Chapter 15
The Separation of Ports from Cities: The Case of Rotterdam

Carola Hein and Paul Th. van de Laar

Abstract Since industrialisation began in the 19th century, some ports have been moving away from the cities that once hosted them. That separation was only possible if land was available where new port basins, industries, and other infrastructure could be constructed and where port activities could prosper without being restricted by urban functions. The port of Rotterdam represents an extreme example of port-city separation. This chapter shows how the port of Rotterdam transformed from a staple port into a transit port. Port activities moved towards the North Sea in four steps that were related to technological, institutional, and trade pattern changes and changes in port-city relations. Such transitions highlight the close relationships between trade patterns, technological innovations and changing governance patterns. Each expansion required close collaboration between business leaders and the municipality, because administrative borders needed to be expanded and infrastructure constructed. The growth also created friction among the various stakeholders in the region. The merchants of the staple markets protected their trades and traditions, whereas the harbour barons that benefited most from the high-volume trans-shipment of bulk commodities pushed the expansion of the port. To illustrate these steps in the separation of port and city, the chapter takes the case of petroleum as a key example. While beneficial for the economic development of the port –and to some degree the city–the separation of port and city has led to a loss of connection between port and city institutions. The chapter concludes by briefly examining the challenges and opportunities of port and city separation in terms of economic, spatial and cultural development.

Keywords Rotterdam · Port-city relations · Petroleumscape · Planning

C. Hein (✉)
History of Architecture and Urban Planning, Delft University of Technology, Julianalaan 134, 2628, BL Delft, The Netherlands
e-mail: C.m.hein@tudelft.nl

P. Th. van de Laar
Department of History, Erasmus School of History, Culture and Communication Erasmus University, Rotterdam, The Netherlands
e-mail: vandelaar@eshcc.eur.nl

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15.1 Introduction

Port-city relations have changed profoundly since the industrial revolution began forcing cities to make changes to port location and infrastructure (Bretagnolle 2015; Hein 2011, 2013, 2016a, b, c). Successful port cities invested in new water and railway linkages and their ports became international gateways for industrial commodities. Such transitions have involved fundamental changes to port regimes, including the rules and regulations, socio-technological landscape and routines which direct the behaviour of port stakeholders (Schot and Kanger 2018). The 19th century, according to Jürgen Osterhammel (2014) became the golden age of ports and port cities, particularly the ones that were big enough to handle the huge volumes of goods and passengers in the expanding world economy. Port cities played a fundamental role in global transformation as vital transition points between countries and continents.

Successive stages in port development have been linked to challenges that are often similar around the world. City-based social, political, institutional, governmental and economic conditions have set the context for effective adaptations (Hein 2011). In 1850, most port cities could change maritime techniques at the same time they adapted waterfronts. The new maritime spaces in most cases remained part of a city and of existing urban functions (Konvitz 2013). However, the increasing sizes of steam vessels and changes in cargo-handling technologies challenged existing port-city relations, fostered new spatial realignments, and created monofunctional areas (Hein 2016a, b, c). Starting in the 19th century, new planning and urban design models reshaped the governance of port areas and industrial districts and port cities' relationship to that governance. During the 20th century, especially after the Second World War, most cities became dissociated from any distinctive port area. Port-city relations, as noted by many scholars, have become more difficult since the post-1960 development of containerisation ushered in an era of complete separation of port areas from the city and of waterfront renewal (Meyer 1999; Schubert 2018; Porfyriou and Sepe 2016; Schubert 2018).

Rotterdam showcases the transformation in port-city regions through the extreme separation that has taken place. Beginning in the late 19th century, Rotterdam developed as a transit port that served the needs of the German hinterland. During this time, Rotterdam had to negotiate territorial claims with its immediate neighbours and to adapt its port system to the New Waterway of 1872, the shipping canal that connected the city with the sea. Neighbouring cities were annexed and rural areas were transformed into a transit port cityscape (Hein 2016a, b, c). From an urban governance perspective, the city had to meet the demands of technical and maritime developments within a limited and shared space. The ongoing increase of scale in shipping and the development of specialised ports and cargo-handling devices put tremendous pressure on an area that became dominated by its port economy (Meyer 1999). Until the mid-1930s, annexing land, neighbouring towns and villages was an acceptable legal way of consolidating territorial claims for port expansion. Then port expansion through the annexation of

neighbouring cities reached its limits and new governing models had to be developed to safeguard immediate port expansion without formal annexation. In particular the post-war development of modern industrial areas proved a test case for port-city relations. Transnational petrochemical industries led decision makers in the port-city region to remake an even larger agrarian and rural region as an industrial landscape.

Port-city relations transformed in four evolutionary stages. These transitions resulted from technological-maritime and industrial developments and had a lasting impact on spatial contexts and on port-city governance relations. We identify four steps in port-city relationships that are related to the growth of the port. (1) Starting in the 1860s, the city government created separate docklands on the south bank of the River Maas that facilitated Rotterdam's transit economy and created a port system specialised in the handling, storage and transport of bulk commodities (grain, coal, iron ore and oil). (2) New docks and canals were extended into a system of "wet-docks" (1885–1940s) and a new port landscape emerged (1910–1940) to facilitate the booming oil industry. The extension of the transit port during the inter-war period transformed port-city relationships, resulting in the city's expansion to the west, particularly when the industrial oil port started to develop in the period leading up to the Second World War. (3) The Second World War and the re-industrialisation of the port region produced maritime industrial development areas (MIDAS) (1940s–1970s). The post-war modern industrial areas were dominated by further expansion of the oil and petrochemical industries with major consequences for the port region. (4) The post-war expansion of Rotterdam, finally, stretched over a distance of 40 km, including the reclaimed Maasvlakte area into the North Sea (1970s–2000s). Understanding these historic transitions and their link to changing port-city relations provides insight into changes to come.

15.2 The End of a Merchant Ideology: The Emergence of the Transit Port South of the Maas 1860s–1910s

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. The geopolitical uncertainties about the future of Rotterdam provided a climate where local elites were reluctant to accept a change of traditional commercial, maritime and trade regimes. Members of the Rotterdam Council and representatives of the Chamber of Commerce came together to protect a merchant ideology rooted in pre-industrial staple market traditions. They welcomed attempts to measure and improve existing port practices, but they opposed ideas that conflicted with their staple market interests (Fig. 15.1). It took some time for local players to embrace new infrastructures and create the port spaces needed for a transit port.

