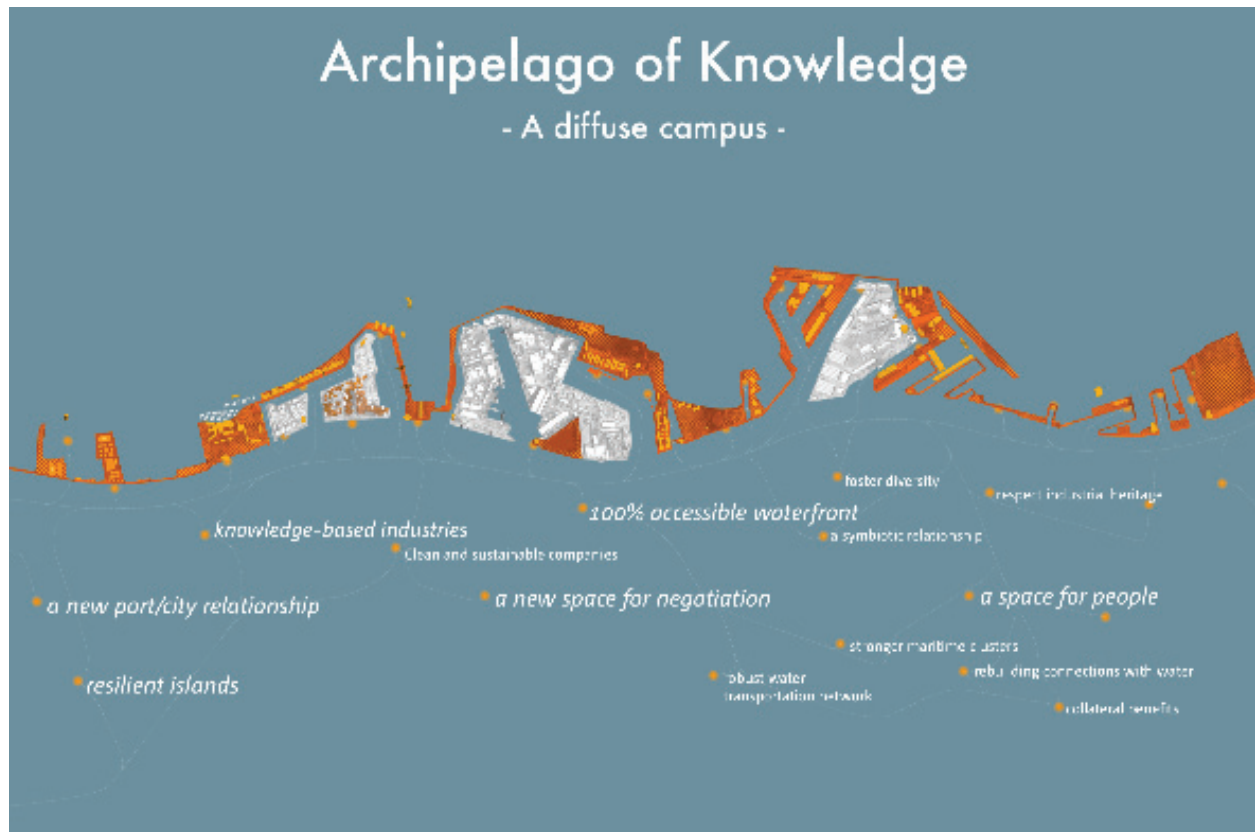


Quality principles VS Scenarios. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

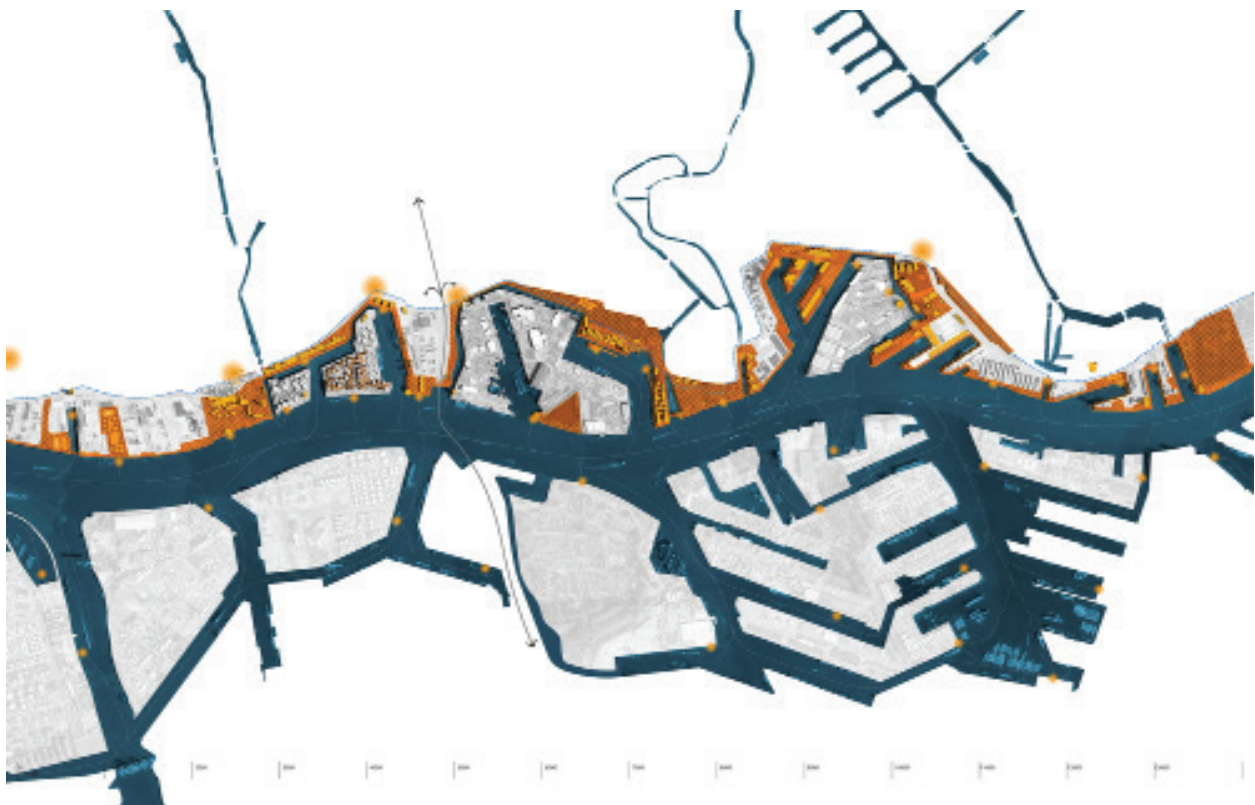
The diffuse campus | trading, making, learning, researching, living, recreating

Starting from the idea of 'making over trading', we can elaborate on ideas for programmatic diversity to meet our 'themes', for instance learning, living, and recreating. Those topics are tied together by the common spatial framework of a continuous accessible waterfront that defines new relations

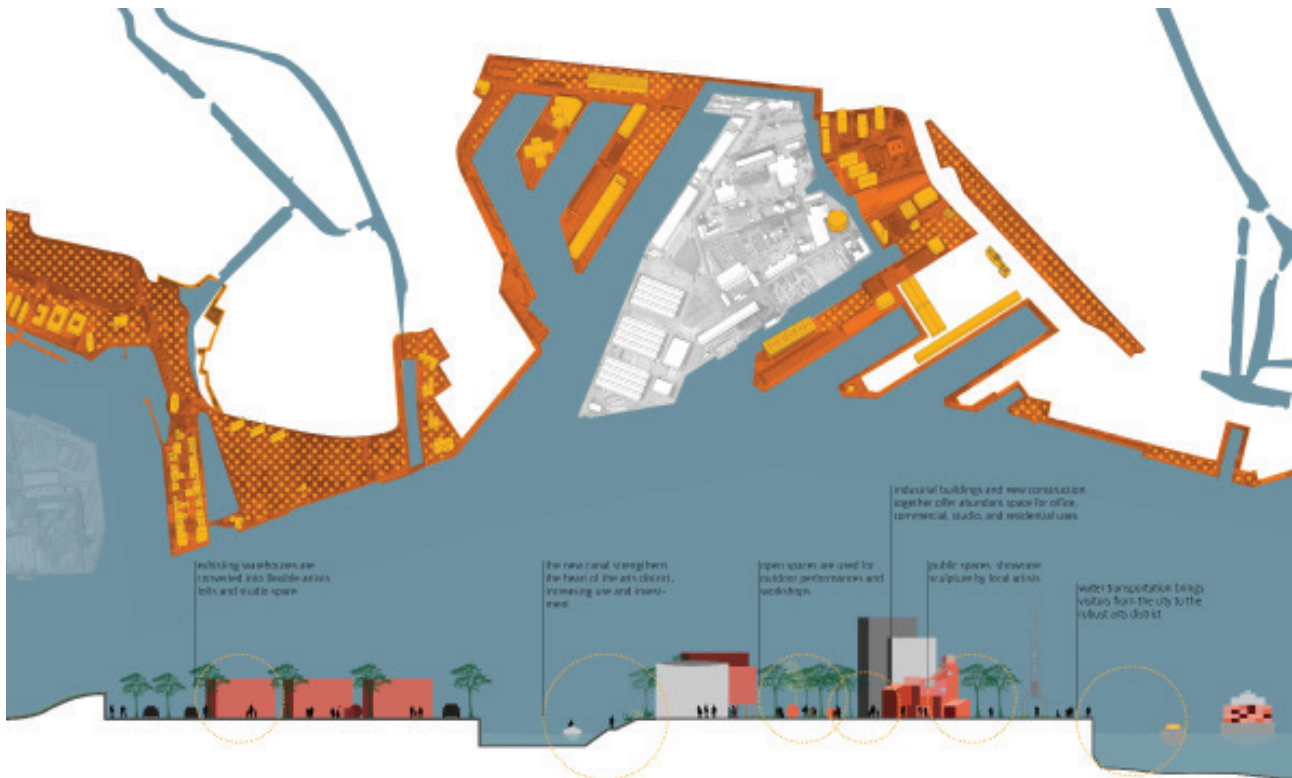
with the Maas. The key is to relate the main maritime companies and supporting companies to cultural and educational institutions for the mutual benefit of the maritime cluster and the city. To achieve those objectives it is necessary a shifting of paradigm in terms of spatial transformation and asset balance, where human scale and ecology gains a central role; without neglecting the industrial/logistic role of port areas, a more virtuous coexistence is possible.



