Rotterdam The Hague, NL

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Photo, previous page: RDM Innovation Dock, Rotterdam.

« Making paths to the next economy »

This chapter looks at the region comprising Rotterdam and The Hague, a richly productive landscape characterised by a vast port, intensive greenhouse based agriculture and urban areas. The recent economic and urban development of this region has resulted in a spatial configuration with unique characteristics, strongly interwoven with each other. Firstly, demand for space has led to the transformation of the region, which has been sculpted, made fit for specific purpose, with barely inches of unproductive land. Secondly, modernist principles introduced new functional zones with segregated areas specialising in mechanical manufacturing, chemical processing, logistics, to housing and leisure, resulting in a particular composition of building and urban areas. Thirdly, as a consequence of ongoing planning and adaptation of this productive environment, socio-economic stratification with a strong spatial manifestation continues to be noticed to this day.

The region hosts a vast range of manufacturing. Many of these have emerged from the port and access to goods, resources and an international market such as chemical processing and machine production. Newer forms of manufacturing are spinning out of centres of innovation such as bio-technology and sensors and are showing that the city's productive base is moving further and further away from the port. As the port itself changes and becomes increasingly automated, it leaves behind vast areas of land. While projected housing demand is putting pressure on the available vacant port areas, there are movements towards districts with new forms of production.

Challenged by climate change and international competition, ambitions have been set for a radical transition towards a new economic models such as the Next Economy. The stakes are high for both private and public actors to focus on building out clean energy, resilient high-tech solutions, and radical innovation. However a range of visions and the strategic sectors have resulted in confusion about what should be stimulated and what the city's new economic profile, regardless of what actually lands on the ground. In the absence of clarity and a holistic approach, the pressure mounts. Providing the desirable Next Economy workforce - those with higher incomes, education, and demands - with suitable housing and attractive urban environments puts in question the region's economic, social and environmental stability.

4.1 History and Present of an Industrialised Territory in Transition

Rotterdam's manufacturing has grown out of its two definable industries: the port and agriculture. As the port grew, so did ship building and process of the resources that arrived at the port. Agriculture on a small but highly productive landscape generated a speciality in food based technology.

TWO LANDSCAPES, TWO ECONOMIES[1]

Rotterdam and The Hague were born on two waterfronts: Rotterdam has grown along the river towards the North Sea and The Hague on the old dunes parallel to the coast that housed nobility, high bourgeoisie and civil servants. They have been connected by parallel forms of infrastructure since the fourteenth century, including canals, railways, motorways, and metro. If Rotterdam's economic character has been historically dominated by its port, The Hague's has been a center of government of and diplomacy. The combination has resulted in an internationally trade focused region with Europe's largest port and most intensive agricultural area.

INDUSTRIAL PAST AND PRESENT

The recent history of industrial development in the Rotterdam-The Hague region is inextricably linked to the port of Rotterdam. Beginning in the late 19th century, the port of Rotterdam transitioned from functioning under a staple market system to being a modern port; it ceased to base its activities in the exchange of high value commodities and specialized on the throughput of bulk and raw materials, and later to additional port-related industries, such as shipbuilding. Eventually, Rotterdam itself transitioned from a mercantile town (where a handful of merchant families were key in orienting the development of the city and market) to an industrial town. It shifted from having a mix of industry, trade, and socio-economic functions, to becoming dominated by a strict separation of functions[2].

The growth of the port that followed in the first half of the 20th century was dramatic. The reasons for this were threefold. Firstly, the construction of the Nieuwe Waterweg in 1872 linked Rotterdam directly with the North Sea and enabled access to the port of Rotterdam for larger ships. Secondly, innovations in water and

A panorama of the Erasmus Bridge and the River Maas in Rotterdam © Massimo Catarinella / Wikimedia Commons

land transportation, were suited to the city's geography or resulted in the city adapting itself to the new technology. Finally, Rotterdam rose in the wake of Germany's late 19th and early 20th century industrial euphoria. The port grew from 200 Hectares in 1880 to 1,880 forty years later.[3] In parallel, Rotterdam grew linearly along the river, flowing westwards following the growth of its port[4].

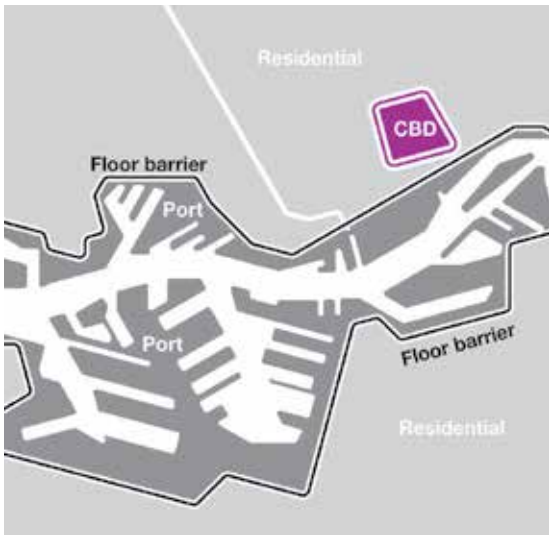
ROTTERDAM, FUNCTIONALIST PORTCITY

Second World War and subsequent reconstruction were a turning point in the port and city dynamics. The city saw some 2.6 km^2 of its medieval centre and other areas levelled by German bombs while the port suffered the destruction of seven kilometers of quay walls and a loss of 40 percent of its warehouse area[5]. By 1950, the port had receded to 1,400 Hectares[6].

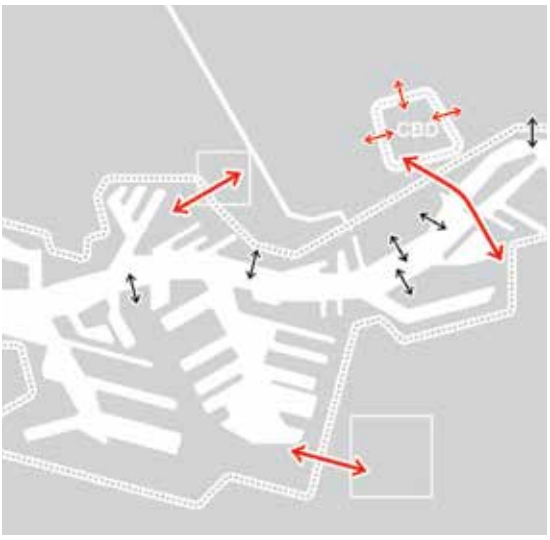
Guided by the Basis Plan of 1946, reconstruction was based on the modernist principle of functional separation[7]. "First the port, then the city" became the motto behind Rotterdam's economic revival[8]. Following on the modernist logics, what happened in the port had its own logic. Obviously, given the scale of the port, and the focus on water based traffic, that had huge effects in the city's economic profile and in its notably less diversified industrial development[9]. Historically, the port has behaved as a 'landlord' port, which leases sections of its premises and supplies with infrastructure to those companies that align with the Port Authority's strategy; the emphasis on throughput of cargo has therefore limited the type of industries that could settle by the River Maas.[10]

In the postwar, the port continued focusing on being a hub for transit and distribution. Investments in waterways and wharfs made room for larger vessels and newly invented containers[11]. Before 1940, 70 to 75 percent of goods were merely in transit. The realisation in the 1980s that

The embankment, Rotterdam, between ca. 1890 and ca. 1900.



Rotterdam 20th Century: (1) Strong functional separation; (2) strong physical segregation between river landscape and urban fabrics.
© Cities of Making team TU Delft



Rotterdam 21st Century: (1) Functional interweaving and flexibility; (2) physical interweaving of river landscape and the city.
© Cities of Making team TU Delft

"barely anything was done with the goods [that came in the port] in Rotterdam" led to define strategies to diversify its economy and focus on developing added value[12], making it less dependent on cargo and taking advantage of the port's location while creating new employment[13]. Initially oil refineries and chemical industries were built[14], followed by an emphasis on supply chain management and intermodal platforms which regionalised the port's economy.

URBAN RENEWAL IN ROTTERDAM[15]

If the dominance of the port in spatial politics was hampering the development of a diversified economy in the large, regional scale, policies of urban renewal in the 1970s and 1980s razed the remaining productive urban ecologies in the inner city. Housing shortage in the 1960s and early 1970s was aggravated by businesses competing for central land. In the period between 1970 and 1974, some 1200 dwellings were occupied by businesses due to the lack of available space.

The urban renewal projects substantially reduced the available space for making via regulation and urban design. Firstly houses were prevented from being transformed into office space. Secondly retail structure was pushed onto high streets to avoiding scattered shops in residential areas. Finally industrial spaces causing nuisance were moved out of the neighbourhoods.

The consequence was a sharp reduction of local jobs and working environments: - 11 percent reduction of local jobs compared to -0.7 percent in overall Rotterdam. Urban renewal resulted in a surprising paradox in Rotterdam's business landscape: while the supply of business space was twice as the demand, there was a shortage of smaller business premises; large companies had left, smaller ones remained, and new, smaller companies could not afford the new rents.

CHALLENGES AND TRANSITIONS

The port has continued its voracious growth in the past 40 years: from 7,600 Hectares in 1979[16], to 12,600 in 2017[17]. This growth exacerbated the inherent conflict between the spatial logic of the port versus that of the city[18]. As the port kept its position as global actor and distanced itself spatially from Rotterdam, the inner

Rotterdam after bombing of World War 2 in the Netherlands Source unknown.

city was neglected: it was, and remains, a relatively poor city, with lower incomes, higher unemployment, lacking good public space, containing fractured communities and cultural life[19]. As the city has extended along the banks of Rotterdam's waterways to the North sea, it has split the whole region in two parts[20] and has hindered the creation of a shared identity[21] while creating social divisions.

In the 1990s, the politics of "if the port is successful, Rotterdam is successful as well" continued[22], the sums didn't add up. Indeed, the economy of the city is dominated by the port, and the income of the municipality is tightly linked to the number of ships docking there and the volume of goods handled. It is the biggest job provider in the city: 85,000 in 2016 with about 250,000 people employed within the maritime economy.[23] In short, the economic spillover of the port in the city is in doubt due to further automation and reduced demand for low skilled jobs.

The most recent strategy focuses on creating a 'knowledge port' by fostering knowledge and innovation-related industries, attracting well-off creative and knowledge workers[24], while being oriented towards the city rather than the sea. The port is now seen as a source of innovation, where multinational firms and knowledge and innovation clusters interact, with a strong accent on maritime industry[25], steered by the Port Authority to transition to sustainable transport, clean energy, and, most of all, the greening of its activities[26]. This strategy is seen to attract partners, investors, and high skill labour[27]. Furthermore, the strategy includes waterfront redevelopment linked to the economic diversification and mix with other uses - particularly development of housing and public space[28].

The region's knowledge economy is quite sizeable and therefore an opportunity, including two large universities (Erasmus University in Rotterdam and TU Delft), three hogescholen (schools of applied sciences), and other academies, enrolling more than 100,000 students. An array of additional knowledge institutions such as the academic hospitals, TNO (Netherlands Organisation for Applied Scientific Research) and Deltares (a large technology institute focused on delta engineering). Workers in this knowledge network live across four cities - Delft,

Leiden, Rotterdam, and The Hague. Greater spatial coherence, more interaction and better conditions for supported facilities, could be important ingredients of future spatial policy in the region.[29]

Today, the pressure to build more housing, and the focus on very specific industrial sectors in the industrial agendas of both port and governments, limit the possibility of achieving a diverse economic system, specially urban manufacturing. The port is redeveloping waterside areas into business sites aligned to its innovation agenda, mainly belonging to the maritime sector and sets out a strict set of requirements for businesses to settle in available land. Furthermore, on these portside redevelopment areas controlled by the municipality, the pressure for building new housing - the city needs to build 40,000 new homes - is putting in risk very young productive ecologies that had settled in marginal, underused industrial areas. As Paul Stouten has noted, urban regeneration and housing construction is moved by the political aim of attracting creative or higher income groups, and gentrifying the inner city of Rotterdam to make it attractive for investors[30] therefore increasing prices per square metre and making it less accessible for small making and manufacturing businesses.