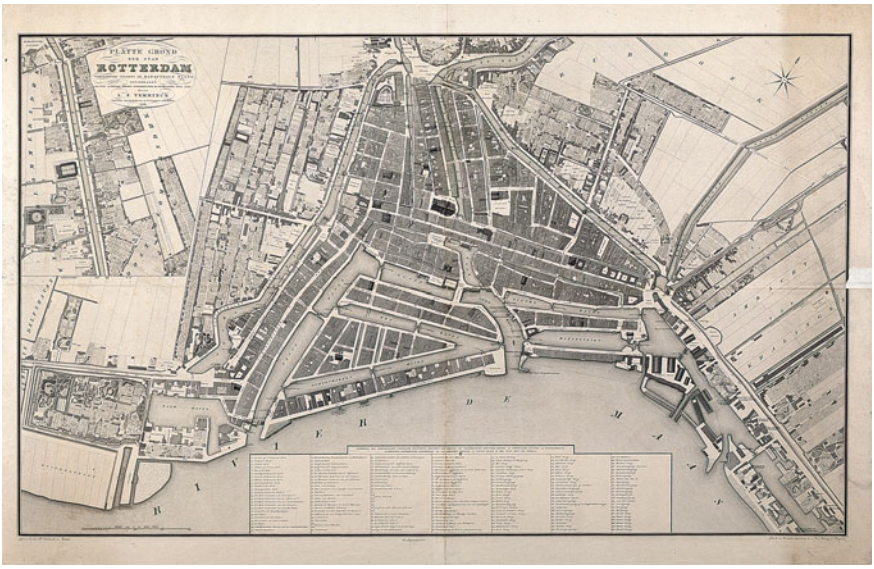

Fig. 15.1 First plan of Rotterdam in 1839, much more accurate than older maps, based on measurements taken by the land registry prepared by Leonard Temminck. *Source* City Archives Rotterdam

Rotterdam's focus on the staple market tradition conflicted with Germany's state and economic policies. Railways, at that time, were not considered a viable alternative to relatively cheap waterborne transport, but they proved a profitable alternative means of moving luxury goods and passengers over long distances. Once competing companies arrived and the railway network expanded internationally, railroads became attractive for the transport of commodities. The rail link between Antwerp and Cologne–the Iron Rhine (1843)–and the Cologne-Minden railway (1847), connecting the Rhineland with the German port of Bremen, were effective instruments to end the monopolistic position of the Rhine as the only route towards the sea (Klemann and Schenk 2013). Throughput of petroleum shipped from the United States after 1862, for example, could reach the German hinterland via Antwerp as well as via Rotterdam. The interests of strong players in the Rhine basin effectively reduced the power of local elites in Rotterdam to control the function of the port.

The improvement of hinterland connections went hand in hand with plans for better access to the North Sea from the winding Maas through a forty-kilometre-long canal. The merchants embraced the opening of the *Nieuwe Waterweg* (New Waterway) in 1872, the shipping canal that connected Rotterdam directly to the North Sea. They supported it not because they were anticipating a regime shift based on steam and transit trade that would change the practices of their trades, but to grant access to larger sailing vessels. They opposed all kinds of new developments, such as the abolishment of Rhine tolls that would stimulate transit functions

of the port, and modern railroads that could jeopardise the distributive function of the old staple market. Paradoxically, in the view of Rotterdam merchants, the greatest disadvantage of free trade was the possibility that the port of Rotterdam would become a transit port and thus lose its staple market position (Van de Laar 2000).

The merchants also realised the need for new docks and trade facilities, but Rotterdam's urban planning history shows that spatial concepts were still based on pre-industrial port concepts and the construction of port spaces close on the waterfront near the city. Around 1870, the Rotterdam Chamber of Commerce, once a body that acted on behalf of the staple market interests, turned toward a new policy that would end the hegemony of the old network (Callahan 1981). The city government needed private partners to spread the financial risks, but local merchants and traders were careful investors. Not just because of the involved business risks, but also because the new port layout would have a major impact on their practices. The national government (responsible for the new railroad and railroad bridge), the city of Rotterdam and Pincoffs' joint-stock company Rotterdamsche Handelsvereeniging (the Rotterdam Trading Association) opted for a public-private partnership in 1873. The Rotterdam Trading Association built docks based on the London dock system. Notwithstanding their modern appearance, the docks constructed by the Rotterdam Trading Association represent the last convulsions of the staple market era; their spatial typologies suited pre-industrial waterfront developments, which were a combination of commercial, residential, and monumental functions.

By 1870, Rotterdam dethroned Amsterdam as the leading port city in the Netherlands. By then, the more dynamic trading network that resulted from the industrial revolution had replaced the rather passive organization of the Dutch staple trade. Rotterdam built a port infrastructure that serviced the German hinterland and became the most important Rhine-traffic and transit port for coal, ore, grain and oil on the European continent before World War I. Almost 70% of Rotterdam's throughput consisted of transit goods (Van de Laar 2000). As early as 1862, several hundred barrels and crates of petroleum from the United States arrived in the Rotterdam port (Loohuis 1952; Janssen 1999). Oil firms were small at the time and focused on transport, storage, and resale as they searched for the fastest and safest transportation chains and refining processes. In these early years, Antwerp held the dominant position. Demand in the German and Swiss hinterland spurred the import of oil through Rotterdam in competition with these other ports. In 1870, the Provincial Executive agreed to extend the Rotterdam municipality against the opposition of the municipalities of Charlois and Katendrecht (Van der Schoor 2013; Loohuis 1952). The storage of oil was transferred to Charlois by 1876 near Sluisjesdijk, a location fully in control of Pakhuismeesteren (De Klerk et al. 2008, pp. 140–142; Van de Laar 2000). After several years of negotiations, on February 28th, 1895, Charlois officially became part of Rotterdam and the central location for oil storing and trading (Van der Schoor 2013). By that time, the Randstad, where railways had first connected the main cities on the Western shore, 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 the long-term development of Rotterdam as an oil port at a time when new global players in oil were emerging (Fig. 15.2).