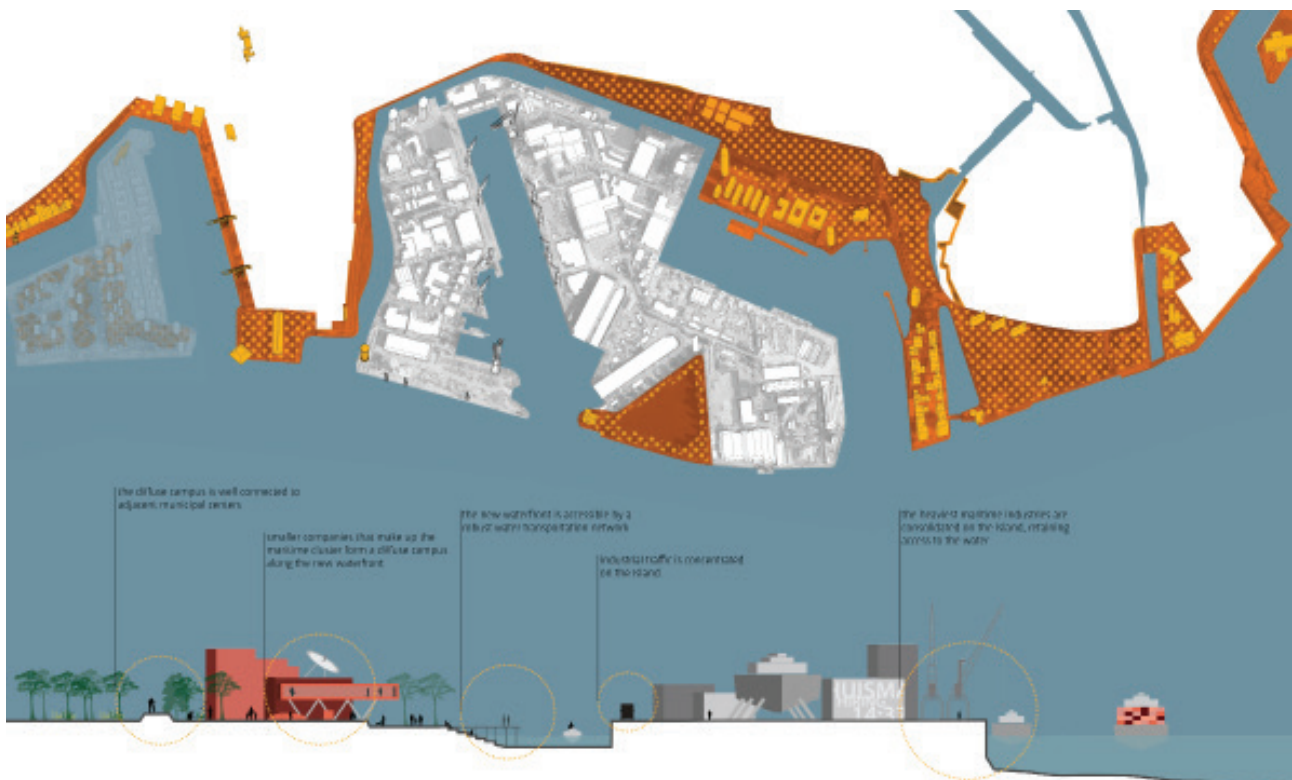
Archipelago of Knowledge. A diffuse Campus. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).



Archipelago of Knowledge. A diffuse Campus. Masterplan. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).



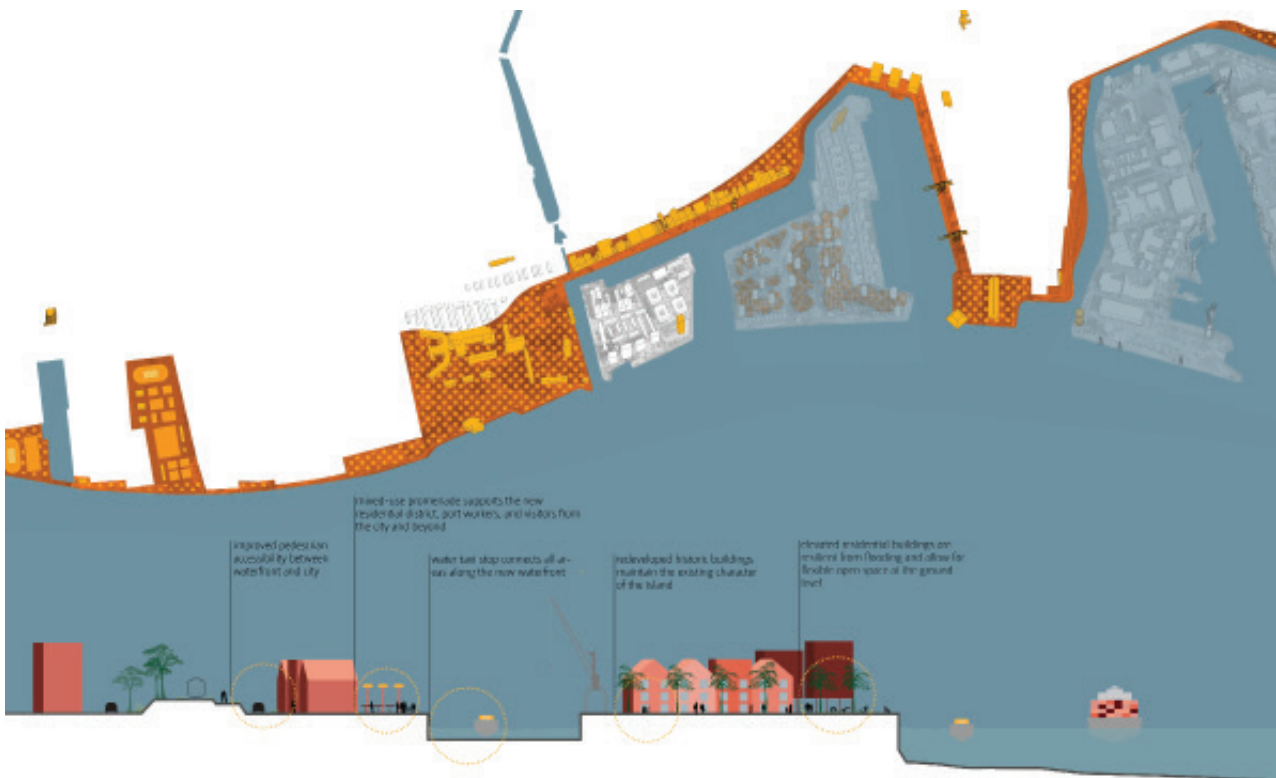
Archipelago of Knowledge. A diffuse Campus. The Creative Island. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).



Archipelago of Knowledge. A diffuse Campus. The Cluster Island. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).



Archipelago of Knowledge, A diffuse Campus. The Wild Island. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).



Archipelago of Knowledge, A diffuse Campus. The Inhabited Island. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).



Archipelago of Knowledge, A diffuse Campus. Aerial view. (© Openfabric in collaboration with KartonKraft, Mauro Parravicini, Noha, Move Mobility).

Notes

[1] The Research by Design project “Archipelago of Knowledge. A diffuse Campus” was commissioned by Deltametropool (Research Coordinator) and Uenl (Coordinator) in collaboration with Province South-Holland, Regio Drechtsteden, MRDH, Regio Alblasserwaard-Vijfheerenlanden, Gemeente Rotterdam. It was developed by a multidisciplinary team lead by Openfabric (Francesco Garofalo, Jacopo Gennari Feslikenian, Matteo Motti, Garrett Craig-Lucas, Laura Lopez Iglesias) in collaboration with Kartonkraft (Marta M. Roy Torrecilla), Mauro Parravicini, Noha (Kai Van Hasselt), Move Mobility (Marcen Van Lieshout). Photography by JGF|ph. (Jacopo Gennari Feslikenian).

[2] B. Kuipers, M. Streng, W. Manshanden & O. Koops (2017), Scenarios for the maritime cluster in Zuid-Holland and Werkendam. Background study ‘Prospective Survey of the Maritime Cluster in Zuid-Holland’, Rotterdam; Erasmus UPT & NEO.

[3] De Martino, Paolo. “Land in limbo: understanding Planning Agencies and Spatial Development at the Interface of the Port and City of Naples”, in Carola Hein (ed.) International Planning History Society Proceedings, 17th IPHS Conference, History-Urbanism-Resilience, TU Delft 17-21 July 2016, V.03 p.203, TU Delft Open, 2016.