Port of Rotterdam
© Jan Voets / Anefo. Nationaal Archief

THE ADAPTED DELTA FOR THE FUTURE INDUSTRIAL LANDSCAPE

The rise of an industrial economy in the Rotterdam-The Hague region is a result of the ability to adapt and exploit the landscape to the technical demands of the time - this interdependency is unique and is vulnerable to the adaptability of the port to climate change and requires a brief summary to show some of the variables at play.

Rotterdam grew out of its favorable position at the estuary ‘Nieuwe Maas’, atf the river-mouths of the Meuse and Rhine. The landscape was the product of the processes of sediment-transport by rivers and sea, resulting in an alluvial landscape of soft clay and peat. Urbanization of these deltaic marshlands was possible by applying a centuries-old land-making technology: draining the highest parts of the alluvial territory, and surrounding the drained territory with dikes for protection against high water events in the river and/or sea. This combination of drainage and dike-construction resulted in the typically Dutch polder-landscape and polder-cities. Ongoing sediment-transported by rivers and the sea resulted in new land outside the dikes, which could be reclaimed by repeating the same process: draining the new silted-up territory and constructing new dikes around it. This type of colonisation of the land took maximum profit of the ‘ecosystem services’[31] of the estuary landscape, using the natural processes of currents, transportation of sediment, siltation and the role of vegetation.

This dynamic process changed radically from the 19th century, as a result of the introduction of new technologies of land-making and river-management and

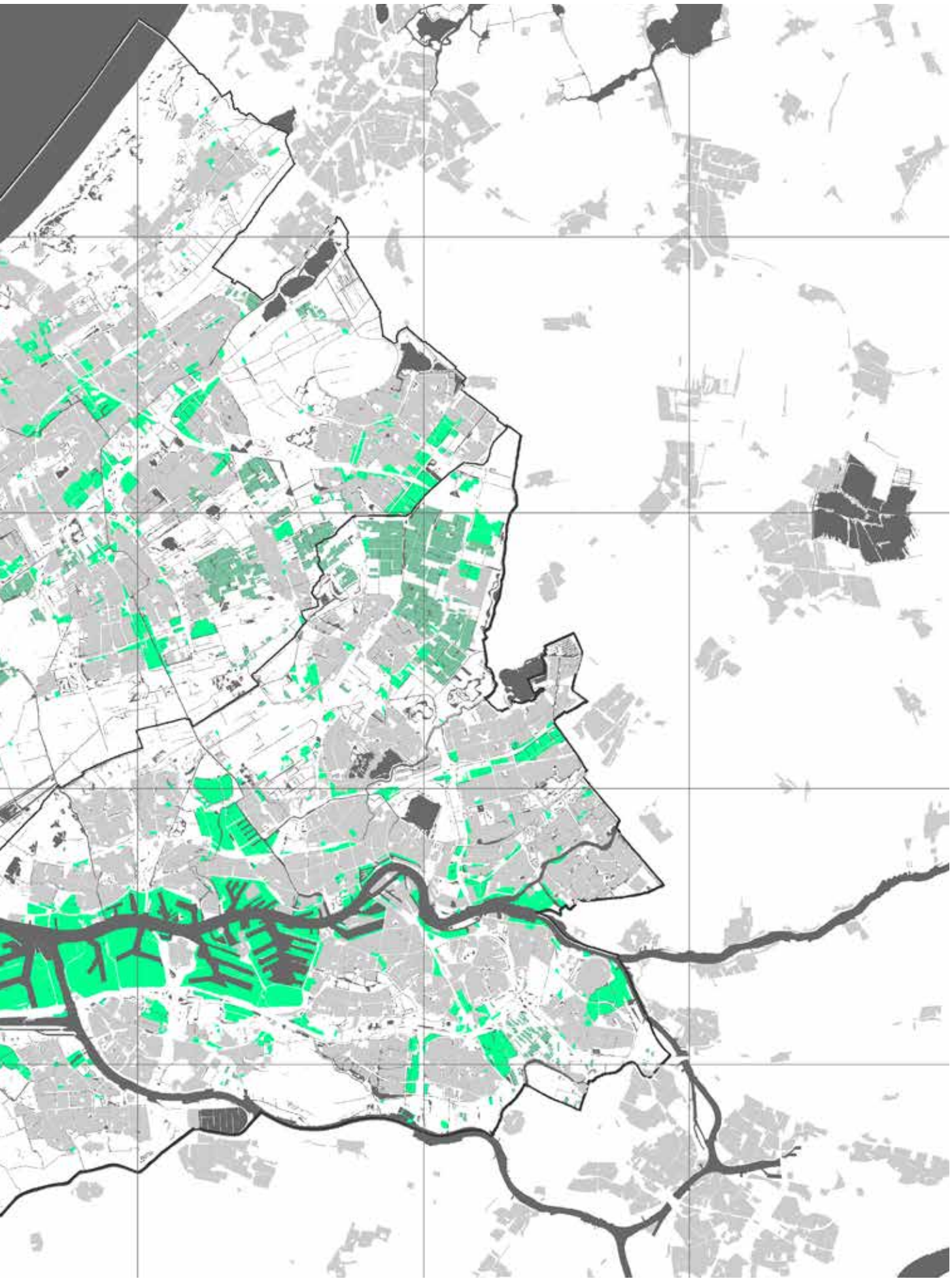
the rise of the industrial economy[32]. The Nieuwe Waterweg and, later, the construction of the large scale port areas of Botlek, Europoort and Maasvlakte resulted in a radical transformation of the existing polder- and river landscape to a completely new, artificial port-landscape of 12,000 hectares. Villages and farms were evacuated and demolished, polders and dikes were excavated, harbor-basins dug out, new land constructed artificially, a new river mouth (Nieuwe Waterweg) deepened by dredging from 6 meters (1880) to 16 meters currently. Ecosystem services were not used anymore; instead, they were denied and ruined.

The making of this new landscape influenced the physical conditions of the city dramatically. Dredging, narrowing and deepening the river mouth resulted in an increased influence of the sea in the urban areas: stronger tidal dynamics, increased impact of storm surges and increased salinisation of river- and groundwater. Consequently Rotterdam had to adapt the flood protection system, including higher dikes and building a series of new storm surge barriers (Maeslant Barrier, Hartel barrier and Hollandse IJssel barrier), and developing special systems for fresh water supply.

Now a large part of the landscape sits somewhere below or just above sea-level, rendering a vast area of the productive landscape exposed climate change. How will it face climate change and deal with rising sea levels and increasing peak discharges of rivers? The region needs a radical spatial reorganisation. In the national Delta program, launched in 2015, two main options are presented: 1) raising the current dike system, and changing the fresh water supply system or 2) closing the New Waterway with a new barrier, and directing the river to discharge completely into the Haringvliet (south of Rotterdam). An alternative 3rd option of totally reorganising the river-mouth area into a more 'natural' tidal river landscape. It has been considered too radical and too damaging for the established economic interests.

All options will have tremendous consequences, giving either more or less space to manufacturing in the harbour areas or changing accessibility to a large part of the port which will relocate the deep sea port to outside the new sluice. All three options should be considered seriously as they will play an important role in the transformation of the industrial economy to the 'Next Economy', as will be discussed later in the chapter.


MAP 1: INDUSTRIAL ZONES
REGIONAL BOUNDARY
ZONED INDUSTRIAL LAND
GREENHOUSES
BUILT AREAS
10km
This map shows land zoned for industrial use, compared with the overall built area. It provides an indication of traditional locations of manufacturing. The map does not show the full extent of manufacturing sites as many are embedded within land zoned for mixed or other uses. Source - see Appendix 2.



4.2 Manufacturing sectors and trends

The Rotterdam-The Hague region supports a vast range of manufacturers from very large-scale chemical refinaries, to food producers, machine manufacturers to smaller scale furniture makers and carpentry workshops. A bulk of these manufacturers are dependent on or have spun out of two activities: firstly Europe's largest port and secondly intensive greenhouse agriculture. Newer manufacturers are emerging through regional knowledge networks.

THE DUTCH ´MAAKINDUSTRIE´

In the Dutch manufacturing industry, maakindustrie, the actual making or production of stuff is just a small part of the process. In fact, design, development, and sales at least of the same importance. Industry is the largest exporter (62 %) and largest buyer (60 million Euro annually) of all economic sectors in the country. Despite uncertainties abroad, such as Brexit, the exports have continued strong, as has domestic demand. After a strong 2017 (production growth + 3.5%), the sector has expected a further 3% increase in 2018. Nonetheless, the rise in industrial productivity may account for greater output yet with fewer employees; as unit labour costs fall, competitiveness improves, but there is a concern about employment growth lagging behind. Irrespective, at a national scale the maakindustrie is proving to be healthy.

Manufacturing, together with health, and financial service form the top three economic sectors in the country. The Dutch GDP topped €540 billion in 2012, and manufacturing contributed €68 billion to the total. Ten percent of the workforce – 825,000 people – works in the manufacturing industry. The Dutch manufacturing sector enjoys high productivity among EU nations, contributing €51.90 of additional value added per additional hour worked. Still, the Netherlands ranks in the second of four tiers in the European Commission Innovation scoreboard for 2015. Denmark, Finland, Germany, and Sweden rank in the top tier as "innovation leaders," while the Netherlands, Austria, Belgium, France, Ireland, and Luxembourg are listed as "innovation followers."

A smaller yet significant player is the Dutch agriculture and food industry, accounting for approximately 200,000

Rotterdam hosts a number of large processing plants, thanks to its connection to the port. © LyondellBasell

employees. There are 70,000 agricultural holdings in the country attending to 1.9 million hectares or 45% of Dutch land.[33]

The driving force behind the growth of the manufacturing industry is technology industry and engineering. Its share in industry is about 40 percent and, as a result supplying sectors such as metal and plastic benefit. Growth expectations for the chemical sector (15% of the industry) remain positive even after 2018 (+ 2%) after a reasonable growth in 2017 (+ 2%). Although profitability is slightly under pressure due to the oil price that has risen.

Another important pillar in industry, the food industry (20% of industry), growth is expected to start again in 2018 (+ 2%). The shrinkage in the dairy industry seems to end and in 2018 the sector will benefit from rising consumer spending in Europe.

A more detailed account of the most important industrial manufacturing sectors in the Netherlands, as derived from recent reports, and their presence in the Rotterdam region, in maps, will follow. Opportunities and threats to manufacturing industry add to those that come as consequence of the aforementioned trends, issues external to production itself, as well as new customer trends. First, the implementation of new technologies is seen as an opportunity to further increase

Box 1:

Nationwide Trends, Threats and Opportunities for the Dutch Manufacturing Industry

As described throughout this chapter, the Rotterdam The Hague region is highly embedded within the larger national ecosystem, making it hard to distinguish local level issues from national level programmes. Sectors described later in the document will therefore point to both regional and national statistics.