At the turn of the twentieth century, Rotterdam's urban form and port-city scape had changed drastically. The port transformed the area south of the River Maas starting with the area of Feyenoord. Gerrit Johannes de Jongh, Director of Municipal Works of Rotterdam (1879–1910), became recognised as the author of the transformation. His new spatial layout for the port city on the south bank of the river Maas differed in many aspects from the docks that the Rotterdam Trading Association had developed. This genius engineer pioneered the construction of docks with an open access from the river to facilitate the trans-shipment of bulk goods. De Jongh realised that Rotterdam needed docks suitable for quick dispatches. From the mid-eighties onward he developed three river docks—Rijnhaven, Maashaven and Waalhaven (Rhine, Meuse and Waal docks)—that reshaped the river landscape south of Rotterdam. The docks were based on the concept of 'wet docks' and large 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.

The creation of new spaces for trans-shipment coincided with the addition of industrial spaces in the port area itself. Notably, the petroleum industry became a key user of these sites. The petroleum site in the then-independent municipality and former fishing village of Pernis, which had stored petroleum since 1887, became the heart of the new development. In 1902, the predecessors of Royal Dutch Shell were ready to jump into the new oil age centered around automobiles and built a gasoline refinery near Pernis. In 1907, the company installed a trial distillation facility for petroleum sent from Borneo, and a trial facility for asphalt followed in 1918. These new industrial facilities required extensive areas in proximity to the water. These could only be found outside the city, leading to further expansion westwards (Fig. 15.3).

The port's layout on the right bank served the interests of general cargo trans-shipment firms and a majority of shipping lines concentrated their business there. Rotterdam South was primarily an area where Rotterdam worked for the German hinterland. Rotterdam's major stakeholders believed that rationalising maritime power and technology would safeguard Rotterdam's future. The port's successes stimulated the city to embrace a port-city identity distinguishing Rotterdam from cities like the Dutch capital Amsterdam and The Hague, the latter the Netherlands' seat of government. Rotterdam as a working city was part of a port culture marked by an exceptional drive to modernise. The port expanded westwards and the Waalhaven, built in three stages and completed in 1931, became the main petroleum hub.

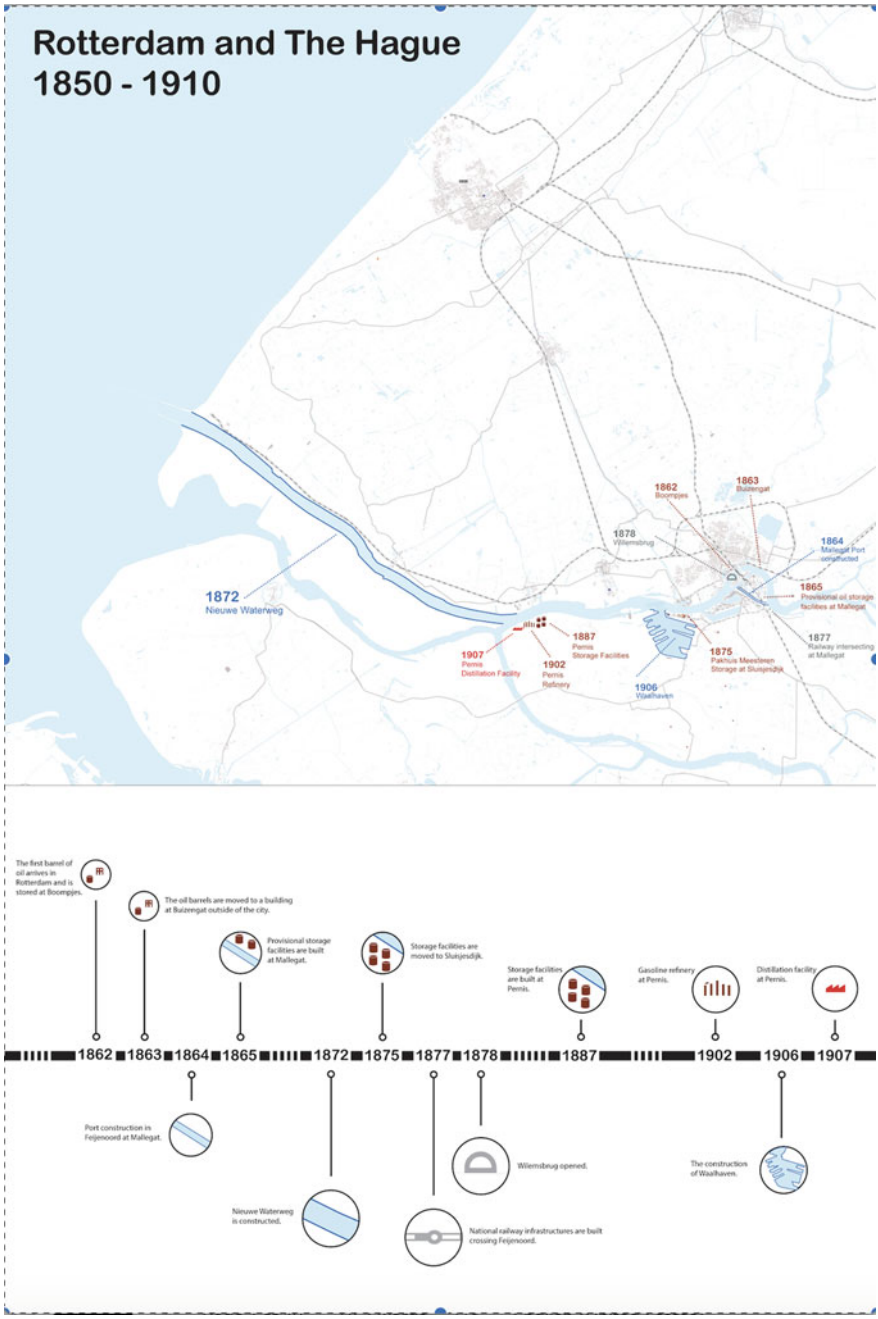

Fig. 15.2 The emergence of the global petroleumscape in The Rotterdam The Hague area 1850–1910. *Source* Carola Hein, Arnoud de Waijer, Otto Diesfeld, Iskandar Pané