[4] Port Vision 2030 (Port Compass by Port of Rotterdam Authority)
<https://www.portofrotterdam.com/sites/default/files/2021-06/port%20vision.pdf/>.

MAGPIE: PORT OF ROTTERDAM LED COLLABORATION WORKING TOWARDS A ZERO-EMISSION PORT



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Storage tanks heat pipes. (© Eric Bakker; Source: Port of Rotterdam Authority, 2020).

As of October 1st, 2021, the Port of Rotterdam takes the lead in a new European project: Magpie [1]. Magpie is a Horizon2020 research and demonstration project, under the Green Deal Program. In this large scale project, the Port of Rotterdam takes up the lead position and collaborates with the port authorities of HAROPA PORT (France: Le Havre, Rouen, Paris) and Sines (Portugal) DeltaPort (Germany), furthermore with 10 research institutions and more than 30 companies from the Netherlands, Germany, France, Portugal, Denmark and Sweden, among these also the Erasmus Center for Urban, Port and Transport Economics (Erasmus UPT) [2]. The broad-based, international research and demonstration program focuses primarily on accelerating the development and adoption of new sustainable technologies, green fuels and sustainable logistical practices. The project not only takes an energy and fuel based technological perspective, but also investigates and develops the enabling potential of digitalization in this context. In addition, it is being assessed how companies can best be stimulated to make their logistics more sustainable, with so-called non-technological innovations. This then all comes together in an integral Masterplan for a port to transform phase-by- phase towards a zero-emission port in 2050.

The logic of the project

To flatten the curve of climate change, urgent actions are needed. Seaports will play a major role in it by facilitating a boost in the use of clean fuel technologies, green energy carriers and green logistics. It is however not yet clear which types of energy, fuels and fuel carriers the industry will adopt, also not for which specific sectors and modes of transport. Various sustainable fuels and energy carriers are now being developed, like green hydrogen, large electric batteries, ammonia and bio-LNG. They all have their advantages and challenges. Where one type seems more suitable for shipping, the other rather for use in the port itself or for transport to inland destinations.

Considering phasing in development, some new technologies have already been tested, others have not yet. That means that we are in a phase in which parallel a variety of new technologies must be (further) developed, tried-out, implemented and scaled-up, with up-front uncertainty on final level of success. Thereby, speeding up the implementation and scaling-up of new technologies and forms of sustainable energy not only depends on the quality and accuracy of the new technologies itself, but also on the availability

and adoption of new digital tools, and on the level to which investors and users can be stimulated to become first movers or quick followers. Digitalization and automation increase logistics efficiency, thereby reducing the energy consumption of transport. It may also enable new forms of transactions (f.e. through blockchain), that help bridging the price gap between old and new technologies and fuels and therewith helps adoption. Adoption may also require or being accelerated by non-technological innovations and measures. The introduction and scaling-up of new forms of energy, smart data-driven energy saving solutions and modal shift in most cases bring issues like initial investment risks, initial price/cost gaps between existing and new solutions, competition risks and trust-related behavioral issues. To overcome this and to get all the actors aligned, committed and actively involved, asks for setting the right conditions, i.e. the introduction of new market mechanisms, new financial arrangements, new organizational structures and/or new regulatory and legislative frameworks. Implementing such non-tech

innovations must support first movers but should also facilitate general use leading towards the desired up scaling of the necessary innovations in the market.

The role that Port of Rotterdam picks up

The Port of Rotterdam clearly adopts the urgency of the climate change and the important role it has in it as a large seaport. The port has developed a vision and strategy up to 2050. In achieving its ambition to become climate neutral in 2050, the Port of Rotterdam foresees three major overlapping phases:

- improving the efficiency in energy use, developing infrastructure for electrification, and CCUS;
- transformation towards a new sustainable energy system for the industry and mobility related to the port complex;
- renewal of raw materials and fuel system: towards full circularity.

Shore power signal board and wind turbine. (© Danny Cornelissen; Source: Port of Rotterdam Authority, 2020)



In realizing this phased ambition, we see the port engaging in many new initiatives and projects, ranging from large scale CO2 storage, to investments in hydrogen and circular projects. And it also engages in the discussions - both at local as international level - on what should be done from market and legislation perspective to make things go forward. The Magpie project fits neatly into this.

The uniqueness of the Magpie project

The Magpie project has a couple of unique features. That starts with its lead partner. Although the Port of Rotterdam more often engages in international consortia for knowledge development projects, it is quite unique that the Port of Rotterdam company takes the lead. This underlines the urgency but also

the awareness that for achieving the ambitions concerning the climate change, clear leadership, but also strong cooperation between industry partners, knowledge institutes and governments is needed. The port of Rotterdam, an organization that has a huge challenge but also large opportunity in the climate change ambitions and that combines strong links with governments while constantly acting in close cooperation with the industry, is very well suited to take a leading role here. Another unique feature of the project is its integral character by combining real life testing and developing of technological innovations with a strong focus on non-technological measures.

The Magpie project is just about to start, while its set-up, focus and ambition are worthwhile presenting at this point. We are looking very much forward to its achievements along the way and its outcomes.

Notes

[1] The Magpie project is financed by the European Commission.

[2] The Erasmus Center for Urban Ports and Transport Economics (Erasmus UPT) is involved as a partner in the Magpie project and responsible for the assessment and development of new market mechanisms and also for impact measurement.

ENVISIONING THE PORT OF ROTTERDAM IN A 100% CIRCULAR ECONOMY



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Proximity of the city and port of Rotterdam. (© Pedro Maia, 2019).

The port of Rotterdam – whose freight throughput of about 470 million tonnes places it among the world's largest ports – is currently specialised in the distribution, storage, and processing of fossil fuels' raw materials, including crude oil, coal and liquid gas (Port of Rotterdam, 2019a). As evidenced by national and international agreements concerning the mitigation of climate change effects (European Commission, 2019; Ministerie van EZK, 2019), a pressing need to transform such activities has become obvious over recent years. The Port of Rotterdam Authority, a corporation between the municipality of Rotterdam and the Dutch national government, has consequently envisioned a series of strategic approaches towards a carbon-neutral port (Port of Rotterdam, Rijksoverheid, Provincie Zuid-Holland, Gemeente Rotterdam, & Deltalings, 2019).

Opportunities for change are seen in synergetic effects between simultaneously ongoing transitions in the realms of digitalisation, logistics, energy, and circular economy. The port's position at the crossroads of raw material and residual flows is also associated with a future international position as a 'waste-to-value port' (Port of Rotterdam, 2019b). Measures to foster this position concern the treatment and distribution of bio-based raw materials, recycling, and the digitalisation of logistic infrastructures and services, for instance through the 'internet of things', material tracking and block chain technologies. The Port of Rotterdam Authority further envisions a staged approach towards a renewable energy system, drawing on hydrogen, solar, geothermal, and biomass sources. A more efficient use of energy (e.g. residual heat), carbon capturing and storage form early milestones in this strategy. At later stages, sustainable energy production and a circular use of

materials can enhance each other in order to form one symbiotic system.

In this article we review how TU Delft Urbanism master students have considered this port vision during design experiments in order to construct a portrayal of its spatial dimension.

The Research & Design studio “Spatial Strategies for the Global Metropolis”

The Master of Science Urbanism track at the Faculty of Architecture and the Built Environment, TU Delft, is a scientific design education program characterized by interaction between thinking – analysis and reflection – and doing – or the speculative imagination of spatial interventions. The Research & Design studio “*Spatial Strategies for the Global Metropolis*”, which runs during the third quarter of the curriculum, has ‘regional design’ as its core theme [1]. Regional designs explore solutions to structural spatial problems that occur on high levels of scale. They allow us to critically reflect on the spatial implications of prevailing political agendas and planning regimes and can inform long-term strategic planning decisions (for an elaboration of this stance, see Balz, 2021; Neuman & Zonneveld, 2021).

The studio resembles a ‘situated learning environment’ (Wandl et al., 2019). Assignments address urgent societal problems, explore real policy agendas, and complement ongoing research. The brief of the 2020-2021 round was defined by the Province of South Holland's ambition to host a 100% circular economy by 2050 (Provincie Zuid-Holland, 2019).

Experts in the research project *Resource Management in Peri-urban Areas: Going Beyond Urban Metabolism* (REPAiR), funded by the European Union under the Horizon 2020 framework, contributed to the set-up and conduction of the course [2]. Researchers from Drift for Transition at Erasmus University of Rotterdam [3] and PortCityFutures [4] inspired a focus on the role of the port of Rotterdam in a South Holland circular economy. Members of the institutes supported a deeper and more comprehensive understanding of this role during lectures, discussions, and reviews.

During a period of ten weeks, 19 groups of students designed visions and development strategies leading towards a circular economy in the South Holland region [5] (for a summary of results, see Department of Urbanism, 2021). The students' primary foci were material flows that produce grave negative environmental impact in the region and that have therefore been identified for reform (Drift & Metabolic, 2018; Provincie Zuid-Holland, 2019). Their designs propose interventions into regional flows leading to a reduced use of non-renewable raw materials, re-use of products, and recycling of waste materials in a more circular construction and demolition sector, a more circular agri-food sector, and a circular bio-based chemical sector. Most designs incorporated thoughts about the role of the port of Rotterdam in the accommodation of these flows as well as wider sustainability transitions.

Imagining the role of the port of Rotterdam in a South Holland circular economy

Students' regional designs can be perceived as experimental explorations of not only the spatial claims and conflicts that may arise during the transition towards a 100% circular economy in Southern Holland but also the role of the port of Rotterdam in this transition. When analysing regional designs by students on this role, a series of port areas and their linkages with the wider region stand out.