Trends defining the manufacturing sector in the Netherlands mainly deal with internationalisation and innovation[34]. Whereas Europe remains as main destination for exports, companies want to expand to new markets (15% of them), especially in Asia, Latin America (23%), and Africa (22%). Also, outsourcing of production offshore continues: one quarter of the companies willing to internationalize include in their plans taking production abroad, at the expense of jobs in the country. Regarding innovation, emphasis is set in new forms of collaboration between sectors, both for chain optimization (linking product development and production), and connecting to existing knowledge clusters and networks to support R&D (60% of OEMs want to increase their expenses on this). Besides, smart industry concepts (such as additive manufacturing and automation) as well as cleantech production processes are on agendas across all sectors of industrial production: 30 percent of companies want to increase their investment in robots further highlighting movement away from low-skilled jobs. Opportunities and threats to manufacturing industry add to those that come as consequence of the aforementioned trends, issues external to production itself, as well as new customer trends. First, the implementation of new technologies is seen as an opportunity to further increase productivity and cost control, through innovation and automation. Besides the side effect of a decoupling between growth of productivity and employment, there is a persistent shortage of skilled workers; despite an increase of graduates in technical education, concerns about secondary and vocational technical education (VMBO / MBO). Second, customer-oriented development and production brings new opportunities, but puts more pressure on production, and specially to smaller and medium business, as it asks for short delivery times, specialization and flexibility. However, the collaboration with customers, as well as with suppliers and other sectors offers a chance to increase innovation capacity. Finally, an external threat to production is the volatility of cost of raw materials and energy. All in all, its worth noting that only 44 percent of manufacturing companies have a strategic plan.

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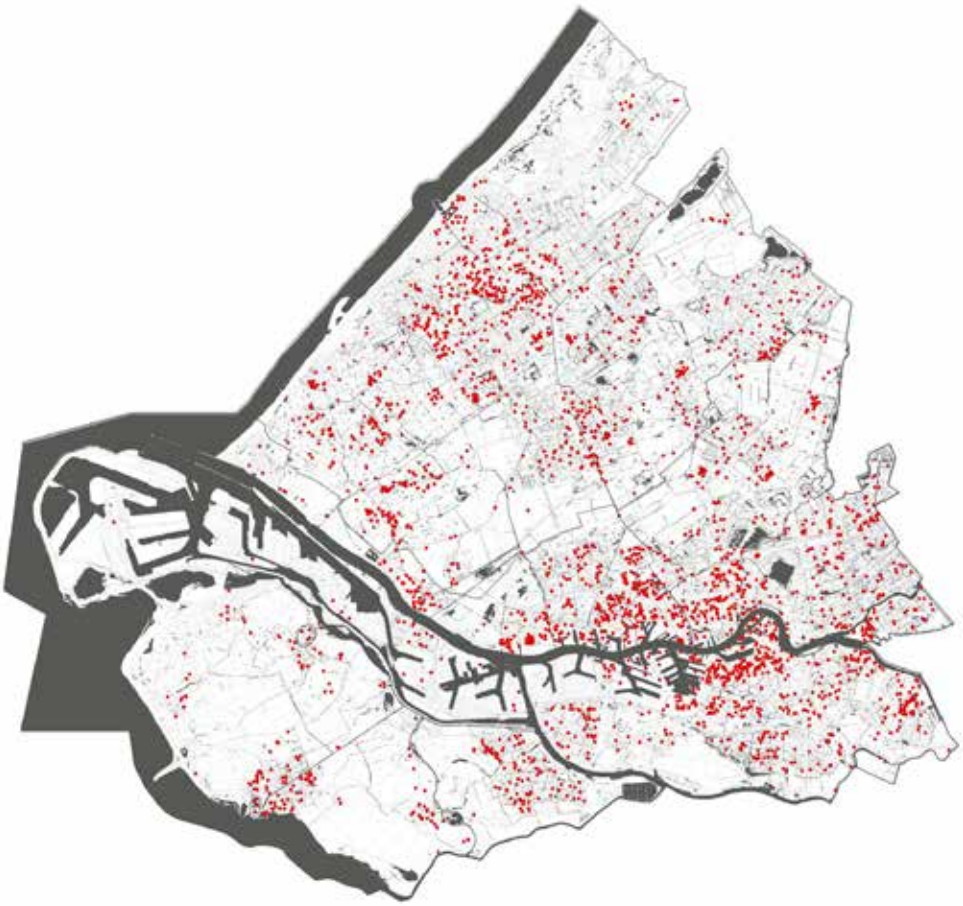


Map 2
Technology industries

Source:
see Appendix 2

Technology Industry[35]

Technology Industry is composed of the following subsectors: rubber and plastics, machine-making, metal industries, high tech, and automotive industry. It accounts for a production of approximately € 122 billion and a share of around 40%. The sector has a number of major challenges. The energy transition, for example, affects a number of important sales markets for the technology industry, especially the automotive (fuel engines) and energy sectors. Another big challenge is finding skilled staff. In order to structurally sustain the higher growth, around 120,000 new people will be needed by 2030.

Lely Astronaut milk robot © Anoek2012 / Wikimedia Commons

Electrotechnical industry[36]

This is a heterogeneous sector, which integrates ICT, software, telecom, and machine building. It ranges from the production medium tech products, such as electric motors, generators, and transformers, to high tech elements, as robots, sensors, artificial vision technologies, microchips, and advanced electronic components in general. Demand for such products comes mainly from other industrial companies in electrical and mechanical engineering, the healthcare sector, the non-residential building sector, OEM's that demand smarter machines, and large manufacturers of electronics which outsource production of components to suppliers.

In the Netherlands, there are around 1,500 companies operating in this sector. Mostly they are small companies: 80 percent of them have fewer than 10 employees. The annual sector turnover is 20 million Euros. However, its big companies that are responsible for a great part of the turnover and export - for example, Phillips. Growth is expected due to increasing automation and sensor technology, but at the same time selling prices are under pressure due to competition.

Changing customer requirements (demand for know-how and flexibility) ask for more flexible processes,

product development in networks with knowledge institutions and customers, the adoption of smart factory concepts (electronics + ICT + machine building). Customers also demand for cleantech and high tech solutions. Internationalization is seen as the way to grow.

Remaining competitive demands innovation, combining specializations through collaboration, supply chain integration, linking engineering services to sale and the provision of complete platforms. Contract research in collaboration with customers and institutions and focus on technologies that ensure shorter product life cycles (mechatronics, nanotech, photonics) are of particular importance. Employees with creative, communication, and resolution skills are scarce, and very much needed in a context of increasing automation.

Plastic processing[37]

This sector encompasses a wide variety of production methods, materials, market segments and sale areas, and deals with the manufacture of semi-finished and finished products result of processing of polymers. It is an industry with potential, as demand is high.

About one third of the production of plastic products goes to the automotive industry, machine, and equipment construction, and 20 percent goes to the packaging sector (fueled by food industry). Innovations in production are growing, in particular composites and bioplastics (with a growth of 10 percent yearly). It is an industry to which customers demand more quality, and faster delivery.

Plastic is becoming to be seen as an alternative raw material, with an increasing use and reuse of plastic in Europe. Those reuse processes, higher customer demands, and the increase use of bioplastics demand complex production processes, requiring automation and ICT solutions. Internationalization and scale up are key for competitiveness. Innovation is seen as source of new product applications, and for that, collaboration with innovation institutions, R&D and sustainable products development, as well as new manufacturing technologies, automation and robotization, are needed. Threats for this industry are the volatility of prices of raw materials and energy and the dependence on raw material suppliers from Asia and Middle East. SMEs tend to have a weaker position in the chain, between large chemical companies and large companies.

Machine-making[38]

This is also a very diverse sector, which makes parts and devices that in a large majority serve as supply for other production companies. There is a strong segmentation by products and sales markets, and has a in international orientation. Some of the companies are niche producers. Demand for this kind of industries is cyclical and dependent on the demand of other industries; it is a sector that is sensitive to shifts in economic cycles. Therefore, it is a sector that has to adapt to rapid changes in demand and provide customized solutions. Evidently, demands for efficiency and productivity require investment in capital (AM, automation, sensors, nanotechnology).

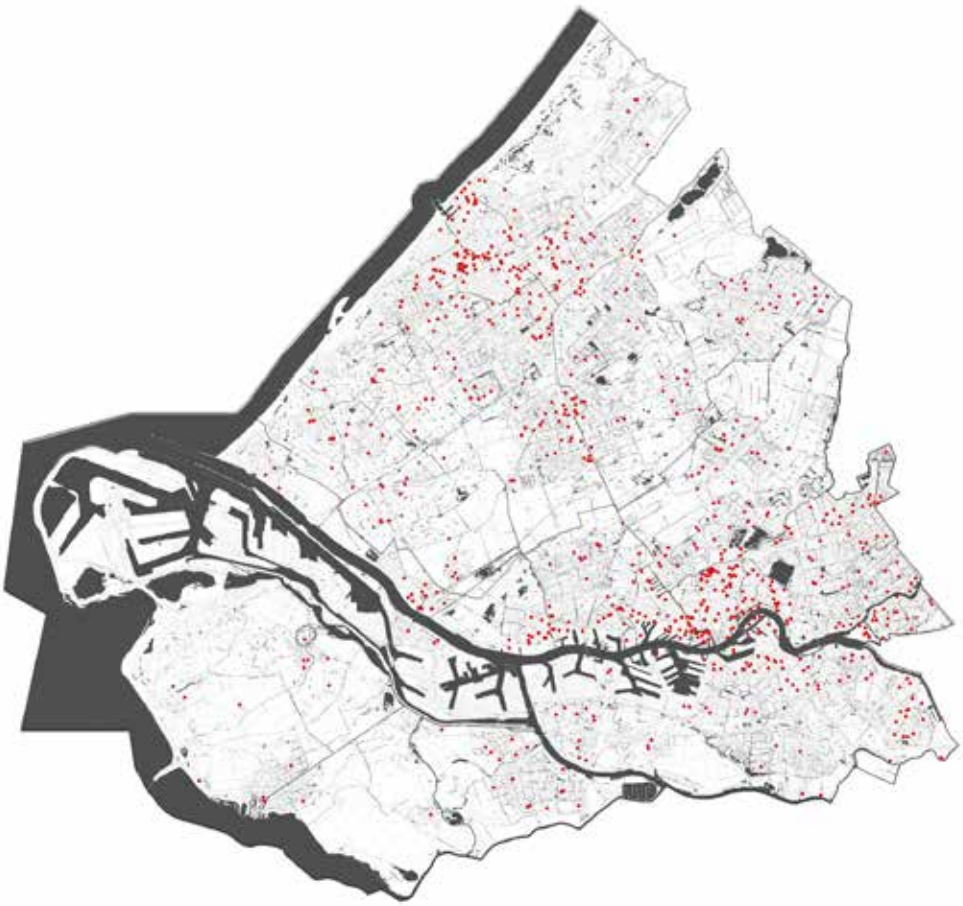
The sector amounts for 2,800 companies, of which 1.800 employ less than ten people. In contrast, 175 companies have more than 100 employees, and account for 50 percent of the total turnover of the sector. In total, all companies employ 80,000 people.

Shorter production cycles (changing needs by customers) demand an increase focus on R&D and strategic parts of production, marketing and final assembly, whereas standard production is outsourced. Delivery of customer specific total concepts, or platforms, including maintenance and service, quick response manufacturing, clean-tech, and collaboration with partners and intelligent software to implement automation are trends that new customer needs bring.