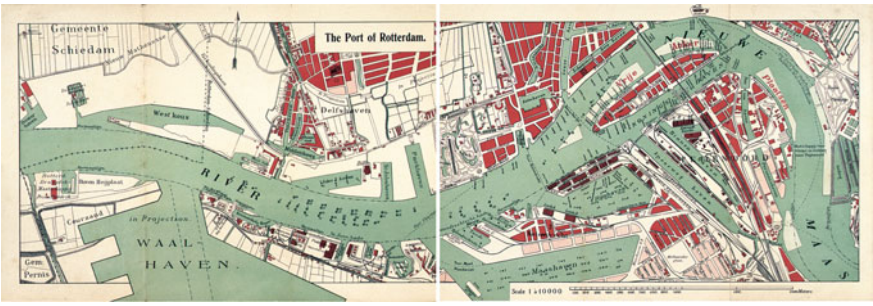

Fig. 15.3 Map of Rotterdam's harbor area around 1907. *Source* City Archives Rotterdam

15.3 The Growth of the Oil, Annexation and Port Extension to the West: 1910s–1940s

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 trans-shipment 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, Rotterdam did not have a very strong position in oil-trans-shipment compared to Antwerp and Bremen. However, Rotterdam's successful transformation into a transit port made it a place of interest for transnational oil firms entering the European market selling new products. Lighting oil had been replaced by other petroleum products like petrol and car owners would soon emerge as important consumers (Hein 2018).

Before the outbreak of the First World War, Rotterdam faced many transitions in a limited and shared space. The city region needed a port vision that would safeguard further expansion, which meant that the city had to renegotiate relationships with its neighbours. De Jongh's successor, A. C. Burgdorffer, wanted to prevent other cities and boroughs in the Waterweg area developing independent harbours to compete with the port metropolis. As a consequence, Rotterdam annexed the village of Hoek van Holland in 1914. The Chamber of Commerce acknowledged the need to expand Rotterdam's petroleum facilities, but was less enthusiastic about port developments at such a great distance from the city centre. The City Council was reluctant to accept the plan, which according to a large majority was full of questionable assumptions about Rotterdam's potential growth, particularly considering how the port economy suffered from the effects of the First World War. After 1918, 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. Its importance is even captured in an oil painting (Fig. 15.4). Petroleum industries needed dedicated harbours and large facilities with ample space for refinery and storage, including advanced railway and shipping connections. The restructuring of the oil industry also impacted port-city relations and this would continue after the Second World War.

The complexities of port-city-region relations can be illustrated by the development of Rotterdam's regional planning perspectives. During the 1920s, new planning and urban concepts were introduced. W. G. Witteveen, who became the leading urban developer of Rotterdam in the inter-war period and a city planner during the Second World War, realised new planning ideas were needed to improve living, urban and economic conditions impacted by Rotterdam's port and industrial developments. He used scientific research methods to optimise the different functions and his port-city regional perspective aimed to expand Rotterdam's territories (Mens 2007). Witteveen's regional plan of 1928 was based on an annexation plan which the city submitted to the provincial authorities in 1927, intending to annex eight surrounding cities and villages in order to safeguard Rotterdam's plans to expand. The ambitions for "Large Rotterdam" faced considerable opposition, in particular among residents of the old cities of Schiedam and Vlaardingen. They were not inclined to encourage Rotterdam's land hunger or its treatment of the region as a port commodity. Schiedam reproached Rotterdam as engaging in

Fig. 15.4 Petroleum storage at the port areas of Pakhuismeesteren in Charlois around 1930. Willem van Dort (1905–1996). *Source* Collection Museum Rotterdam

imperialistic behaviour aimed at erasing the independence of regional entities in order to create a united Rotterdam stretching towards the sea (Rotterdam 1927; Van de Laar 2000). Although the Province of South-Holland rejected the annexation plan, Rotterdam was able to annex Pernis, which allowed the city to expand its industries in 1934. This was particularly relevant for the development of the petroleum industry (Fig. 15.5). Until the mid-1930s the major oil companies' refining capacities and oil storage activities were concentrated near the Waalhaven (Fig. 15.6).

Since the mid-1920s, Witteveen had been working on new regional plans, which enabled him to integrate the major infrastructural and port developments into a more balanced growth scenario. From De Jongh's early port expansion plans and Burgdorffer's much debated port schemes, Witteveen had learned that the city should take a leading role in an integrated port-city-region plan. According to Witteveen, the river Maas was the lifeblood for an urbanised port region, a meandering infrastructure defined by port activities, both those already realised and those planned, on both riverbanks, flanked by existing and planned neighbourhoods. Spaces of work, leisure, living and so forth had to be connected by an extensive network of railroads, roads and new river crossings. These infrastructures formed an essential framework for connecting the different parts of the port region and integrating them in an overall plan. Other options were discussed as well,

Fig. 15.5 Map of Rotterdam, showing the extensions to its territory from 1870 to 1941, with the years in which the relevant laws were passed. Adapted by C.A.A. de Graaf, Rotterdam Department of Public Works. *Source* City Archives Rotterdam