Projects that envision desirable, more circular material flows in the construction and demolition sector anticipate a central position of the port in a layered system that distributes flows of re-used products and recycled waste materials via cascading medium and small-scale hubs across the region. These projects emphasize the opportunity that inland waterways offer for the sustainable transport of materials, and also point at a need for smart logistics in a system that is required to flexibly adapt to changing demands for materials over time. The future import dependency of a central waste-to-value hub in the construction and demolition sector is controversially discussed.

Projects that envision a strong reliance on bio-based construction materials conclude that these materials cannot be fully produced within the region and plead for the import of agricultural waste products. Projects that imagine flows of a broader range of construction materials – including products of urban mining – argue for greater resource independence. These projects typically stress the importance of emerging clusters of innovative makers industries in port areas that are conveniently close to urban ones. It is commonly argued that such positioning allows for the bundling of a wide variety of material flows, including raw materials and residual flows from numerous industrial and logistic port activities, and for the socio-economic upgrading of old districts, e.g. post-war neighbourhoods, that typically hold similar positions.

Projects that engage with a more circular agri-food sector mostly envision more decentralized material flows in the production of food and the re-use of organic waste and thus a diminishing role of port activities in international food chains. A variety of strategies for the re-use of port areas that formerly hosted these activities is proposed. Strategies typically facilitate transitions towards a more local circularity via fine-grained relations between the port and urban areas. When discussing the environmental sustainability of food production, the proximity of the port to the greenhouse horticulture cluster at its north-western edge is repetitively emphasized as an opportunity for closed energy and water cycles. A more circular bio-based chemical sector is discussed by very few projects only, which points at uncertainties about the spatiality that is implied in the phasing out of plastics.

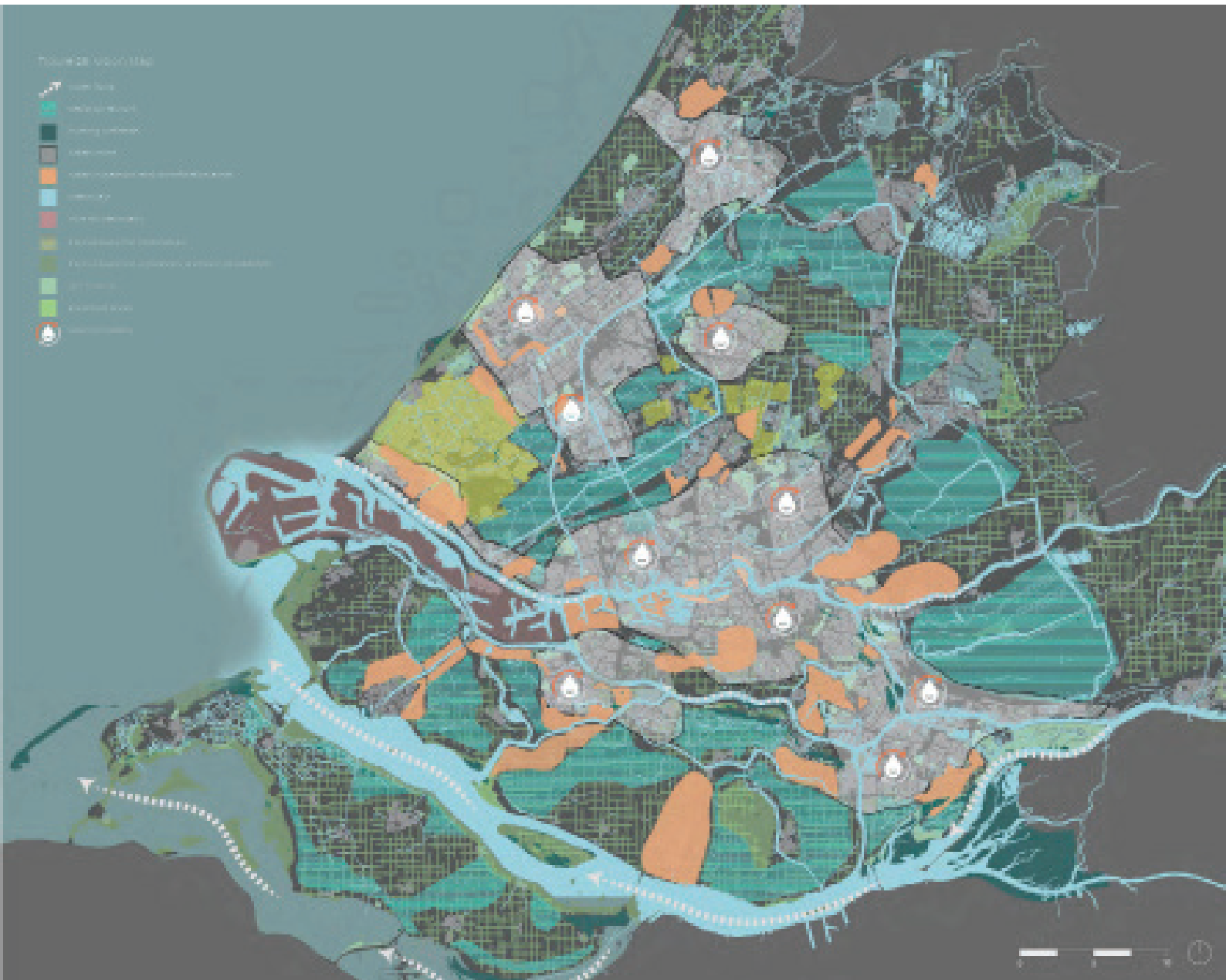
A series of projects envision spatial change from the perspective of not only a single economic sector but also more fundamental, structural issues. Perspectives include the imagination of mobility systems that rely on other-than-fossil fuels, energy systems that draw on renewable sources only, as well as water management systems that mitigate climate change effects such as sea level rise. When reviewing the roles that the port plays in these imaginations, its land use comes to the foreground most prominently. Drawing on earlier research into the spatiality of sustainability transitions (for instance Amenta & Van Timmeren, 2018; Hein, 2018), projects share a concern about the vast portions of port 'wastescapes' that will result from the phasing out of fossil fuels on the one hand. On the other, they indicate that the privileged position of port areas on high grounds as well as the importance of the industrial complex call for a more dense and mixed use of land.

ANCHORING THE PORT OF THE FUTURE: PATH DEPENDENCIES, SUSTAINABLE TRANSITIONS, AND FUTURE URBAN ECONOMIES

PORTUS 42 PORTRAIT ROTTERDAM

As a result, many projects include strategic approaches that – depending on values that are promoted – suggest a staged re-use and intensification of parcels of the larger port area. How such change can be inspired by circularity is exemplified by a project titled

'Towards a Circular Delta Environment' (Den Hartog et al., 2021). This envisions vast stretches of wetlands that contribute to not only a greater absorption of water in Southern Holland but also a more circular use of this (see following image).



Vision 'Towards a Circular Delta Environment'. (© Den Hartog et al., 2021).

It demonstrates how smaller port areas become either wetlands themselves or dense industrial clusters, depending on their current ecological value, possibilities for the exchange of grey and purified

water, and existing energy infrastructure that can be re-purposed for the re-use of residual heat and CO2 (see following image).



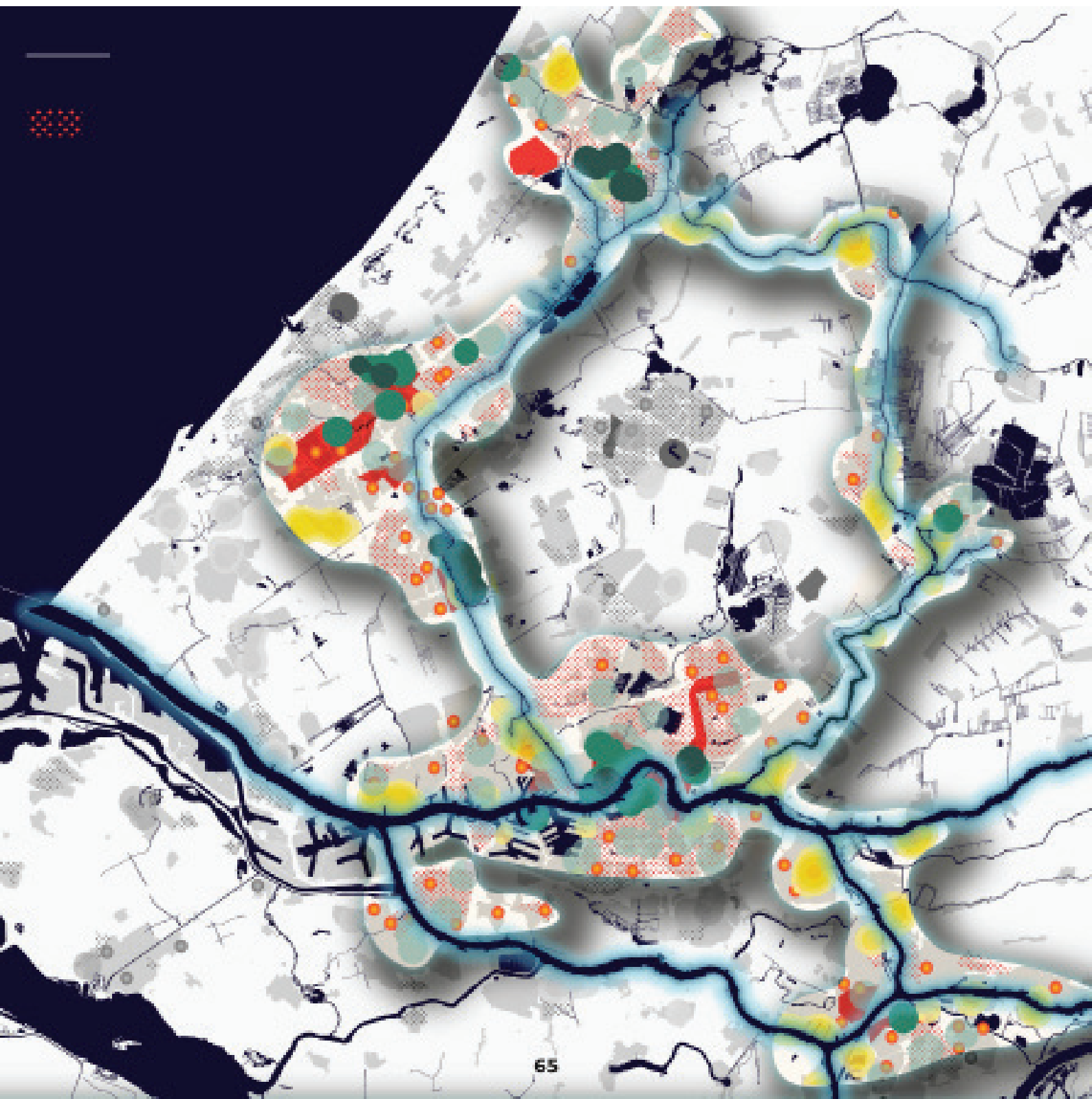
Strategy 'Towards a Circular Delta Environment', indicating future (from top to bottom) (1) flows of water, heat and CO₂, (2) hydrogen management, and (3) nature. (© Den Hartog et al., 2021).