More integration of emerging technologies, such as modular machine concepts or intelligent software, industrial IoT, smart industry are an opportunity to address the need for flexibility, customization, increased speed of response: end customers require research and development capacity. Increasing competition and copying

Chemical processing
© LyondellBasell

P151
Workshop of Quooker, Ridderkerk
© Quooker



Map 3 - Furniture industries

Source: see Appendix 2

from machine makers in low wage countries is a threat to sustained innovation. Circular economy and reuse of machines is to be taken into account

The Metal Industry[39]

Again, it is a very diverse sector, in which companies are suppliers of machine parts and other metallic, semi-finished products. Sub-sectors include: construction and welding, machines supplies, surface treatments, metal ware, sheet processing, and maintenance and service. This industry works mainly as a supplier, and therefore is vulnerable to trends in other industrial sectors, and to economic fluctuations.

In the Netherlands, there are 10,600 companies. Smaller companies by far dominate the landscape: 9,000 employ less than 10 employees. In turn, 120 companies employing more than 100 people each account for 50% of turnover.

Metallic 3D printed components at RDM © Víctor Muñoz Sanz

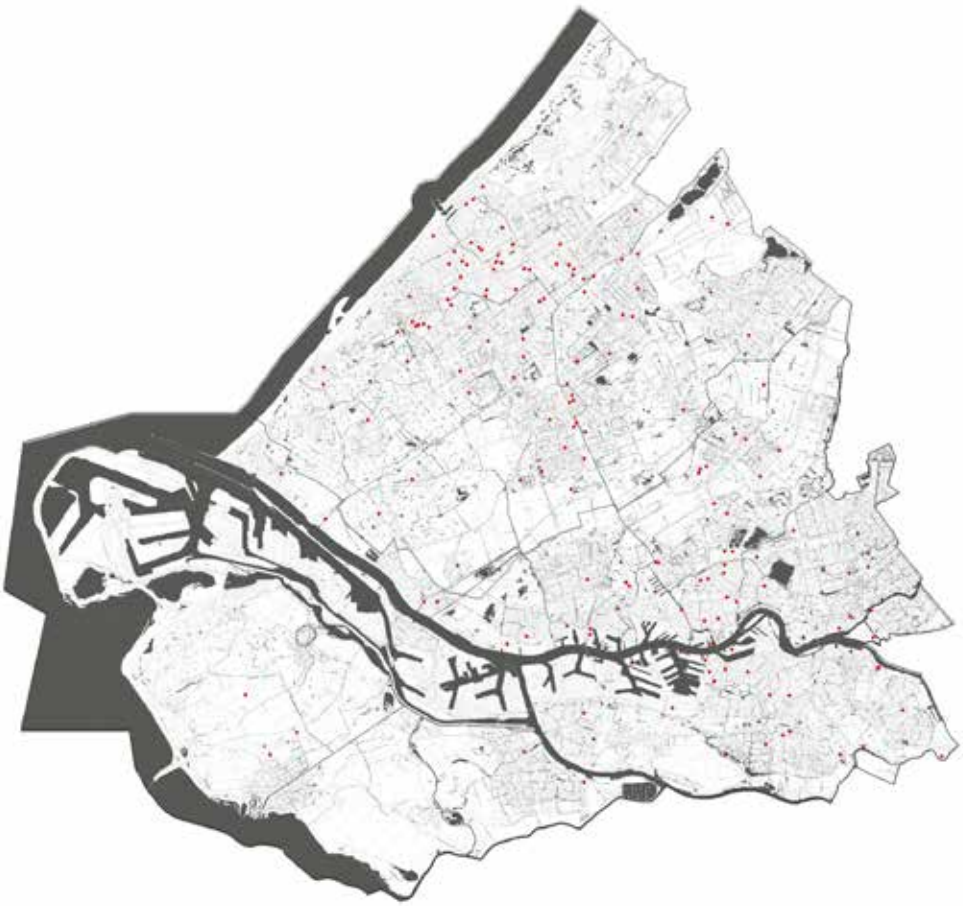
Smaller of order sizes and shorter lead times ask for lean management, use of innovative production techniques (additive manufacturing specially), and smart factory systems. This is linked to an increased demand for development capacity from customers, who also require high quality, composite products.

Opportunities against the vulnerabilities of this sector are the specialization in smaller niches, cost reduction and optimization, achieving higher productivity by speed, flexibility, and automation, shifting orientation to exports, and attracting and retaining competences. Competition from cheaper countries is a threat.

Furniture-making[40]

This sector includes the sub-sectors of home furniture, office furniture, kitchen furniture, and interior design. It is highly dependant on consumer spending and likes. It is predominantly a small salle sector, including crafts: 95 percent of 3,600 companies employ less than 5 employees.

Dutch furniture making



Map 4:
Carpentry industries

Source:
see Appendix 2

is positioned in the middle to high segment of the market, and international competition is high: 70 percent of what is sold is manufactured abroad. The improvement of the housing market and consumer spending is helping this sector.

Consumers increasingly ask for value for money, shorter product life-cycles, and have rapidly changing needs. Such customer oriented production means small production.

Internet as platform for sales, circular economy and reuse of furniture, and the consolidation of businesses are trends that could counterbalance the import of cheap furniture. Innovation in design, manufacturing, sales, and marketing, new materials, reuse, engaging with well-known designers, automation and quick response manufacturing, and exports to emerging markets are big opportunities for this sector.

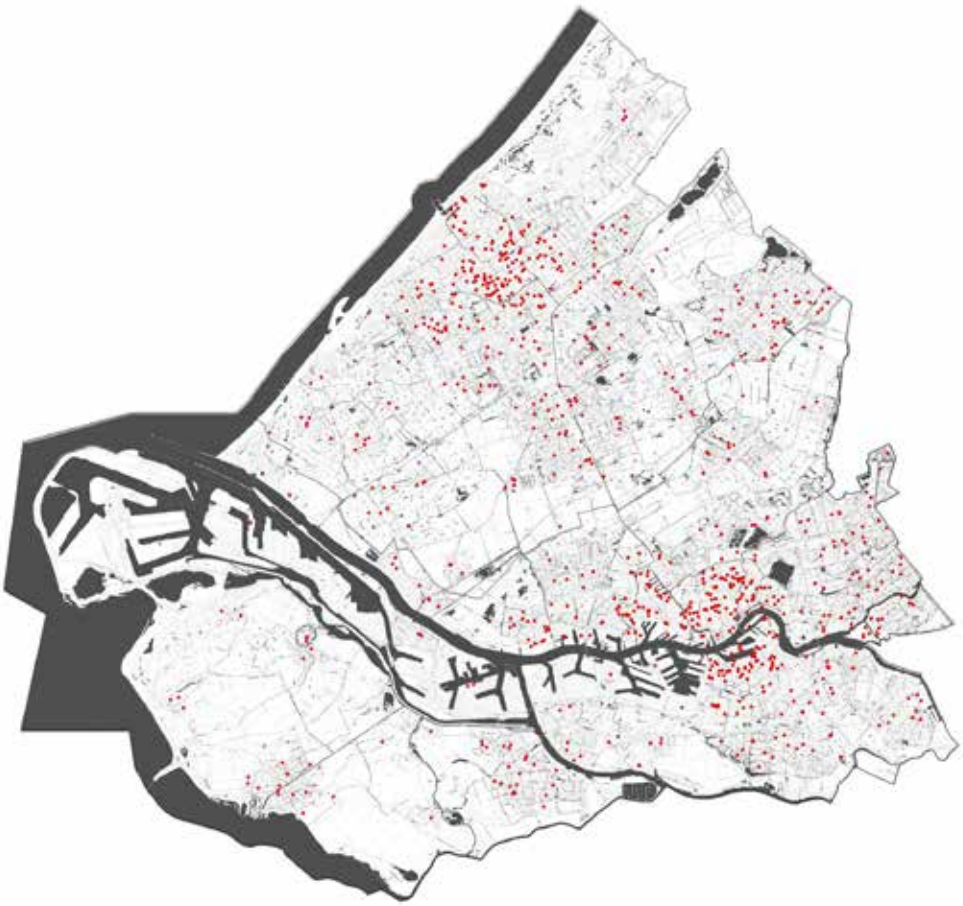
The increasing power of retail platforms at the expense of manufacturer's position, price pressure, volatile price of raw materials, and shortage of qualified personnel in turn threat its sustainability.

V-Table, by Elok
© Elok

Carpentry[4.1]

About 1,300 companies operate within the carpentry industry, manufacturing doors, stairs, timber frames, window frames, etc. These are small companies, only 15 of them employ more than 50 employees. In turn, 800 of them are craft businesses, with just one employee. It is mainly a supplier of the construction industry, so it is certainly dependant on its developments, and seasonal patterns. It is in competition with plastic and aluminum products.

Automation to save labor costs and materials, Chain optimization, speed-up delivery and production, prefabrication, new low-maintenance wood concepts, and giving added value to products (service and maintenance) are ways to adapt the industry to a changing landscape of customer demands, and to



Map 5:
Food industries

Source:
see Appendix 2

Buurman construction market
© Buurman

position it through innovation against the competition of plastic and aluminium.

Dependence on decision makers, for example architects (in choice of material), the scarcity of timber due to emerging markets and use for biomass, competition by other materials, and the increasing demand for high-quality are threats that well channelled become an opportunity to differentiate in price and quality with the competition. The use of FSC certified timber, investment of knowledge in sales, and quick response manufacturing are additional ways of finding niches in the market. The aging of workforce asks for new models of training.

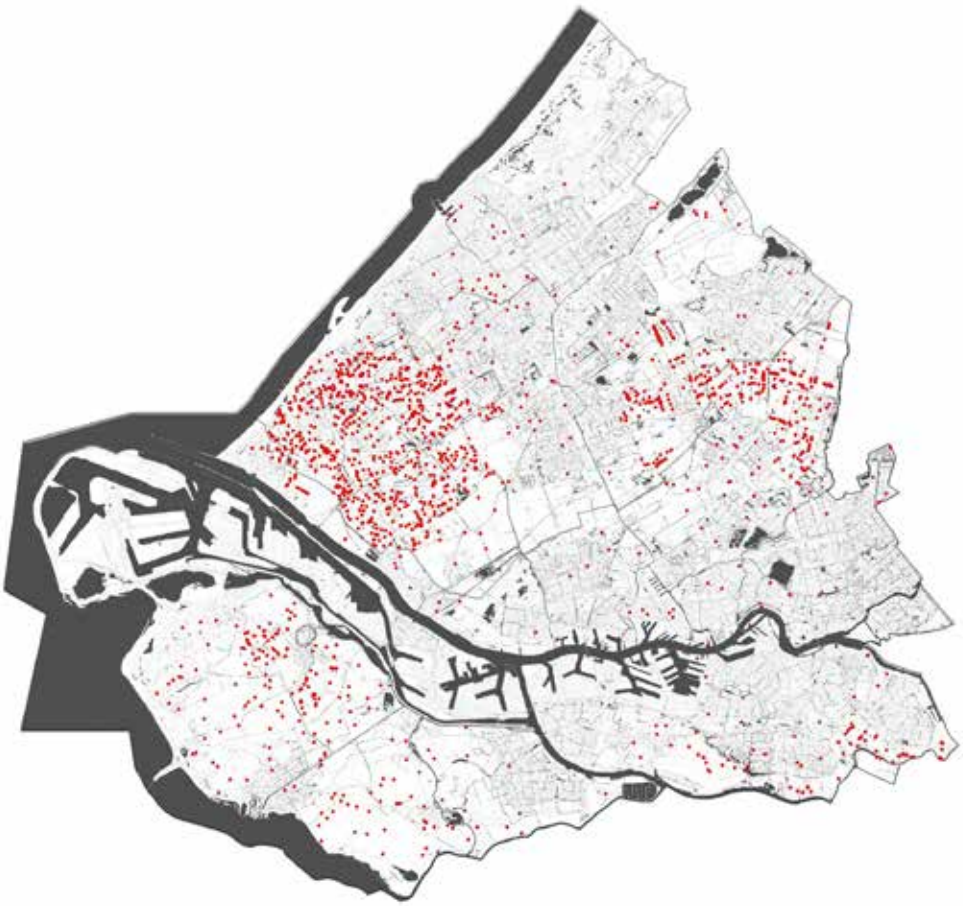
Food[42]

Dutch food industry encompasses many sub-branches, namely:bread processing industry, meat processing and slaughterhouses, dairy industry, oils and fats, derivatives of fruit and vegetables, animal food, drinks, cocoa, chocolate and sugar, tobacco, flour and starch products, and fish. The turnover in the food industry increased by 0.4% in the third quarter of 2017 . In this sector domestic sales decreased by 3.8%, foreign sales increased by 4.2%. In the tobacco industry, sales fell by 19.1% the last quarter of 2017 compared to a year earlier. The turnover in the beverage industry has remained virtually unchanged.