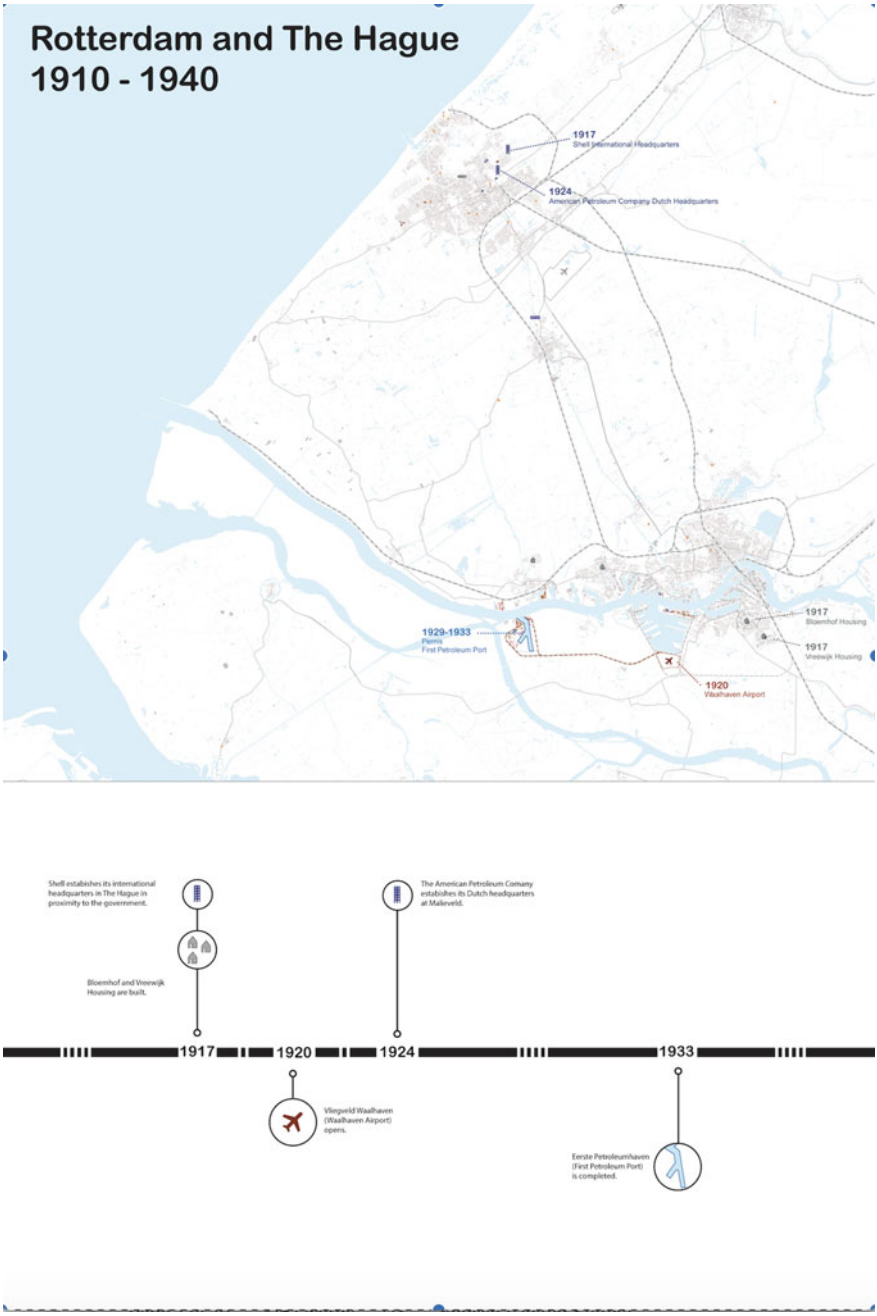

Fig. 15.6 The Petroleumscape in the Rotterdam The Hague Area 1910–1940. *Source* Carola Hein, Arnoud de Waijer, Otto Diesfeld, Iskandar Pané

including the possibility of bringing all ports along the Maas and New Waterway under the heading of a central authority, a Port District, a semi-public legislative body which would operate all ports in the city-region. Before the Second World War, neither the city of Rotterdam, the city's neighbours or supra-municipal bodies were able to come up with a governance structure that would satisfy all major stakeholders. Rotterdam's post-war expansion and industrial development, however, would reset the port-city agenda again.

15.4 The Functional and Spatial Characteristics of the Industrial (Petroleum) Port Areas: 1940–1970

On the 14th of May 1940, Rotterdam's historic inner city was erased by a German bombardment. Although the port infrastructure was still intact when the Dutch surrendered the following day, in September 1944 the Germans destroyed almost 42% of the quays and other port facilities (Van de Laar 2000). During the German occupation, plans were being made for a large post-war reconstruction and industrialisation programme. The pre-war transit docks planned by De Jongh had created a new waterfront, but although urban planning was secondary to port planning, the working port was still integrated with urban neighbourhoods. Large-scale industrialisation of the port called for a different type of transit port, separating port activities from other urban-based maritime services.

In the post-war period, the oil industry brought new demands and opportunities to Rotterdam as the port expanded with the municipal boundaries of the city (Figs. 15.7 and 15.8). Most of the oil started coming from the Middle East. With the nationalisation of oil there and the creation of OPEC (Organization of Oil Exporting Countries) in 1960, demand increased, supply was reduced, and prices rose (Bauer and Boer 1981). The expansion of oil industry operations reached a new level. Cargo ships grew in size and could no longer be accommodated by ports such as Antwerp, which were accessible only through an estuary (or Amsterdam, a port accessible only via locks). Among ports, Rotterdam stood out with its direct access to the sea. Beginning in the 1960s, the chemical industry blossomed, indicating another major change in the petroleum industry. According to Dutch historian De Goey (1990), the construction of refining compounds (petrochemical complexes) made the biggest difference between the pre- and postwar periods (De Goey 1990; Loyen and Van de Laar 2004). The post-war period saw the development of a different kind of industrial area, so called Maritime Industrial Development Areas (MIDAS), where the separation between city and port was complete. The Rotterdam port grew in size and Pernis, Botlek and Europoort emerged as the main areas controlled by six multinational oil companies (Hein 2018).

The demands of the oil industry continued to dominate planning and land allocation in the Rotterdam area. The national government advocated preserving