A circular port of Rotterdam

The 19 individual projects that were designed during the course of the “*Spatial Strategies for the Global Metropolis*” studio have a wide variety of scopes and it is impossible to present the rich amount of

evidence and ideas that they incorporate within one short article. When seen as one common effort to explore the role of the port of Rotterdam in a future 100% regional circular economy, they do deliver an impressionist ‘portrayal’ of what this role can be, however.

Vision ‘FLUX - Rethinking flows and networks to spark the transition towards a circular construction sector’. (© Cortés Macías et al., 2021).



The port of Rotterdam currently serves as an important European oil port and is thus deeply penetrated by a broad array of unsustainable material flows. The above sketched Port of Rotterdam Authority's vision underlines how intertwined flows are, and how fundamental a transition towards an environmentally sustainable port economy will therefore be, but lacks indications of the whereabouts of this transition. Students used the practice of regional design to explore the spatiality of a Southern Holland circular economy. A common feature of all visions and strategies is their argument for a port that is embedded in a wide array of fine-grained flows that transgress the port's administrative territory. They demonstrate that individual parts of the port hold distinct opportunities

for the building of a regional circular economy due to their current function, spatial characteristics, and proximity to existing land uses and infrastructure. Projects also demonstrate that opportunities per area are multiple and that they vary under the influence of degrees of intended decentralisation. Results thus underline a need for spatial planning approaches that acknowledge the multiplicity and complexity of spatial claims that are unleashed by sustainability transitions, that recognize the conflicts that emerge from these competing sectorial claims, and that integrate these in long-term strategies. Projects also demonstrate the role of imagination in the building of these strategies.

Notes

[1] The responsible chair of the "*Spatial Strategies for the Global Metropolis*" studio is Spatial Planning & Strategy at Department of Urbanism, Faculty of Architecture and the Built Environment, TU Delft, see: <http://www.spatialplanningtudelft.org/>.

[2] For more information on the REPAiR project, see: <http://h2020repair.eu/>.

[3] For more information on Drift for Transition, see: <https://drift.eur.nl/nl/>.

[4] For more information on PortCityFutures, see: <https://www.portcityfutures.nl/home>.

[5] Students' projects of the 2020-2021 edition of the studio Spatial Strategies for the Global Metropolis can be viewed in an online exhibition that can be accessed via this link: <https://www.yumpu.com/en/document/view/65718658/circular-southern-holland-an-online-exhibition>.

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IMAGES OF PORT-CITY ROTTERDAM, THROUGH THE MENTAL MAPPING METHODS



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Space, and he is a guest professor at various foreign universities. He is among others part of the core team for PortCityFutures, and leader of the research projects City of the Future, and the Design of Public Spaces research group.



Blurred aerial view of the Port-City of Rotterdam. (© Maurice Hartevelde, from Landsat/Copernicus, 2021).

Imagine: You are asked to draw a port-city from memory. What would you put on paper? Do you think of harbours? Water, docks, cargo, moving loads, and ships? If your drawing shows these elements, don't be surprised. Sixty-five graduate students also took on the challenge in 2020 [1]. Another group of fifty-five graduate students did so in 2021. In answering: "draw the port-city of Rotterdam by mind", the drawings of the participants displayed exactly the above features. Of course, this makes sense. A port just happens to be a place on the water in which ships shelter and dock to (un)load cargo and/or passengers. A harbour is a sheltered place too, and in its nautical meaning it is a near-synonym for sheltered water, in which

ships may dock, especially again for (un)loading. So, all the above linguistic lemmas are there and all these are connected to imaginable objects. Apparently in a 'port-city', the adjective 'port' modifies the meaning of 'city' in such an extent that this echoes in the mind. Objects associated with the port form what we call a mental map. In general, putting such a map on paper displays a person's subconscious representation of an area, and although each map is subjective, a representative sample helps to identify areas and people's affiliation to these areas. Yet, mental maps with a strong emphasis on ports – rather than of port cities as a whole – seem very limited (see: <https://youtu.be/nh1yD8noz9c>).



Mental Maps of the 'Port-City of Rotterdam'. (© Maurice Hartevelde, 2020).

Harbour areas are huge, but hardly known

In general, people use to approach ports as a vague relatively large section of the city: In the urban design perspective of Kevin Lynch [2], we may call port areas a 'district' in our mental maps, with the river as water edge and predetermined path for ships. It is alike all those areas we know, but not know exactly. In the Rotterdam sample, students occasionally give some sort of detail: if so, they draw different areas with containers and oil drums. These are large enough to identify as specific nodes and they are used as an image of the port for decades. Also, the old-school landmark cranes are sometimes drawn clearly. They are big enough to experience when you are in the port area today, and, again, they are pictured to represent the port city for at least over a century. In contrast, the lesser-known and more-recently developed areas including huge wind turbines are seldom drawn. Likewise, the overhead cranes in the iconic non-human automated port terminals of Rotterdam are nearly absent in the maps. They are only a few years old, mostly out of view and not yet so often used as an illustration of the port area. The unobserved is never taken into account, whereas objects generally associated with ports are. It is a duality which is

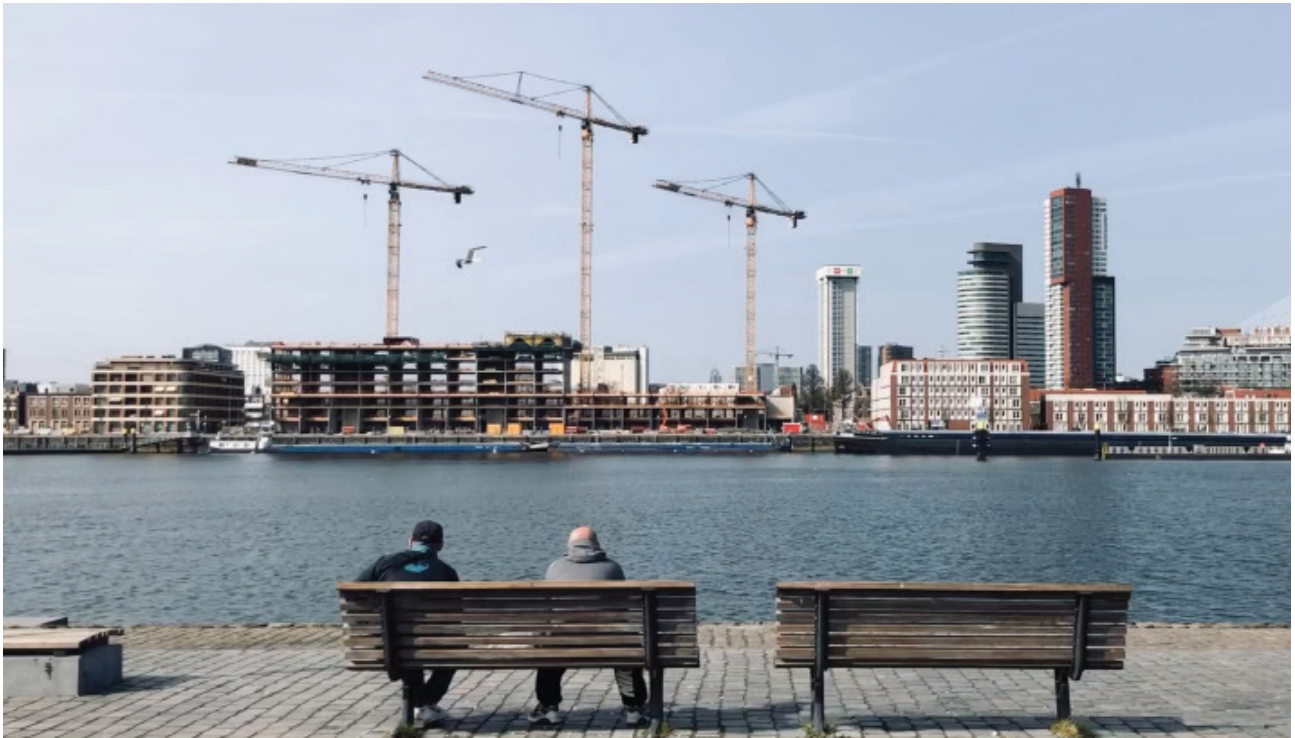
recognised since the birth of an experimentalist search for psychophysical correlations [3].