Selling prices have risen again after almost three years. An increase in prices had not occurred since the third quarter of 2013.

The Dutch food industry includes 5,275 companies, employing 135,000 people. The food industry accounts for 22% of the total industrial production in the Netherlands. Total production value is approximately 65 billion euros.

Bakkerij Voordijk
© Bakkerij Voordijk



Map 6:
Horticulture

Source:
see Appendix 2

Horticulture[43]

Between 10,000 and 10,500 Hectares of land in The Netherlands are occupied by glasshouses for horticultural production - around 4,000 in the Westland. While this area has remained unchanged, its productivity has increased. This is a very capital intensive and innovative industry, strongly oriented to exports. Since sales remain constant, and productivity improvements due to automation and digitization, it is expected that the glasshouse area will be reduced. Scaling up is not expected.

The overall trend is that leading to not scaling up production, but achieving higher productivity per square meter by means of technology: increasing automation and mechanization of operations; semi-closed cultivation and geothermal energy, new long-term preservation techniques, and intensification cultivation through increased use of LED lighting. Growing sales but increasing consumer demand call for more intensive cooperation in the chain of breeders, growers, exporters, and customers, and certification of business processes. Reaching a wide range of consumers asks for more diversity in sales methods, and a new focus on local-for-local production.

Scarcity of qualified personnel, emergence of foreign production areas, the growth of the EU, strong mutual price competition, or the strong position of retail organizations are a threat to the sustainability of the Dutch horticultural sector. Division in sales channels, restoring exports, digitization and improving efficiency by automation and robotisation, clusterations and regional distribution centers, and the use of sustainable energy sources (including geothermal energy) and closed cultivation systems are opportunities to remain competitive. Know-how and product innovation, and collaborations in the chain could address the demands for added value and exclusivity by customers.

Westland glasshouse
© Goldilocki /
Wikimedia Commons

PROFILE OF INDUSTRY IN THE ROTTERDAM THE HAGUE REGION

The city of Rotterdam has a mixed economic profile, with lower GDP per capita, growth rates and employment rates than the national average. Rotterdam The Hague Region has an economic structure with a significant share of business services, a harbor activity associated with it (such as shipping, hoisting-lifting-hauling, constructions and food and food stuffs), a capital intensive industry and a sizeable public service sector. Rotterdam is the location of numerous companies, notably: Unilever, Mittal Steel, Nationale Nederlanden, Flora Holland, and Robeco. The declining economic sectors in the region – including traditional industry, logistics and public services – are still dominant[44].

The main three sectors in the country, manufacturing, health, and financial services, are underrepresented in Rotterdam due to its specialisation[45] Energy, water, and the waste sector are overrepresented when compared to the Dutch economy[46]. ICT and financial services are also underrepresented. This affects the diversification of Rotterdam's economy[47]. In contrast, horticultural business, export of products, knowledge and technology are well represented.

In Rotterdam, jobs in the manufacturing sector account for 32.3%, versus a 67.7% of jobs in the service sector. In contrast, in the larger region of Rotterdam, manufacturing accounts for 53.8% percent. Within the high-tech production sector, metal products and machinery, and equipment industries are the most important manufacturing areas. Main employment industries in Rotterdam, from larger to smaller are: IT Services, Architects, Engineers and Technical Design Metal Products Industry, Other Machinery and Equipment Industry, Repair / Installation Machinery and Equipment, Electrical Equipment Industry, Computer and Semiconductor Industry, Research and Development, Automotive Rubber and Plastics Industry, Basic Metal Industry[48]. There is a strong specialisation in transport, storage and wholesale, due to the presence of the port of Rotterdam[49].

The city of Rotterdam set in particular three priority clusters:

- The energy-intensive chemical and refining industrial cluster in Rotterdam and Moerdijk is under pressure. On the one hand, the competitive position of these companies has significantly deteriorated in relation to the United States due to the development of shale gas in that country. The cluster is challenged by having to drastically reduce CO2. Without further action, the cluster will be faced with stagnation and contraction. As a result, Clean-Tech and Water related industries are emerging. Rotterdam is a city with an efficient and clean port complex, making it the European centre of the biobased and circular economy. On a global scale, Rotterdam is at the forefront in the field of water management and delta technology. This places the economic Clean-Tech cluster in a solid position as one of the pillars of the Rotterdam economy. ;
- The medical and health cluster is relevant due to its high-tech and innovative character, new entrepreneurship, but also its employment potentials in the future. Rotterdam aims to increase the economic spin-off of the Rotterdam and healthcare institutions in medical research and education. 3) The Creative Industry is limited in size but certainly promising for the future and a key, innovative part to broaden the Rotterdam economy while the city aims to expand locations for creative industries[50].

EMPLOYMENT TRENDS AND CHALLENGES IN THE METRO REGION ROTTERDAM THE HAGUE

The city of Rotterdam contains some 474,000 residents and employs 284.598 people[51]. The Metropolitan Region Rotterdam-The Hague reaches 1.2 million (2016)[52]. The workforce in the Netherlands increased by 4.5 percent in the period 2006-2016 since the 2008 financial crisis.

Strategy and vision reports for the Rotterdam-The Hague region

Although the economy is recovering, the labor market is lagging behind; unemployment remains relatively high with an 7.8% (2016) - as compared to a 6% in overall Netherlands, or 6.9% in the Province of Zuid-Holland[53]. In the agglomeration of 's-Gravenhage (The Hague) unemployment was barely below the region's average with a 7.7%, while in Rijnmond (Rotterdam region), the figure was the highest among subregions within the Metropolitan Region Rotterdam-The Hague, 8.1%.

The general employment market in the metropolitan region is currently undergoing a series of important transitions that can offer an insight into conditions for manufacturing. Firstly, there is the trend from industrial to post-industrial employment. Between 1996 and 2012, the Netherlands has overall experienced that shift, nonetheless, in Rotterdam there is still a relatively large share of manual labor - 16 percent as compared to 7 percent in Amsterdam. Secondly, from employed to self-employed; the 2009 to 2012 recession period scratched 16,000 jobs in Rotterdam, while 17,000 self-employed activities began, a growth of self-employment from 8 to 10 percent. To clarify this statistic: self-employment does not necessarily mean entrepreneurship but often concerns precarious forms of work. Third, from full-time contracts to part time: the share of part-time jobs went from 47 to 49 percent in the aforementioned period[54].

Fourth, a trend of polarisation and displacement of jobs with a decrease in 10,000 jobs low skilled jobs (primary and secondary level education) ; vanished during the crisis. It is worth saying that the proportion of people with a higher education in the working population of South Holland / Metropoolregio Rotterdam The Hague (36%) is below the average of

Box 1:

What is urban manufacturing in the Next Economy paradigm?

While the Next Economy appears to be a catch-all term, let's unpack what it means for urban manufacturing.

Firstly, it is characterised by blurring boundaries: 1) between sectors, clusters, and scales of operation - local or multinational; 2) between production and services; 3) between public and private initiative; and 4) between living, working, and leisure (having as downside the rise of the 'gig-economy' and other kinds of flexible jobs)[60].

Secondly, it is driven by technological and social innovations, being its pillars digitisation, the internet of things and sustainable, distributed energy[61]. It represents a shift from "centralized, vertically organized and linear economy towards a distributed, collaborative and circular economy"[62] however it is based on the "The... renewal and development of the economic sectors already present in the region..."[63].

Thirdly, it calls for inclusive economic growth, promoting social innovations and new organizational modes that invest in people and their skills[64]. Finally, it is "the transition from mass-production to mass-specialization and from stable to flexible"[65] andbased on customisation[66] .

"Nothing illustrates the Next Economy more than the so-called makers movement" , as "the new economy is, among other things, based on small scale, locally organised networks of manufacturers and consumers, and offers space for technological innovation.... The new makers are fully at home in the new economy:... based on honest, clean circulation"[67].

Urban manufacturing [1] develops radical new technologies, collaborative models and skills; [2] brings to urban ecosystems "scalable and open business cases"; [3] crossover opportunities; and [4] bridges between "entrepreneurial region and society"[68].

metropolitan regions in Europe (2015): London tops the list with 49% followed by Brussels with 48%. This rate lags below the average of other European city regions (4.4% growth between 2008 and 2015)[55]. Vacancies for low skilled workers decreased by 23 percent between 2011-2014. In turn, vacancies for high skilled staff grew 8% in the same period, and 22% just in 2014. Between 2008 and 2016, the labour force with a higher education level increased relatively quickly, by 6 percent[56]. Unskilled staff remains mostly in the trade, business services, and hospitality services. In the non-working population, the proportion of those aged 55 to 64 and belonging to non-Western groups is higher.[57]

Furthermore, companies under the management area of the Rotterdam Port Authority accounted for 26 percent of the regional employment in 2016, by far the largest employer. The Port and Industrial Complex of Rotterdam include economic activities which are directly or indirectly related to the port, and are located in the area managed by the Port Authority. This includes activities such as transport and logistics, manufacturing and maintenance and maritime services[58]. In the Rotterdam port area the expectations for the labor market for the short and medium term are positive. The higher demand for labor resulting from increased spending exceeded the loss of jobs is followed by trends linked to technological developments and increasing labor productivity (automation and digitisation). However, this raises concern. Firstly, the requested level of education in vacancies is increasing, beyond regional supply. Secondly, it is very likely that people who have been been in long term unemployment will remain so

as they cannot catch up with new employment opportunities. Therefore, programs linked to the acquisition of technical skills and support for those long away from the labor market are needed[59].

THE NEXT ECONOMY

The 'Next Economy' is the paradigm dominating the urban and economic development in the Rotterdam since 2014. Founded by economist and social theorist Jeremy Rifkin, 'Next Economy' is the broad umbrella under which new forms of urban economy can be explained including the framework for a new 'third' industrial revolution, refer to Box below.

The Next Economy founded on connectivity, open source and high-tech, which does not sit neatly into the adaptation of more traditional industries. In contrast to the idea of a technologically-driven productive future, more traditional ways of making, such as craft, are present in the mind the City Development Department of Rotterdam when defining manufacturing resulting in different visions for the future. Friction is emerging between the camp focused on a high-tech future and the camp that sees manufacturing as a socially oriented profession oriented towards development of jobs and skills.