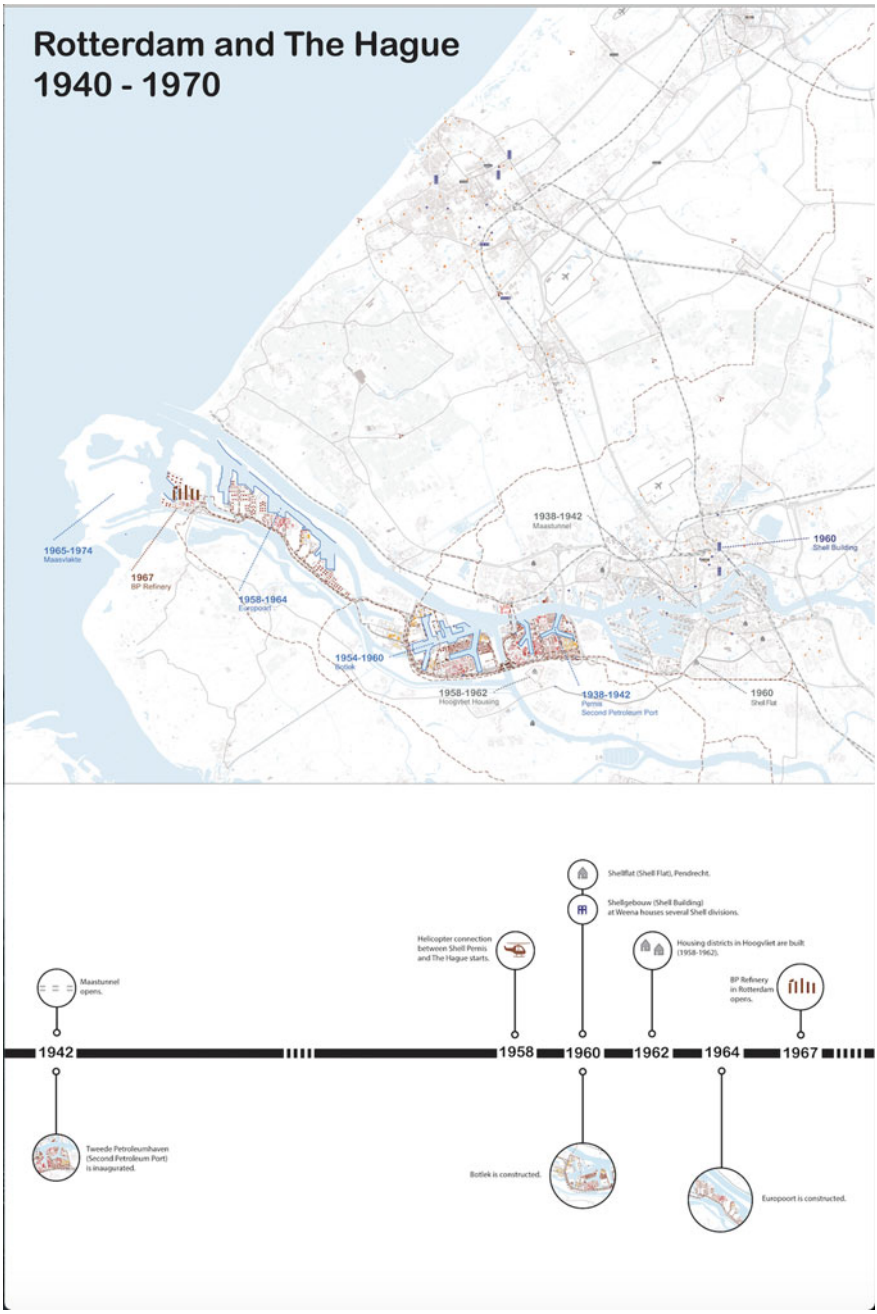

Fig. 15.7 The Petroleumscape in the Rotterdam—The Hague Area 1940–1970. *Source* Carola Hein, Arnoud de Waijer, Otto Diesfeld, Iskandar Pané

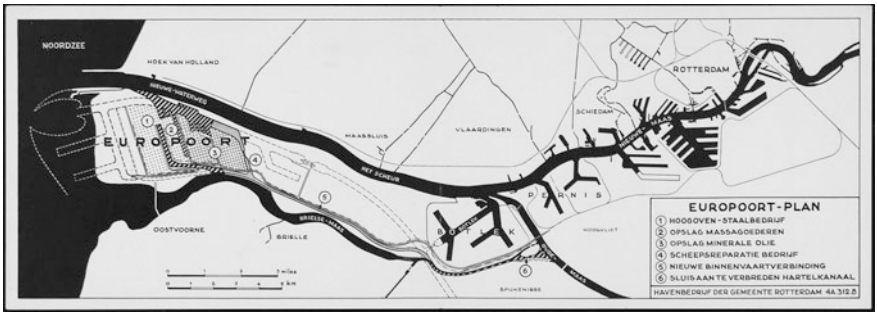

Fig. 15.8 Europoort Plan in 1957. It consisted of new petroleum docks, petroleum storage areas, including a new inland waterway. Additionally, a new shipyard was planned, a steel works, a rolling mill for shaping metal and a blast furnace. Port of Rotterdam Authority. *Source* City Archives Rotterdam

land in the port for companies that needed access to deep water and letting other companies relocate (Hajer and Zonneveld 2000). A regional plan for West Brabant established around 1969 allowed for a new Shell refinery in Moerdijk—accessible by pipeline—and provided space for future expansion (Van der Cammen 2012). Opening this land for the oil company was in clear conflict with national spatial planning policy and the parliament decided that such 'flexibility' should be curtailed by statutory planning decisions. The port continued to grow in ways that separated it from the city. From the 1970s, pipelines became the main carrier for oil (cheaper than train or ship), notably crossing borders towards Antwerp in Belgium and the Germany Ruhr area long before the Schengen agreement allowed people to circulate freely (Boon 2014; Fig. 14). The construction of the pipeline from Rotterdam to the Rhine, instead of from Wilhelmshaven in Germany (a proposal made by Exxon), was influenced by Shell Netherlands' intervention and reflected the battle between the two oil giants.

The first containers arrived in Rotterdam in 1965. The Port of Rotterdam Authority recognised the importance of container development and stimulated the concentration of Rotterdam stevedore companies, Dutch Railways and the leading Dutch shipping firm Nedlloyd into what would become Rotterdam's major terminal operator, ECT. The Port of Rotterdam Authority was convinced that to ensure its position as a container port, the city needed to construct docks to optimise the accommodation and handling of containers. In 1967, plans were presented to construct the Rijnpoort (Rhinegate dock) between the villages of Maassluis and Hook of Holland on the right bank of the river Meuse. The plans emphasised roll-on/roll-off facilities combined with a cruise terminal and an enlarged space dedicated to container handling and storage. In 1975, a changing international, national and local political climate made the authorities postpone the construction of the Rijnpoort dock. In the 1980s, the Maasvlakte, once designed as an industrial outpost, was transformed into a high-tech service center, home to the largest European bulk trans-shipment and container center.