Public spaces in the dedicated port are poor

The limited amount of information in these mental maps can be explained quite simply. Mental maps are always based upon our experiences and upon information we have gathered over time. When we know less, we draw less. In the Rotterdam case, we only draw physically large features that we may have seen from a distance, and/or objects we presume are there. This is connected to the lack of public accessibility of the port area itself. Public space is often fenced and walled there and the street network is large gridded. Since the general public cannot access most of its maritime and industrial landscapes, few people can map the exact layout of the port area from their memory. In addition, the lack of detail in the maps also relates to the speed visitors have. Public spaces in the port area are car-dominant. An old urban design lesson teaches that we see less if we move fast [4]. Applying such lessons in a harbour may result in huge signs to be recognised and remembered [5].



The Port of Rotterdam, on Instagram. (© Instagram, 2021; CC BY-SA).



View on Maashaven and the redeveloping Katendrecht pier, Rotterdam. (© Maurice Harteveld, 2021).

Rotterdam by mind

Still, instead of a blind focus to the port, and therefore its harbours, I prefer to consider the resilient and acculturated interrelation of port and city in order to identify port cities as 'cities'. Thus, I asked the same groups of graduate students to "draw Rotterdam by mind", before challenging them to draw the 'port-city'. In this question, 'port-city' was explicitly left out. This set of mental maps is richer in the kind of objects drawn and still they do relate to a subconscious image of port cities. Fundamentally, it makes sense that this question generates more info. Networks of public spaces are more refined outside of the port areas. Here, we can experience cities very differently and here, we move with different paces. Our paths are different, our perspectives are different, and our perceptions are different. We can be informed in various ways. Very fundamental in environmental psychology is the difference between people who know the city in mediated ways and those who reside there [6]. We may know the city by heart, or through a novel or other books. We may recall paintings or online images. We may be informed through a wide variety of social media, films and music. Despite a multiplicity of differences between individuals, their mental maps, the set of drawings show many more elements related to port cities than the ones introduced before. Remarkably, if the question is less biased, the amount of information drawn in mental maps increases.

In order to test if the information in the mental maps actually relates to an identity of port cities, we can study to what extent the drawn objects are tied to the specific port city, and thus their what we call situational conditions. And, we can relate these elements to imaginable concepts, which are deriving from the accumulating port city research. In other words, we can test if what is present in the drawings, may also be indexical in port city research texts and vice versa. The set of mental maps of Rotterdam reveal for instance buildings related to long established migrant relations, objects related to global capital, and nodes and lines related to distribution.

Beyond biases

This approach builds upon the method of mental mapping as it has been adopted in urban design, both in academia and practice, to connect histories of cities to future making [7]. It can also be seen as a continuation of participatory approaches in urban planning and policies for development [8]. Yet, it takes into account that what is drawn is "rooted and influenced by cultural frameworks of experiences", and what is discovered in the maps reflects "the biases and values of their beholders" [9].

Within the PortCityFutures team, the update of the method is being catalysed by overlapping insights of many colleagues.



By uniting among others visual ethnography, cultural anthropology, human geography, urban sociology, and port economy, the novel application of mental mapping can help to reveal hidden dimensions of port cities and understand their complex nature. At a certain point of saturation, new maps may not be surprising anymore; still, the undrawn is always out there. The intent cannot be complete, however, to discover maritime mindsets which help us to look beyond the water, docks, cargo, moving loads, and ships in the future.

A desire for Port-City union

The challenge particularly lies at the desk of the professionals of today. In their mental pictures for the future of Rotterdam, port and city remain two dichotomistic entities. This is enforced in urban governance and the urban design practice.

Following the privatization of the Rotterdam Port Authority in 2004, 'port' has been represented by this entity (private, from juridical perspective) while city has been the domain of the Municipal Government (public entity). This construct resulted in two very different approaches towards the design of public space, because each has a full mandate to design public spaces within the territory. In the 'city', considered as compact, the community and metropolitan scale comes to the fore, whereas in the 'port', a larger peripheral area including active

harbors, the public space stays foremost an efficient traffic machine. This influences the mental maps of others, the general public, and professionals in training [10]. Still, in the last decade, authorities also acknowledge that the two are interrelated: "the future of the port goes hand in hand with the future of the city" [11]. They aim to offer a greater variety of living and working environments "coloured by maritime activities", wherein traditional port-activities are gradually substituted by making and manufacturing [12]. It unfolds a desire to confirm the port-city union.

Mapping maritime mindsets in public space

By reviewing public spaces in the proximity of the objects drawn in the mental maps, we can illustrate the unique port-city characteristics. These may help us to re-understand the age-old port-city union. Port is everywhere in the city. With a similar approach, we can reveal identities of port cities in everyday public spaces of any kind, also those not drawn in the described experiments. Many public spaces in the civic areas have such particular characteristics. For instance, about every street associates to the water, yet each emphasises peculiar land-water relationships. Most obviously, riverfronts, docks, inlets, piers, wharves, embankments, and landings come to the fore, but also, assembled together in networks, more particles form an urbanised landscape; the delta-shaped estuary of Rotterdam. Other examples could be given by all those public

Street Art of artist Bart Smeets, at the Boompjeskade, Rotterdam. (© Maurice Harteveld, 2021).



spaces which serve logistics, but are integrated in the differentiated, layered, and refined urban fabric of Rotterdam. Many streets serve the movement of merchandise and people, as, in essence, they have already done for ages. These are embedded in a layout of the distribution network, including all water-, road-, and railways, but also including a large amount of public pick-up and transfer points and public transport hubs, and/or mail shipping services and travel agencies. Multi-scalar reviews of our maps help to explicate relations between nature and artifice, as

well as for example the flows of goods and people. Signs and symbols affirm that up to the smallest detail [13]. Civic areas reveal much more tangible and intangible characteristics of the port-city in addition. Perhaps more than do the huge or formally redeveloped harbour areas. Accepting such undivided images at all levels, and at all places, deforms our mental maps, and thus the images of the port-city of the future. As professionals, we may simply need to have an open mind.

Notes

[1] This article is an extended reprint of Harteveld (2020).

[2] Lynch (1960).

[3] Boring (1934).

[4] Appleyard, Lynch, and Myer (1964), and Venturi, and Scott Brown (1972).

[5] e.g. Dunlap (1992).

[6] Canter (1977).

[7] e.g. Moughtin† et al (2003), Carmona, et al (2003), Larice, and Macdonald (2013), and Sheppard (2015).

[8] e.g. Berman (2018), and Banks, et al (2013).

[9] John-Steiner (1985), and White, and Gould (1974).

[10] Harteveld (2021a).

[11] Havenbedrijf Rotterdam (2011).

[12] Programmabureau Stadshavens Rotterdam (2011).

[13] Harteveld (2021b).