Conflict in future land use

With the large portions of the older portland closer to the city, opening up to new development, the question is now what will replace it? The main obstacle in the development of a strong urban manufacturing sector is the availability of space, which could be an ideal candidate. However there is another agenda. The primary conflict comes from 1) the demand for developing more housing targeted at middle to high income groups, 2) the environmental regulations that limit the possibilities of mixed-use housing-manufacturing, 3) the dominance in the economic agenda and sectors of the port, and, in general, 4) the lack of a vision or policy for urban manufacturing.

Key Sectors of the Next Economy

The Next Economy entails "the renewal and development of the economic sectors already present in the region"[69] . Which are the key sectors that the policies are actually addressing? As it becomes apparent, "the generic themes that characterize the Next Economy (communication, energy, and mobility internet, circularity and education and labor market) are confronted with the sectors established in the region"[70] Three key sectors emerge as the ones dominating the future economy of Rotterdam:

1) Agro-Food: The presence of the port of Rotterdam makes the city a hub for the transhipment of fruit, vegetables, juices, soya beans, maize, edible oils, grains and seeds. Rotterdam boasts cold storage facilities with 1.8million m3 for climatised storage and 750,000m3 for cold storage, and 580 horticulture companies receive CO2 from the industries in the port complex Rotterdam. The Netherlands accounts for 7% of worldwide agricultural exports, mostly moving via the port: agro-food accounts for 10% of Dutch GDP and 20% of industrial export. The Greenport Westland-Oostland, in the vicinity of Rotterdam is the largest agro-industrial complex in the country.

The city is also close to Greenport of Barendrecht. Food production and logistics processes are concentrated in the Rotterdam, Westland, Oostland, Ridderkerk and the Barendrecht region. Key players in the Agro-Food business include: producers such as Refresco, Verstegen and Provimi; logistic services companies as Eurofrigo and Fyffes; traders such as Verstegen and Nidera; suppliers such as Akzo Nobel, Emerald, Kalama and DSM; and R&D companies such as Unilever and Rijk Zwaan.

Related knowledge institutes such as Erasmus Medical Centre, NIZO food, TNO, WUR, Top institute Food & Nutrition (TIFN) are all in close proximity of Rotterdam.[71]

2) Life Sciences and Health: with the Erasmus MC as the spearhead for technol-

ogy and health research and development, innovation in medical world, domotics, robotics, medical instrument, and pharmaceutical industry. Also in connection to Agro-Food, the Erasmus Medical Centre is leading in research on the role of food in the prevention and treatment of disease. Near the M4H area, the Rotterdam Science Tower aims to become the location where spin-offs from Erasmus MC can thrive, with a mix of laboratory and office space and facilities for medical education

3) Cleantech: Circular business principles are foundational for Rotterdam's Cleantech/Maritime sector. The sector includes the following subsectors: Sustainable building, sustainable mobility, sustainable energy, maritime and delta technology. These businesses could potentially benefit from flows of waste, for example: plastic wastes (~30 kton p.a. from households), green waste from trimmings & pruning etc (~20 - 40 kton p.a.), E-waste from households (~1 kton) and SME's. Waste water (~58 Mton p.a.). Companies that are in the cleantech business are: Umincorp, Sita, VGG, Circularity centre, Wecycle, Topsurf, Evides, Marconia, Akzo/Enerkem. These three sectors account already for 146.000 jobs in Rotterdam.

Researchers, students and designers partnered up with business to develop one of the most efficient petrol vehicles at RDM Rotterdam. © Adrian Hill

ROTTERDAM THE HAGUE AS TESTBED OF TRENDS TOWARDS THE NEXT ECONOMY

Technology

Visions and strategies of urban economic development in Rotterdam are founded on the adoption of new technologies in services and production[72] . These are mainly digitisation, robotisation, circularity. Most certainly, these will guide the way urban manufacturing will unfold in the Rotterdam region in the coming years. Rotterdam aims to be at the forefront of a long list of innovative technologies starting from smart applications of ICT technology, artificial intelligence (AI), Virtual Reality (VR), Internet of Things (IoT), blockchain, robotics, automation, sensors (all these applied to the logistics or medical sectors, e.g.), to those directly linked to the material world, such as additive manufacturing, 3D printing, and the development and use of new materials.

3D printing is hailed for its potential as a driver for an urban making economy: it is suits low-volume production, allows for mass-customisation, and it frees production from the spatial and economic requirements of traditional factories: "just as digitization has freed some people from working in an office, the same will happen in manufacturing."[73] . It is also expected to simplify the process of making and enable attracting the power of the crowd to production. Both 3D printing and robotics have the potential of making factories smarter and flexible: "The days of huge factories full of lots of people are not there anymore. Advanced robotisation also means factories can run 24 hours a day, 7 days a week without heating or lighting, saving costs to the point of making manufacturing cost effective in higher-wage countries" [74] .

The sector in which this shift towards smart industry will be more visible in Rotterdam is that of the maritime industry, as seen in the projects, existing and planned, for the Stadshavens[75], or in the maritime delta of the Drechtsteden, where shipbuilding and offshore industry is gaining momentum with 3D printing and robotisation[76]. This is the best example of the aim of renewing existing industrial sectors under the umbrella of the Next Economy.

Energy

Rotterdam, the region and country at large, have the target of transitioning to sustainable energies in the coming decades, leaving fossil fuel economies behind. The deployment of smart grids in the region to be more energy efficient and self-sufficient has its prime example in the Westland, the agro-food cluster, where plans for a smart grid of geothermal energy and reuse of CO2 are underway[77].

Labour

The Next Economy is that of the 'prosumers': customers become part of the production process or provide services, with the potential emergence of cooperative models, or ideas of a self-sufficient city[78]. It is also related to the sharing economy, which entails the risk of bringing gig-economy and unstable, temporary jobs[79] .

Digital manufacturing will decrease costs and make it less labor intensive, making it possible to reshore industries from developing countries with the possibility of non-human factories and displacement of labor[80] . However, "In some cases a "manufacture locally" revival could take root, as companies cluster their design, production and customer service unites regionally to enable faster responses to new trends, demands and preferences of end-users.

As production and design become increasingly integrated, it is foreseen that off-shoring of the production process will become more difficult and lose its advantage of cost per unit for those products that rely on high customisation and new technologies"[81].

4.3 Governance and Decision Making in Rotterdam-The Hague

Holland has grown out of rigid territorial planning that clearly described what was to occur where. This generated almost a century of top-down segregation of manufacturing from other land uses such as housing and leisure. However with a radical change in planning policy based on performance criteria, the manufacturing landscape may undergo radical change.

SPACE: PLANNING CONDITIONS

Dutch Planning System in a Nutshell[82]

In the Netherlands the Spatial Planning Act (WRO), national level, defines how the spatial plans of the state, provinces and municipalities are to be put into effect. A municipal land-use plan (bestemmingsplan) is an example of a spatial plan. This section will summarise the main instruments in Dutch planning, but one must be aware that all this will change with the passing of the new Environmental Law (Omgevingswet), which will profoundly change how planning is made in the Netherlands: for example Zoning Plans and other plans will be replaced by one single plan, called Environmental plan (Omgevingsplan).

Spatial planning decisions are made at the national, regional and local levels, therefore is characterized by decentralization. The spatial visions of the government, provinces and municipalities describe the spatial developments they expect as well as how these developments will be directed or implemented. Spatial visions are policy papers that have replaced the key planning decisions (of the national government), the regional plans (of the provinces) and the structure plans (of the municipalities).

Spatial planning policy and its implementation are, in so far as possible, shaped at the municipal level; municipalities hold the most important powers in planning. The municipalities are able to set appropriate regulations based on their knowledge of the local situation. The state focuses on subjects that are of importance to the entire country, such as improving accessibility; these national interests are set down in the Spatial Vision

on Infrastructure & Spatial Planning (SVIR). In turn, the provinces focus on provincial interests, for example, landscape management, urbanisation and the preservation of green spaces; provincial interests are set out in the provincial spatial visions.

Land-use Plans

Land-use plans, or bestemmingsplannen, are the most important tool in Dutch spatial planning, defining thelegally binding form of spatial designs. Such plans set down where construction may take place, what may be built, the size of the structure and what it may be used for. The fixed components of a land-use plan are: the rules and regulations for the area concerned; an illustration (planning map / bestemmingen) that indicates and explains the various zones, land-use objectives (residential area, industrial area, agricultural use). The plan contains rules about building lines (rooijlijnen), vistas (zichtassen), as well as development regulations (bebouwingsvoorschriften) on, e.g, building height or mass.

Building Permits

The key governmental power in planning law is that of requiring permits to a project initiator. These affect planning of building work, for execution of the work, and for use of the work. It has to comply to different levels of regulation, and can be rejected if it is in conflict with, a.o: Building decree (Bouwbesluit), Municipal building ordinance (bouwverordening), Municipal Land-use Plan (Bestemmingsplan), Requirements of external appearance (Redelijke eisen van welstand); Rules of provincial order or national order. These orders must be incorporated in the affected Bestemmingsplannen by municipalities.

Another plan at municipal level is the Visual Quality Plan (Beeldkwaliteitplan) which offers notions on the desired form and structure of an urban area. It is not ground for refusal of a building permit, but in fact, it is used for that, as it can be used as reference by the External Appearance Committee in its decisions.

Rotterdam: Compatibility with urban form and systems

In the economic and urban planning and policy discourse in Rotterdam, there is a case made for urban manufacturing and mixed uses as the most clear manifestation of the Next Economy in the city. “As young makers prefer to live and work in the city, the makers movement brings back production to the city. They tend to locate in underutilised areas, given the availability of space and the ‘raw’ atmosphere that they seek-after.

As the Next Economy is about human interaction, creation of denser urban spaces and enabling social interaction”[83] . Because it is often about clean and often small-scale industry (3D printing), the new manufacturing industry can also settle in the urban areas near their employees, clients and other partners[84] holding the potential of “moving small scale industry back into city centers, using the city as an incubator by taking over disused office and retail space and breathing new life into the city centre”[85]. In short, urban making is desirable and compatible, at least in theory, with the city of the Next Economy, but urban making requires mixed, vibrant urbanities to thrive.

Such realisation is present in the municipal visions: “Strengthening interaction-friendly is one of the most important tasks in the Next Economy. It’s not just a nice appearance of public space, workplaces and buildings, but also to create the right mix of features....[however] in Rotterdam, [despite] all ingredients are present for a successful mix,... there is still lack of cohesion, cooperation, spatial connections, meeting places, etc.”[86]. The plan for an ‘Makers District’ at the former city harbours, Stadshavens, is the project with which the city wants to push forward this idea of a mixed urban district that has space for both production and living.

URBAN PLANNING CONDITIONS

There are numerous national and local planning conditions embracing and restricting urban manufacturing and new urban economies, ranging from very practical 'work at home' regulations to a development prejudice towards housing.

Environmental Categories

The Association of Dutch Municipalities (Vereniging van Nederlandse Gemeenten; VNG) provides a guideline advising municipalities on zoning locations of different types of businesses in relation to dwellings and vice versa, in terms of possible nuisance such as smells, dust, and potential danger (of explosion or fire e.g.). The guideline classifies activities in 6 environmental categories, and establishes a recommended distance between those economic activities and dwellings.[87]

Housing shortage

The city of Rotterdam has set a target to build 50.000 new homes by 2040. City expansion is not desirable to satisfy the demand for housing. Instead, the use of old port areas in now central locations, and the densification of the city center is the preferred option. Added to the restrictions in mixed use housing-manufacturing imposed by environmental laws, the emergence of interactive spaces for living, innovation, working and making seems unlikely, unless more flexible frameworks were put in place. The first structural vision of the Stadshavens[88] already discussed the possibility of adapting environmental contours, using all legal possibilities, to combine companies with housing.