By the mid-1970s, Rotterdam was called a "city in doubt" in a report by the Dutch Economic Institute (Nederlands Economisch Instituut 1974) which argued that it needed to change its economic structure, reducing its dependence on industrial output and the trans-shipment of bulk goods, thereby increasing the relative contribution of service industries to GNP. A complicating factor was that the public-private partnerships that had been successful in the post-war era had dissolved. Rotterdam's post-war industrial development had become a matter of public discussion as well. By the 1960s, the Rotterdam region had become the most polluted area of the Netherlands. Environmental problems called for a drastic reorientation of industrial port policies and thus a halt to any further expansion of polluting industries like the petrochemical, shipbuilding, and metal industries (Van de Laar 2013).

A shift in local politics encouraged a more social and welfare orientated urban programme and growing resistance to an industry agenda. Large-scale port industrialization was no longer a viable option. Rotterdam did not have a competitive edge in the general cargo sector. Establishing large concentrated peripheral container terminals would not add a significant number of new jobs. New, less polluting, high value-added industries, such as optical, medical and upcoming creative industries and those offering specialised services were the best option, but Rotterdam found them difficult to attract. These, often innovative, industries needed better trained and qualified staff than Rotterdam was able to supply. In addition, Rotterdam's urban and working-class image and civic climate (housing and living conditions) proved to be a formidable obstacle in realising these goals. The Rotterdammers' image as hard-working citizens in a newly built modern port city had lost appeal. Rotterdam was no longer the model city of the Netherlands or the workhorse of the Dutch economy.

15.5 The Expansion of the Port Into the Sea: 1970s–Present

The 1970s oil crises, when major industrial countries faced oil shortages, could have challenged the ability of petroleum actors to continue shaping the built environment. Car-free Sundays in the Netherlands allowed citizens to reclaim highways. However, after the crises passed, the memory of the public was short and few long-lasting changes occurred. In the 1970s, Rotterdam was firmly established as a leading oil port, serving consumers particularly in the German hinterland. Refineries continued to grow. The BP refinery in Rotterdam, which started production in 1967, and which includes 480 acres of facilities at Europoort and Pernis (The Netherlands Rotterdam Refinery Facility Fact Sheet 2011), has a production capacity of 400,000 barrels of crude per day, with a storage capacity of 4.5 million cubic meters. It illustrates the growth of the industry, but that growth is visible only through dedicated mapping (British Petroleum in the Netherlands 2015). The

production sector is huge in scale (with some 5300 ha for industrial sites and 1500 km of pipelines within the port) and its impact on planning decisions is high, but it tends to be invisible to the general public (Port of Rotterdam, Netherlands 2015) The pipeline network that links Rotterdam with Antwerp (where the big ships can no longer dock and where the petrochemical industry needs petroleum) and with Germany is largely out of sight.[1] Oil companies share other parts of the infrastructure such as important rail and highway networks with passengers who rarely recognise them as part of oil networks. In the face of global changes in the energy landscape, climate change and the emergence of new green energies, the petroleum landscape in Europe is changing. Today, with refinery closures looming in northwestern Europe, scholars of the Clingendael Institute expect that the refineries of the Rotterdam and Antwerp port will be among the last ones standing (Van den Bergh et al. 2016). Changes in the refining business will affect ports, cities, and transportation infrastructure, and those entities will have to formulate planning strategies in response (Fig. 15.9).

The construction of the Second Maasvlakte was the first new major expansion of the port. since the 1970s. 2000 ha of newly created land allowed the port of Rotterdam the possibility of doubling the trans-shipment 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 will 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. 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 (Koppenol 2016).

Hans Smits, former CEO of the Port of Rotterdam Authority, claimed in 2013 when he stepped down from office that a Maasvlakte III would be an unlikely option.[2] According to him, the Second Maasvlakte offered enough space to fulfil Rotterdam's ambitions (Fig. 15.10). He expected the port of Rotterdam to reach a level of throughput of 600 million tons in 2030. In the past, Rotterdam's port officials have been overly optimistic about the port's growth potential. Smits' public announcements about the Third Maasvlakte came at a time when Rotterdam was basing its future strategy on climate change and energy transition and since 2015 debates on the energy transition have accelerated rapidly.

Debates about the future of port-city relations follow the pattern set by earlier conversations. The energy transition will foster another regime shift in the port of

[1]There is also an extensive NATO pipeline system (http://www.nato.int/cps/en/natolive/topics_49151.htm?selectedLocale=en) (accessed 15.7.2015).

[2]"Derde Maasvlakte niet nodig' Trouw," 21.4.2011, https://www.trouw.nl/home/-derde-maasvlakte-niet-nodig-~acf8fc54/, 21-4-2011, accessed 16-04-2019.