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PORT(S) OF ROTTERDAM

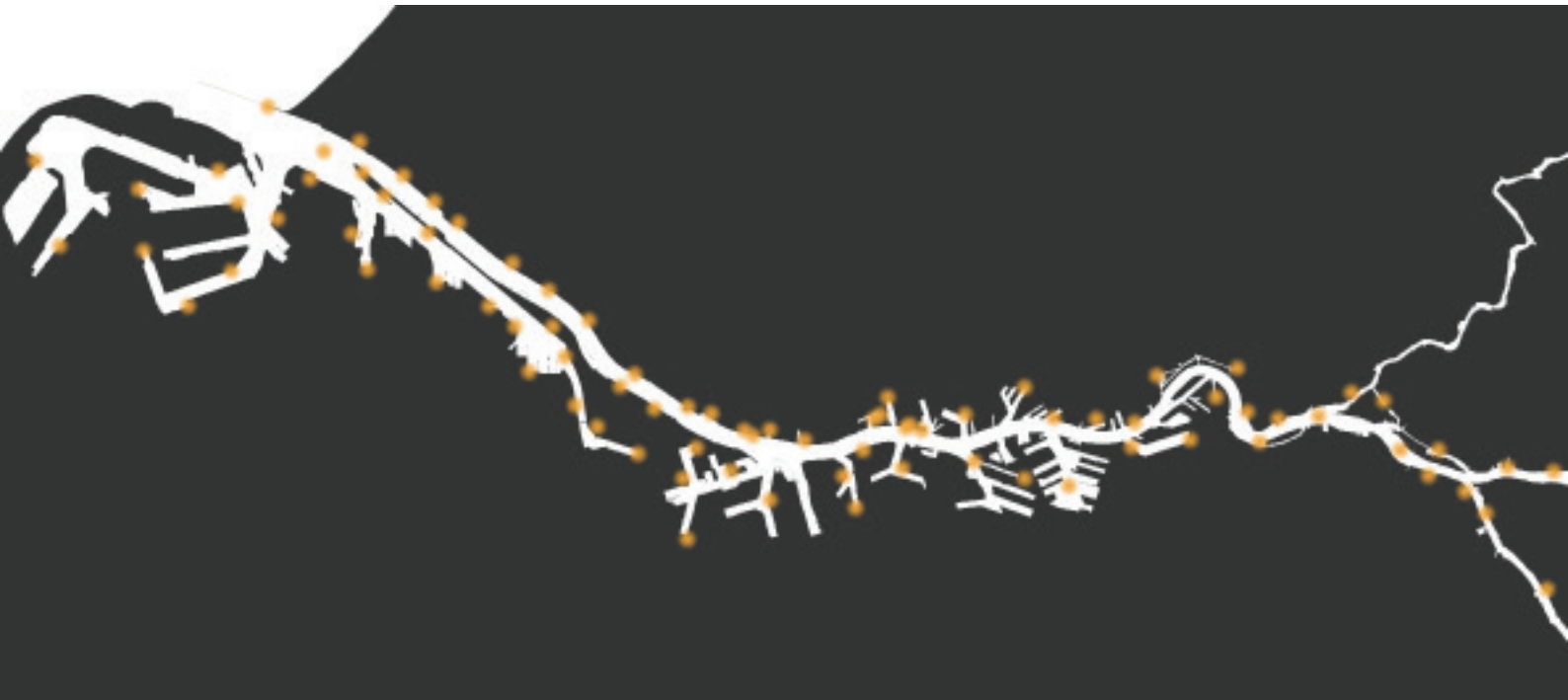


Jacopo GENNARI FESLIKENIAN

Photographer. Founder of JGF|ph. Rotterdam, The Netherlands (Photo: @Marco Menghi).

Photographer. Founder of JGF |ph., photography atelier based in Rotterdam (The Netherlands), Milan (Italy) and Lisbon (Portugal). He studied Architecture and Urbanism in Politecnico di Milano, DA/UAL in Lisbon and FAUP in Porto. His work focus on Architectural, Landscape and Maritime photography. He has a strong interest and passion for the maritime and offshore environment and the multiple levels of interactions between humans and environment that

take place in or along the Sea. Degree in Architecture 'cum Laude', FAUP University of Porto (2009).



Port(s) of Rotterdam, A personal journey through the unintended industrial beauty (©JGF|ph. Jacopo Gennari Feslikenian, 2021).

I present here a small selection from my on-going photographic project about the Port(s) of Rotterdam that tries to describe the diversity of conditions and scales, and to captivate the functional and unintended beauty of some of those hyper-industrial spaces.

The choice of black and white photography was a natural choice to give coherence and some uniformity in such diversified context.

Some of the above mentioned aspects are described and presented through details that focus the attention on relevant topics like water pollution, biodiversity, environmental implications. In other, industrial details cranes and other structures can become abstract compositions.

The industrial structures found within the Port have a strong presence even within the city center. Somehow they can be seen as site specific installations that punctuate and define the skyline of Rotterdam and the other territories touched by the port, where architecture, landscape and industrial infrastructure merge.

Another example of that idea is "The poetic of oil tanks", in the cozy port of Vlaardingen just waiting for gentrification. These structure, portrayed from a certain angle and with a certain light, became outstanding contemporary architecture that can easily compete with those the city center of Rotterdam.

The photographic essay is opened by a map that serves as a cover and visually explains my personal trajectories trough the Port. It is realized with GPS points that I was taken every time I was stopping to portrait some aspects that have captivated me.

The images are presenting very "dry" and "technical" captions with the aim of giving specific information about naming and geographical location, while leaving space to personal imagination for who's seeing them. I make this choice because it is a very personal project, a sort of industrial meditative journey that implies an extensive amount of hours and thoughts.

For my background in spatial research and design, I believe it is very important to give precise information about geographical locations giving some tools for everyone interested in discovering this complex entity called "Port of Rotterdam".

I strongly believe that several location within the Port are exceptional attraction, well known by locals, but still unknown from a touristic point of view. Rotterdam and the other municipalities that host and are crossed by the port could embody even more this identity of Port-territory and unfold this potential of industrial tourism.



Cranes in Charlois Doklaan, Rotterdam. (© JGF|ph. Jacopo Gennari Feslikenian, 2017).



Wiltonhaven, view from the south bank of Neue Maas, Vijfsluizen – Schiedam. (© JGF|ph. Jacopo Gennari Feslikenian, 2017).



Vopak Terminal in Vlaardingen, Vlaardigen. (© JGF|ph. Jacopo Gennari Feslikenian, 2018).



Container deposit, cable reels and ship repair at Eemhaven, Rotterdam. (© JGF|ph. Jacopo Gennari Feslikenian, 2018).



Landtong and Calandkanaal. (© JGF|ph. Jacopo Gennari Feslikenian, 2018).



Sliksloothavem at Stormpolder, Rotterdam. (© JGF|ph. Jacopo Gennari Feslikenian, 2019).



Wind Farm Installation Vessel at Waalhaven, Rotterdam. (© JGF/ph. Jacopo Gennari Feslikenian, 2018).



The Iconic "Mammoet" HD at Wiltonhaven, Schiedam. (© JGF/ph. Jacopo Gennari Feslikenian, 2018).



Rotterdam center skyline from Waalhaven, Rotterdam. (© JGF|ph. Jacopo Gennari Feslikenian, 2019).



Shipyard in Marineweg, Alblasserdam. (© JGF|ph. Jacopo Gennari Feslikenian, 2019).



Docking in the center of Rotterdam, Parkkade – Rotterdam. (© JGF|ph. Jacopo Gennari Feslikenian, 2019).



Water taxi pier ramp in the Maas. (© JGF|ph. Jacopo Gennari Feslikenian, 2019).



Linear Windfarm at Langtong. (© JGF|ph. Jacopo Gennari Feslikenian, 2020).



Water pollution at the Port of Rotterdam. (© JGF|ph. Jacopo Gennari Feslikenian, 2020).



Cycling under the maas, Benelux Tunnel, Schiedam. (© JGF|ph. Jacopo Gennari Feslikenian, 2018).



Continental juice terminal, Ljsselhaven, Rotterdam. (© JGF|ph. Jacopo Gennari Feslikenian, 2020).



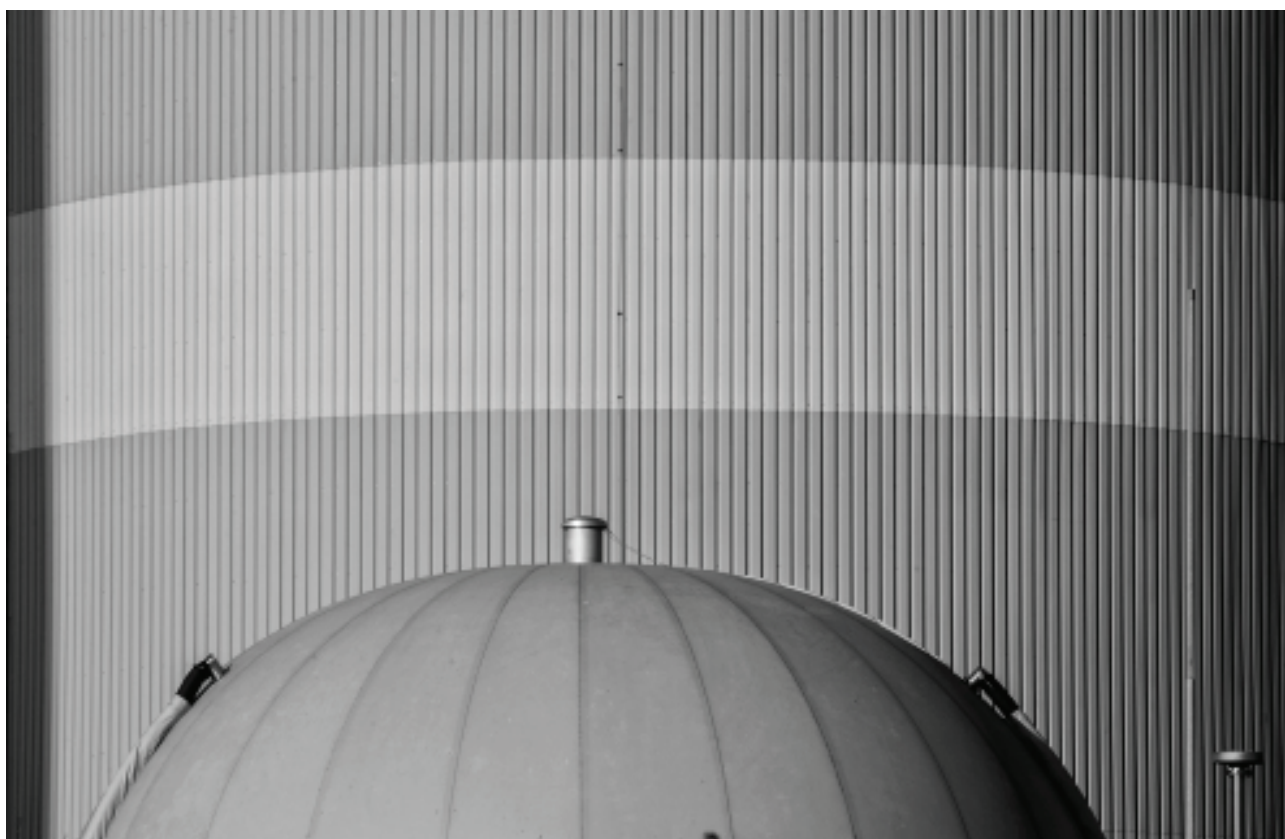
Oil terminal, Vlaardigen. (© JGF|ph. Jacopo Gennari Feslikenian, 2019).