30% rule for work at home

A rule, 'Werken aan Huis' (working at home) or 'Aan huis gebonden beroep/ bedrijf' (home based business), present in most of the current zoning plans in Rotterdam allows to use up to 30% of living space for work purposes; depending on the specific zoning category of the location, different types of businesses are allowed. These are usually those of category 1 according to the VNG, except retail activities and car repair.

Restructuring of Horticultural Cluster in Westland

In the case of the Westland, the situation is the opposite to Rotterdam. The priority is to serve primarily the needs of the greenhouse horticultural industry. Other uses are subordinate to this

Implications of the New Environmental Act

This new Environmental Act is a real shift in Dutch spatial planning policy that was renown for rigorous detail, is now focusing on performance based criteria. Zoning as it's now known will disappear, and land use could become, in general, more flexible--in the so-called areas in transition for example. When it comes to manufacturing uses, It would be up to a municipal organ to decide whether the use is appropriate or not for a given area. Flexibility means that, if well argued, a clean, high tech, nuisance-less manufacturing business could settle in an urban environment, in spite of belonging to one of the environmental categories that were not supposed to mix with housing before. It also means that, in the absence of a mediating figure or a strong urban manufacturing lobby, decisions will be made in a business as usual mode[91].

The Environment Act requires the government, provinces and municipalities to make an environmental vision (this replaces spatial visions). In the environmental vision they have to take into account the different interests in an area. Then environment plans are done for specific areas substituting the current bestemmingsplannen. In practice, applicants require 1 license (digitally) at either the municipality or province (either of them) makes a decision.

An abandonned former wharf offers obvious potential for public space and housing.
© Adrian Hill

industry[89]. The solution proposed by the Province of Zuid Holland and Westland municipality is to restructure the glass-houses, being more efficient in the use of space in order to free up land for uses that would increase the liveability of the area.

New Environmental Act

To be in effect in 2021, the new Environment Act, the Omgevingswet, the Dutch government wants to simplify and merge the rules for spatial development. Making it easier, for example, to start construction projects. This law brings together 26 existing laws, dealing with, among other construction, the environment, water, spatial planning and nature.

The goals of the government with the new Environment Act are threefold: to better coordinate and integrate the various plans for spatial planning, the environment and nature, encouraging sustainable projects (such as wind farms); further decentralize decision-making, so that municipalities, provinces and water boards can adapt their environmental policy to their own needs and objectives. The law wants to encourage the private sector. Permits are simplified and rules will be more general. The “attitude in assessing plans is ‘yes if’ instead of ‘no unless’”[90].

Over the last decade, a number of examples of urban manufacturing and Next Economy have emerged across the region. Interestingly voices in the municipality claim that “the necessary ‘next city’ is already in progress in the existing and concentrated physical and functional structure of the city. This applies especially to the northern Maas river, the city center and surrounding areas such as Kralingen, Delfshaven, the Old West, the Middle and the South of the South. The attractive housing market, together with the presence of strong companies and facilities for the next economy of consumers and producers, lends itself to capitalizing on innovative economic dynamics”[92]. However, some areas in transition, being transformed from their mono-functional use to interactive environments are of particular importance in the region.

4.4 Ongoing projects and Activity

Rotterdam's pioneering DNA is projecting ambitious moves in development projects within abandoned inner-city port sites - however under the surface both vision and compatibility with house are in question. Within the inner-city, grass roots projects are emerging based on more 'informal' spaces for making. While in the greenhouse district, a mechanised agricultural future looms awaits.

STADSHAVENS: M4H AREA + RDM, "THE MAKERS DISTRICT"

Early on 2018, the city of Rotterdam and the Port of Rotterdam Authority decided to rebrand the RDM and M4H areas as the "Rotterdam Makers District", "the place in the region for the innovative manufacturing industry."[93] For these authorities, innovative manufacturing industries (focused on new technologies such as additive manufacturing, robotics, and material science) requires small and medium-sized spaces, labs, cleanrooms, data centers, and flexible, open environments. With these facilities co-developers and co-producers can quickly react to the changing nature of technology and economics.

RDM Rotterdam

RDM is a collaboration between the Port of Rotterdam Authority and Rotterdam University of Applied Sciences and brings together port-related manufacturing industry and related education and R&D. The 23,000m2 site is located in Heijplaat (Rotterdam Zuid), in a former submarine and shipbuilding facility, a 20 minute ferry ride away from the city centre. The area is the lighthouse of the port's transition towards innovation. There are three educational institutions with 1200 students, the Hogeschool Rotterdam (HBO), the Albeda College (MBO) and the Zadkine College (MBO). Start-ups, SMEs and big names in the maritime sector can take advantage of the space, the technology and also the knowledge and skills attached to the education facilities. Vacancies at the RDM are limited and demand continues to increase despite voices claiming it to play a minor role in " innovative business dynamics", isolated nature, and lack of amenities"[94].

Merwe Vierhavens area
© Stadshavens Rotterdam

M4H Rotterdam

Located opposite to the RDM, M4H was in use for fruit transfer for many years. The juice cluster in Vierhavens is still functioning, but fruit transshipment has largely disappeared from the Merwehaven as a result of containerization, leaving behind many vacant buildings. Pioneering and craft manufacturing companies have found space on their own in the Keilewerf or use the facilities at Fair Design Square. Creative entrepreneurs such as Studio Roosegaarde and Atelier Van Lieshout were offered a space there. Other companies in the circular manufacturing industry such as Rainmaker Holland, and Buurman are located there.

The area is divided in two parts, a central one, on land of the Port Authority, and the peripheral, belonging to the City of Rotterdam. The port is renovating the premises and infrastructure and leasing properties to companies exclusively. Businesses willing to settle in the port's land have their candidacy assessed by a board on the basis of the adherence with the following values[95]:

- Social value: if entrepreneurs can offer work experience places to people from surrounding neighbourhoods or if they are going to make use of the student population of RDM and its faculty.
- Economic value: Innovative, technological companies that add to Rotterdam's manufacturing economy especially in the maritime sector.
- Physical value: Businesses wanting to invest in the area or that have a background in sustainability.

The larger the contribution to the three forms of value creation, the more possibili-

Bird's eye view of Rotterdam centre © Debot / Wikimedia Commons

ties there are for attractive contract conditions and duration.

The site under control of the City of Rotterdam falls under a very different paradigm. Plans are to develop a mix of living and working environments and a clear system of public spaces. Here the city will offer the land to residents and companies with an erfpacht (long-term lease), but without any other contractual requirement with regard to the way land will be used. In principle, there will not be land zoned as 'industrial' or 'manufacturing' but as 'flexible use' (which includes retail and hospitality uses). Some of the current industrial or retail uses present on municipal land, for example Continental Chocolade, a chocolate factory, are considered undesirable for the new character of area and negotiations are being made for their relocation. In cases where redevelopment is affecting and effectively pushing out companies that the city wants to keep on site, like Buurman (a woodworking company), relocation within the area will be the desirable outcome.[96]

CITY CENTER (BINNENSTAD)

The city centre of Rotterdam has seen interesting manufacturing locations popping up in the recent years, providing workspaces for collaborative, high tech and creative businesses, including making activities. There are two types of urban location that enable these activities: first, the area or urban block and second, the high streets. Examples for area or urban block developments are hubs such as the Schieblock[97], ZoHo Rotterdam[98], or BlueCity[99], and social enterprises as Het Lab, among others.[100] Examples for the high streets, called stadstraten in Rotterdam that are part of the old structures of the city are the Beukelsdijk, Kruiskade, Oude and Nieuwe Binnenweg, Meent, and Hoogstraat among others. Whereas the first category takes advantage of vacant areas in the city centre and focuses more on collaborative innovation environments, the second category provides more spaces for individual smaller companies, which find their place in smaller buildings, being part of the high street. The location of the high street allows businesses to produce and sell to the end user at the same place.

Buildings in this environment become more and more interesting as locations for small scale manufacturing, since many cities experience a decline in retail businesses that have been dominating high streets in the last decades. Most of these activities play a pioneering role in urban regeneration; high streets are, for example, the first space where (small scale) manufacturing usually comes back (due to real estate prices). Nonetheless, as real estate pressure increases, small manufacturing activities in these locations are at risk of being pushed out. According to Emiel Arendts[101], spatial advisor at the Department of City Development, regeneration and densification would be desirable in central locations, as it is more sustainable and would create synergies[102]. This would mean, however, the addition of more public infrastructure, schools, doctors, green spaces, and an increased competition for commercial space. Due to this, it is very relevant to develop planning and design rules that enable integration of manufacturing as a central function in urban life.

ROTTERDAM ZUID

While modest in productive scale, several initiatives focused on crafts and manual labour are emerging in Rotterdam south, creating synergies between creative industries in the north of the city with a mainly immigrant population that has traditional making skills. These activities mainly take two forms: home-based crafts (see 30% for work at home, section 4.3), and collaborative workspaces and enterprises specialized in high-quality, local food products. An example of the first is the initiative Wijkatelier op Zuid (neighbourhood Atelier), which connects among others Dutch fashion designers and related industries with residents who have access to knowledge of craftsmanship in textile making[103]in the Afrikaanderwijk. Examples of the second are 'The Rotterdam Mint', a herb garden where fresh herbs for Rotterdam-based catering companies are grown and sold[104], and Rotterdamsche Confituur, a social enterprise manufacturing fruit preserves.[105] For the city, these are noteworthy initiatives because they not only provide excellent urban manufacturing products, but also create community and bring people together in deprived areas, [106] addressing high unemployment in neighbourhoods in the south of Rotterdam.

WESTLAND

The regions of Westland-Oostland are home of the largest horticultural production glasshouse area in the world. The Westland alone contains more than 700 companies, involving 2,400 hectares of production and accounts for about 60,000 direct and indirect jobs. This cluster is in constant transition in order to retain its strategic importance, renovating its production systems and spaces to become more economic, resilient, efficient, and smart. However, increasingly the greenhouses are involving high-tech solutions resulting in automation of labor, production and logistics, which holds the potential of rethinking productive spaces, urban typologies, and its entire territory. In this sense, mechanisation and automation of the sector is turning it increasingly more industrial in nature, pushing the limits between agriculture and manufacturing.

Texile making workshop at Wijkatelier op Zuid

4.5 Driving Rotterdam's next economy

While no shortage of ambitions, finance and ideas, Rotterdam's 'New Economy' oriented future is not so clear. Jobs are shifting away from low skilled-manual labour which is available in abundance to high-skilled knowledge workers which is in shortage. Development pressure on available former port land is favouring housing over more strategic land uses for jobs or climate resilience.

1. CHANNELING THE NEXT ECONOMY

The transition to the so-called Next Economy attracts great confusion regarding which sectors to stimulate, the priorities, the new economic profile of the city and region and its basic industry in the future. Nonetheless, some sectors are named as strategic - and therefore absorb all the focus by institutions (particularly the port with regard to maritime manufacturing) and investors including: clean tech, maritime industry, health and agro-food. The opportunity lies in understanding the meaning of the Next Economy, in terms of the renewal of all productive cycles, innovation in manufacturing processes, products, logistics and knowledge transfer. The strong institutional support to for the Next Economy agenda, knowledge institutions and the availability of space in areas on transition (post industrial settings such as the port), in regeneration such as Rotterdam Zuid or being restructured including Westland) and several large waste streams mean there are conditions for a diverse and sustainable manufacturing landscape to emerge. How can the Next Economy and its resources be channelled into constructive urban manufacturing?