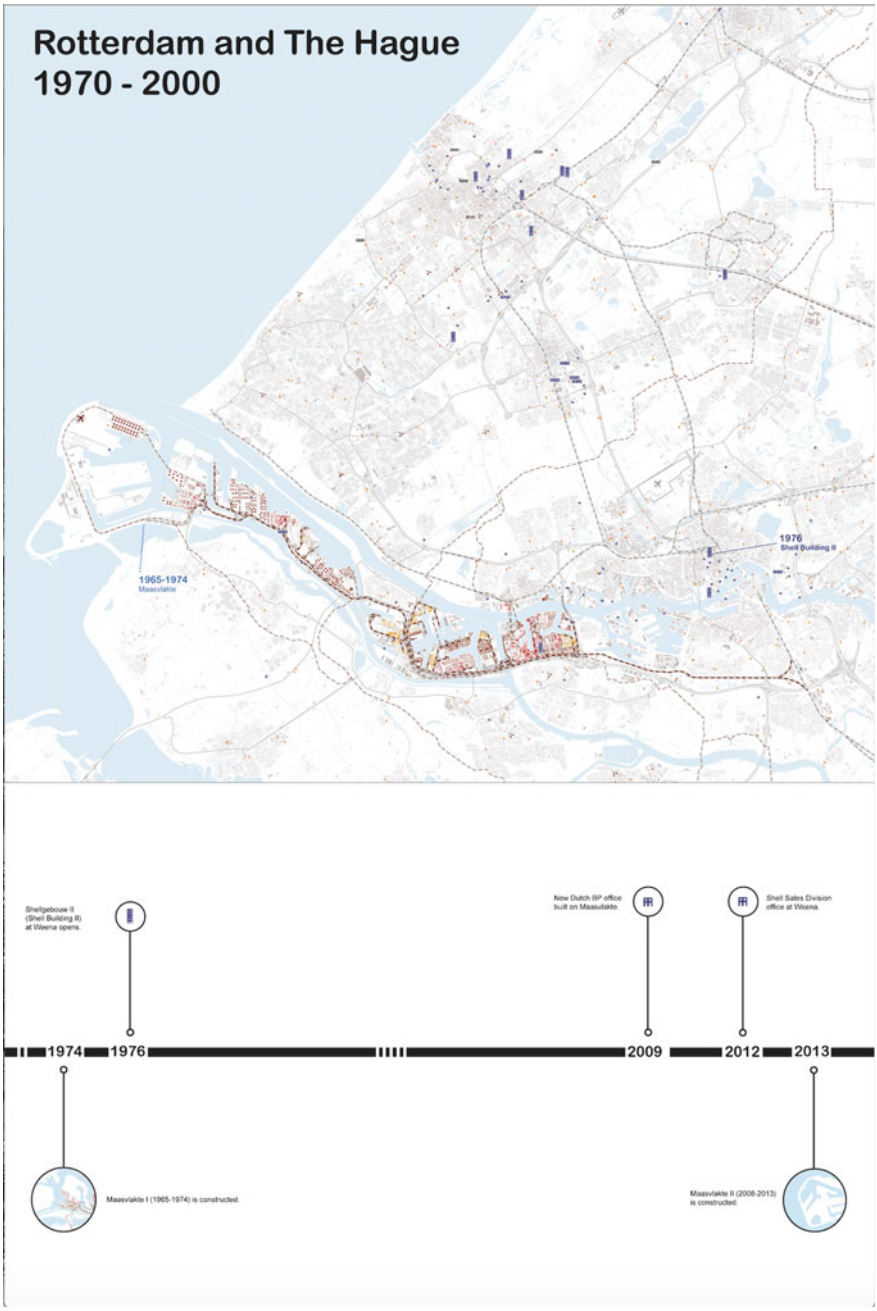

Fig. 15.9 The Petroleumscape in the Rotterdam The Hague Area 1970–2000. *Source* Carola Hein, Arnoud de Waijer, Otto Diesfeld, Iskandar Pané

Fig. 15.10 The plan for the Second Masvlakte in 2008. *Source* https://beeldbank.rws.nl/Rijkswaterstaat

Rotterdam. Since the Port of Rotterdam published its vision document in 2011 (Port Vision 2030 2011), the world has changed rapidly, because of geo-political, social, technological and, in particular climate change impacts (Halim et al. 2016). Innovation is again necessary as we face several transitions, but the OECD claims that the vision should be "imaginative rather than technocratic" (OECD 2014). This will be a major challenge for Rotterdam since the port's regime is still based on scale and volume and its success is measured in throughput (Bosman et al. 2018). Since the 1950s, the port's infrastructure has developed to meet the requirements of the petrochemical industry, which has made it very difficult to change focus. The most fundamental strategy changes thus far proposed are the Bio Port initiative and the Rotterdam Climate Initiative,[3] but the major challenge is, according to scholars on transition, "how to transform from a linear to a circular port economy, from fossil to bio-based and from a monoculture based on three isolated pillars (logistics, maritime industry, energy and chemistry) to a diverse and flexible industrial ecosystem" (Bosman et al. 2018, p. 9).

[3]Port of Rotterdam, Port of Rotterdam C02 Neutral, https://www.portofrotterdam.com/sites/default/files/port-of-rotterdam-co2-neutral.pdf, 2017, accessed 16-12-2018.

15.6 Conclusions

Over the last century and a half, Rotterdam's port development and port-city relations have been heavily determined by Germany's hinterland connections and industrial dependencies. The Maas area turned into a port landscape, reconverting a rural space to an area dominated by wet docks and specialised industrial estates. The emergence of the transit port led to expansion to the south, the expansion of industry in the inter-war period and the construction of refineries in the post-war era pushed the port towards the sea. The expansion to the west had a major influence on port-city relations, notably following annexation plans. Intended to safeguard the city's industrial ambitions, especially the promising development opportunities of the major oil companies, the port's development needed new governance and planning structures. The prevailing concepts and mindset were, however, influenced by the war and post-war developments.

After 1945, Rotterdam developed an industrial port cityscape that created a 'city without port' (Hoyle and Pinder 1992). The iron and steel industry, oil refineries, petrochemical complexes, power plants—in short the major raw material-using factories—relocated to new industrial areas. Oil had become the most important bulk good. Rotterdam floated on oil. Major Maas adaptations, tank storage parks, and a network of pipelines became a critical linkage that pushed forward the petroleumscape and refineries, serving the growing demand for oil and petrochemical products in the Rhine-Ruhr area (Hein 2018). The port network underwent another radical change with containerization and the gradual implementation of new thinking in the field of information and communication. The container became an essential chain in a new philosophy of modern logistics. Containers were revolutionary, not because of the fact that general goods could be stored and transported in efficient boxes, but because of the changes in international logistics they brought about. This rotation of the logistics network coincided with a reorientation of the Western European transit economy caused by the economic recessions of the 1970s. The construction of the Second Maasvlakte (Maasvlakt II) was the first new major expansion of the port since the 1970s, granting the port of Rotterdam the possibility of doubling its trans-shipment of containers.

After 1970, Rotterdam lost its primacy as 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. The planning process of Maasvlakte II has shown how environmental issues have had a major impact on existing port-city-region relations and planning decisions, including the vital element that this would be the last extension into the sea (Koppenol 2016, p. 155). Further planning strategies and port-city relations will be dominated by the energy transition. Despite this, there remains the paradox that Rotterdam still depends on the oil and petrochemical industries.

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. During a century of port extension and growth to the West, the port has physically detached from the city. Environmentally it remains related to the surrounding area and the larger port-city-region ecosystem. Post-oil scenarios must attend to the many scales of the port cityscape including its material and non-material flows, its infrastructure, the historic city and the dispersed city. Rotterdam's port history—as a case of extreme separation between port and city—shows the urgency of a research agenda on port-city regions and their spaces, values and people.

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