Maas promenade, Vlaardigen. (© JGF|ph. Jacopo Gennari Feslikenian, 2020).



Waste materials storage, Vlaardigen. (© JGF|ph. Jacopo Gennari Feslikenian, 2020).



Industrial detail, Maasluis. (© JGF|ph. Jacopo Gennari Feslikenian, 2021).



Water, Maasluis. (© JGF|ph. Jacopo Gennari Feslikenian, 2021).

WHY I PAINT THE HARBOUR



Sasja HAGENS

Artist. Rotterdam, The Netherlands (Photo: Peter Bak).

Sasja Hagens (Utrecht, 1973) studied at the Royal School of Arts in The Hague, the Netherlands. Her paintings are in the collections of (a.o) the Maritime Museum Rotterdam, the Cityhall Rotterdam, ABN AMRO bank, ECT Rotterdam - Hong Kong, Arcadis and Deloitte the Netherlands.

Her work is also widely exhibited a.o. during a big solo-exhibition at Duolun (MoMa) in Shanghai, Habitare in Helsinki, Oblast Art Museum Kemerovo (Russia), Gallery Neuberg in Hong Kong and Museu Maritim in Barcelona. Currently she joins the exhibition 'Maritime

Masterpieces' in cooperation with the Boijmans & Maritime Museum and Maritime Museum Rotterdam. The exhibition will be open until September 2022.



Rotterdam Sunset. (© SasjaHagens, 2018. Seize: 100 x250 cm. Technic: Acrylic paint, emulsion styrofoam sand on canvas).

Our family often took vacations on our tiny sailboat. The wooden 7.10m Waarschip was called Waratje.

With two older brothers and a little sister, there was not much for me to do during our sailing trips. My brothers sailed the boat with my father. When I was bored and sat on the floor of the cabin, I often stared at the depth gauge. Making sure we didn't get stuck on a sandbank. My father occasionally cut a course between the buoys.

We would always sail in Zeeland, Haringvliet, Hollands Diep, Veerse Meer. I still remember our outboard motor. 8 HP was stamped on it. I asked my father, "Dad, what does 8 HP mean? To which he replied, "8 Horsepower. As strong as eight horses." And in my imagination I saw eight harnessed jetblack horses pulling our little boat forward, and I thought, "8 horsepower, more than enough."

One day my parents had set course for Breskens. For that we had to cross the Western Scheldt. We had never been there before. A busy shipping route runs right through the Western Scheldt, which connects openly to the North Sea.

We sailed up the Western Scheldt in Waratje: father, mother and 4 children. I remember the feel of the swell; I had never seen waves this high before. And

the sails were lowered because sailing is forbidden in a shipping channel. We were lifted high on a wave, and I saw the propeller of our 8 HP outboard motor turning helplessly in the air and in the subsequent wave trough I saw the entire outboard motor disappear under water together with the stern. The engine stalled.

Now the six of us were adrift in perhaps the busiest shipping channel in Europe. The sails had to be raised again, and my father kept pulling the starter cord on our soaking-wet outboard. And then it happened, the shouted commands on board faded

Because here they came

one by one,

like a scene from Jurassic Park.

The absurdly large container ships passed right by us.

Slow and unapproachable.

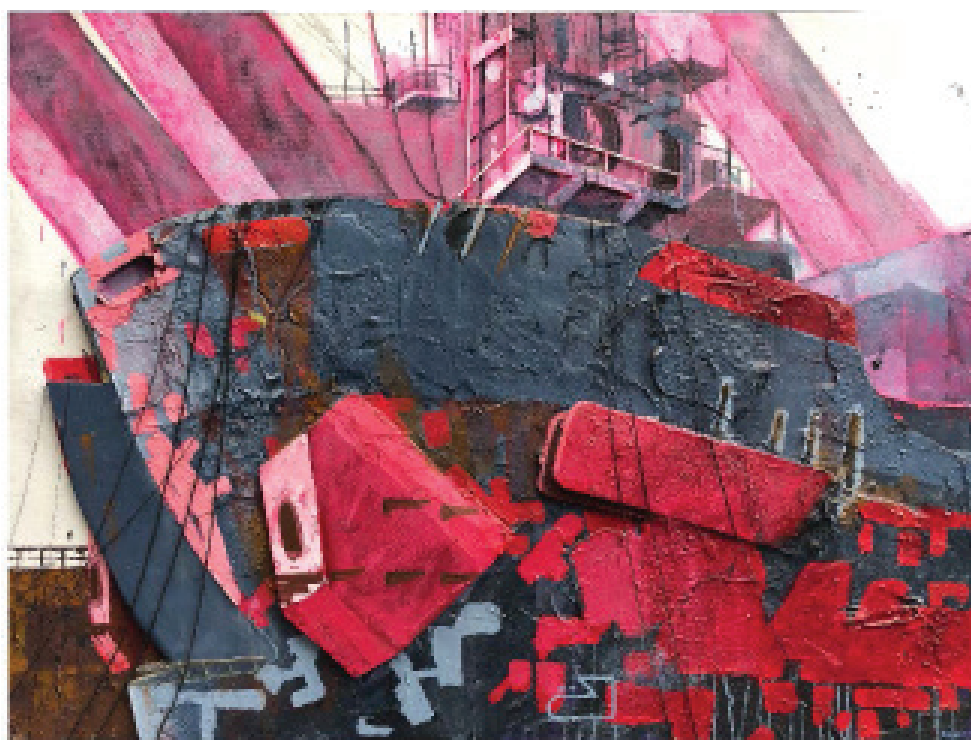
So close,

I was enchanted.

For good.



Craneship. (© Sasja Hagens, 2013. Seize: 170 x 230 cm. Technic: Acrylic paint, emulsion rope, styrofoam on canvas).



Audacia. (© Sasja Hagens, 2006. Seize: 150 x 200 cm. Technic: Acrylic paint emulsion, rope styrofoam on canvas).

'People sometimes ask me why I've spent so much time painting ports, such an obvious theme. But their size and industrial quality light the fire in me'.



Unbounded. (© SasjaHagens, 2014. Seize: 140 x 340 cm. Technic: Acrylic paint and emulsion on canvas).

'Artists can still be innovative within classical themes like ports and portraits, so as far as I'm concerned there's plenty of space for me'.



Tugs in action #3. (© Sasja Hagens, 2020. Private collection. Seize: 80 x 100 cm. Technic: Acrylic paint, emulsion on canvas).



Sasja Hagens drew inspiration from interpreting ports as a metaphor for vigour, desire, life. The artist for the triptych 'Bridge Over Troubled Water/The Intoxication Of Victory'. (Photo: Lisa Diederik).

'To me, it s all about colour, About rhythm, about seeing what it is, yet letting the abstract value of the painting dominate'.

AUTHORS INTERVIEWS



Carola HEIN

Professor, Chair of History of Architecture and Urban Planning. Department of Architecture, Delft University of Technology. Delft, The Netherlands. Director, LDE PortCityFutures. UNESCO Chair Water, Ports and Historic Cities.

She trained in Hamburg (Diplom-Ingenieurin) and Brussels (Architecte) and earned her doctorate at the Hochschule für bildende Künste Hamburg in 1995. Among other major grants, she received a Guggenheim Fellowship to pursue research on The Global Architecture of Oil and an Alexander von Humboldt fellowship to investigate large-scale urban transformation in Hamburg in international context between 1842 and 2008. Her current research interests include transmission of architectural and urban ideas along international networks, focusing specifically on port cities and the global architecture of oil. Her (co-) edited books and monographs include: *Oil Spaces* (2021), *Urbanisation of the Sea* (2020), *Adaptive Strategies for Water Heritage* (2020), *The Routledge*

Planning History Handbook (2018), Uzō Nishiyama, *Reflections on Urban, Regional and National Space* (2017), *History, Urbanism, Resilience, Proceedings of the 2016 IPHS conference* (2016), *Port Cities: Dynamic Landscapes and Global Networks* (2011), *Brussels: Perspectives on a European Capital* (2007), *European Brussels. Whose capital? Whose city?* (2006), *The Capital of Europe. Architecture and Urban Planning for the European Union* (2004), *Rebuilding Urban Japan after 1945* (2003), and *Cities, Autonomy and Decentralisation in Japan*. (2006), *Hauptstadt Berlin 1957-58* (1991). She has also published numerous articles in peer-reviewed journals, books, and magazines.



Paolo DE MARTINO

Architect and Ph.D. in Architecture and Urban Planning.

Paolo De Martino is a researcher and teacher at Delft University of Technology. He moved to the Netherlands in 2015 where he started as a Ph.D candidate at the Department of Architecture of TU Delft under the supervision of prof. dr-ing. Carola Hein. He received his PhD diploma in May 2021 within a dual program between the Department of Architecture of Delft University of Technology and the University of Naples Federico II. His research interest – which touches upon the complex relationship between ports, cities and regions – deals with port cities from a spatial and institutional perspective. He has investigated the port

city of Naples in comparison to port city territories along the Hamburg-Le Havre range, with particular reference to the cities of Rotterdam, Antwerp and Le Havre. He is involved as tutor in the development of MOOCs on port cities (<https://online-learning.tudelft.nl/courses/re-imagining-port-cities-understanding-space-society-and-culture/>) and water works (<https://online-learning.tudelft.nl/courses/water-works-activating-heritage-for-sustainable-development/>) working with Carola Hein and PortCityFutures research team. Since August 2021 he has a temporary teaching position at the Department of Architecture at TU Delft.