Manufacturing Smart Technologies

The Next Economy will force manufacturing to adapt. Clients will demand manufacturers to provide more flexibility, greater customization, smaller batch orders, quicker responses, more extensive level of service, possibility for R&D, require internal marketing, while scaling up demands internationalisation. All of that requires a new whole set of skills and higher capital investments. Dutch manufacturing companies, mostly small and medium companies across all sub sectors suffer from increased pressure to adapt to

these conditions. The consequence is likely to require higher collaboration between parts of the chain, which could lead to mergers, consolidations and acquisitions, ironically making the manufacturing ecology less diverse and resilient.

Another answer to the new demands is investment in Smart Factory concepts involving automation, additive manufacturing, sensors, digital platforms. This potentially will result in a shift in the character of manufacturing employment. Industrial platforms might also increase the dependence of companies in larger, multinational actors developing technology or software.

The question remains: how can a strong local network of knowledge institutions and entrepreneurs collaborate to develop innovative smart industrial concepts? Could sensors, robots, and other systems be designed, developed, and manufactured locally, creating in turn new jobs that replace those that will be lost by digitisation?

Manufacturing as Potential Source of Local Livelihoods in the Next Economy

Recovery since the 2008 financial crisis has manifested in higher productivity, but employment growth is lagging behind, and it is generally in form of precarious conditions as self- or part-time employment. Jobs for those which didn't pursue higher education, or have not updated their skills, a profile that defines a large pool of the region's population, have fewer options. In turn, vacancies for those highly educated or with skills linked to the Next Economy are in high demand. How to keep the large lower skilled segment of the workforce active and valuable in the Next Economy? How could urban manufacturing become a source of both traditional and groundbreaking modes of labor intensive, local jobs based on local knowledge and skills?

2. ENGAGING WITH THE PORT OF ROTTERDAM

The Port of Rotterdam has historically, and to this date, defined the economic profile of the city and region and its narrow focus on a few industries such as logistics and fossil fuels. Beside employment, there is limited local added value actually from all the materials and goods that flow through the region. Furthermore in the context of economic transitions and a European move away from fossil fuels, the region's dependence on employment from this large single actor remains a serious weakness.

The Port Authority certainly is adapting its profile and developing former port areas to introduce new, innovative manufacturing opportunities that support directly and indirectly its business towards the transition to the Next Economy. However, the focus on certain, specialised kinds of making, namely those linked to maritime industry, may limit the growth of a diverse manufacturing scene.

New urban manufacturing economies could benefit from being situated by the most important port in Europe, building on available resources and skills while turning its focus to Europe's most important agricultural cluster. World class logistics infrastructure and expertise, in addition to a growing network to capture wasted resources from port activities (such as CO2 or heat) could hold a huge potential. Furthermore, as the port modernises and moves westwards, it is leaving vacant, now more central areas that could become interactive spaces for a highly competitive ecosystem of urban manufacturing ecology.

The port authority is a strong actor, able to 'make things happen' when it comes to stirring urban and industrial development in the region. A fundamental question remains, how can the port be engaged in a conversation dealing with a broader understanding of urban manufacturing?

RDM Rotterdam - a place for R&D and startups
© Adrian Hill

3. NEW URBAN DESIGN PARADIGMS FOR A RESILIENT URBAN ECONOMY

If something defines Rotterdam's approach to planning it is "Rotterdam Make it Happen." This is evident in the city's ambitious plans of becoming circular, resilient and in offering more attractive housing, urban spaces and conditions for investment.

While this makes planning flexible and dynamic, it also means that planning officials can easily change priorities to meet certain urgencies. Some plans with great long-term potential, such as urban manufacturing, can benefit from this flexible planning environment. However, with medium to higher income housing considered the most urgent priority, this way of flexibility instead of rethinking the space and technologies for urban productive activities and their combination with living and territorial strategies against climate change could mean a missed opportunity.

The foreseen land price rise due to housing projects affects urban manufacturing as other higher paying commercial functions (such as logistics and large retail) push out the productive activities. In short, despite the plentiful amount available space in the city for making, it may be curtailed by short-term development opportunities.

In the absence of medium to long term certainty in zoning, or subsidies to improve insulation and technology to make it possible to mix making with residential, new initiatives and investments could be discouraged in favour of generic gentrified neighbourhoods.

With the region in very much in need of climate adaptation solutions and strategies to support the Next Economy, how can a case be made for environmental compatibility of urban manufacturing with other functions, including residential within the context of serious climate change challenges?

Mediating for Urban Manufacturing in Future Environmental Plans

With the new Environmental Act, traditional zoning will change. It will allow for even more flexibility to introduce new uses - in so-called zones in transition for example. Regulation will be looser, and the municipalities will have more power in deciding what and how things could happen. It would be up to a municipal commission to decide whether a clean, high tech, nuisance-less manufacturing business could settle in an urban environment, despite belonging to an environmental category which did not allow for mix with housing until now. It could also mean that without the proper expertise in municipalities, decisions will fall into a focus on low risk and predictable solutions addressing tangible issues such as housing.

Is a bridging actor necessary to mediate between decision makers, local residents and manufacturers in order to facilitate informed decisions at municipal levels on where and how industry can be integrated in an urban setting?

APPENDIX 1: KEY ACTORS

Gemeente Rotterdam. Department of Urban Development of the City of Rotterdam
This department starts and supervises spatial and economic investments in the city, and its initiatives are driven by the motto 'Make it Happen'. It is divided in four main areas: Spatial and Economic Development (Ruimtelijke Economische Ontwikkeling, REO), Urban Design (Stedelijke Inrichting, SI), Engineering Office (Ingenieursbureau, IB), and Project management office (Projectmanagementbureau, PMB).[107]

Spatial and Economic Development (REO)[108]
REO's goal is to stimulate spatial developments and investments in the city, together with other governments and market parties. It aims to make the city more attractive for private investors by working on the residential, living and business climate, with an special focus in the city center of Rotterdam.

Urban Design (SI)[109]
SI is the area in charge of defining the use and layout of the urban and regional space. It elaborates one of the main urban strategy documents, the 'Kaart van de Stad'. The Urban Planning department comprises the departments Space & Housing, Traffic and Transport, and Building and Housing Supervision. The Space & Housing department works on the spatial planning of the city, and it elaborates both the bestemmingsplannen (zoning plans) as specific, project-based interventions. Its core competencies are: urban development, planning, landscape, zoning plans, and the environment. The Building and house supervision department was created in 2015 from the merger of the Permits and Supervision Buildings departments. It focuses on building regulations and related procedures.

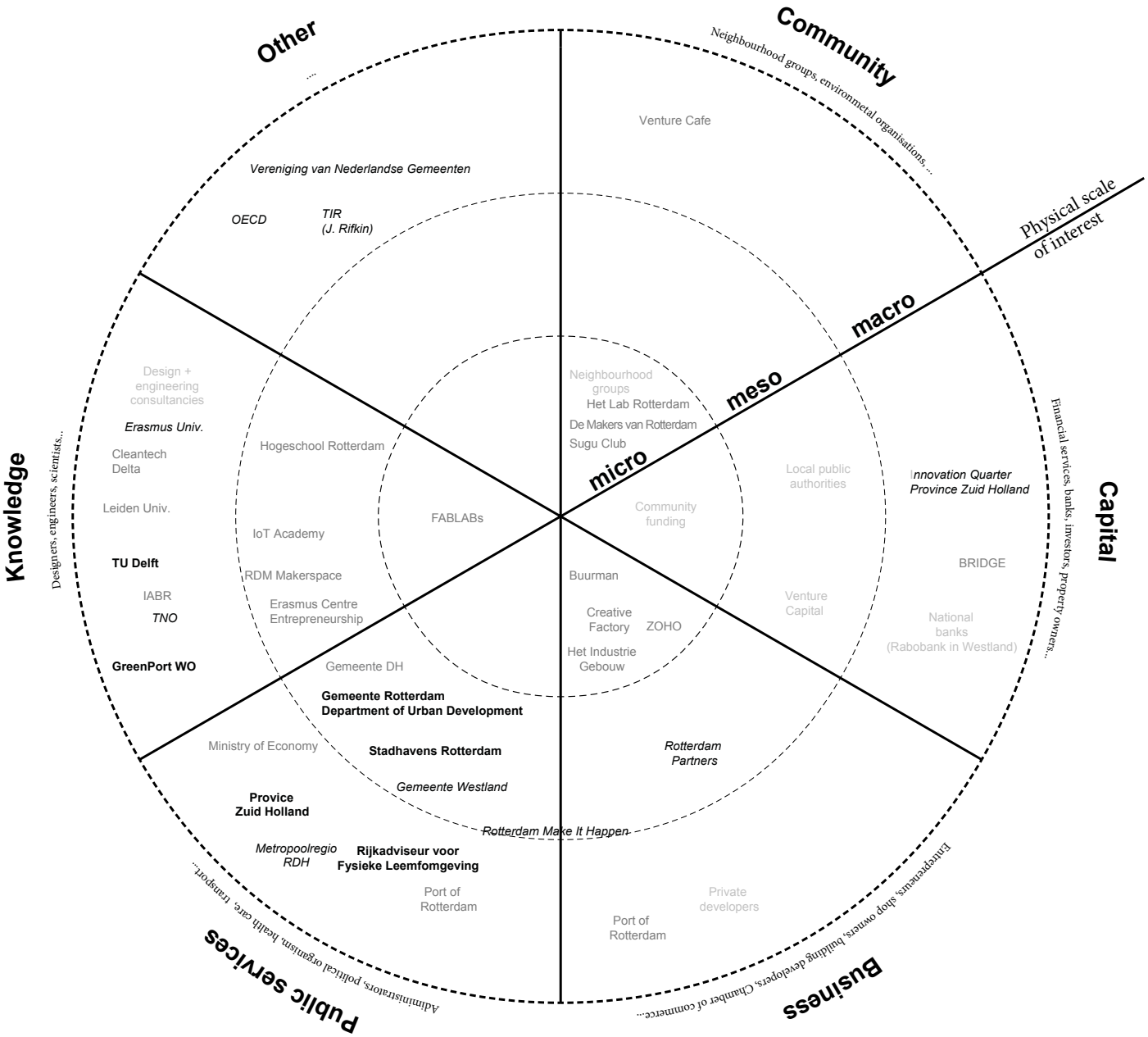
Port Authority of Rotterdam
As explained in the introductory text in this report, the Port Authority holds enormous influence on urban and economic planning and development in the city and region. As a 'landlord port', that leases areas to companies and provides them with infrastructure, it has great power in deciding what happens where and how, according to its long term strategy (Port Compass) towards becoming a greener and more efficient port. The Port Authority partnered with the municipality in the Stadshavens organization.

Stadshavens Rotterdam[110]
In 2007, the Port of Rotterdam Authority and the Municipality of Rotterdam entered into a special partnership for the redevelopment of the port areas located adjacent to urban areas in Rotterdam. The Stadshavens Rotterdam program office has done work to connect the city and port in the Rhine-Maashaven, Waal-Eemhaven, Merwe-Vierhavens (M4H) and RDM Heijplaat districts.

Province of Zuid-Holland
The provincial government is an intermediate entity in Dutch governance and policy; is is an important link in the government chain, between the national government and local authorities. The province has the position and the network to translate European and national policy into the region. The province is responsible of developing and implementing the Visie Ruimte en Mobiliteit (Vision for Space and Mobility). The Vision Space and Mobility do not offer a well-defined spatial final picture, but a perspective for the desired development of South Holland as a whole.

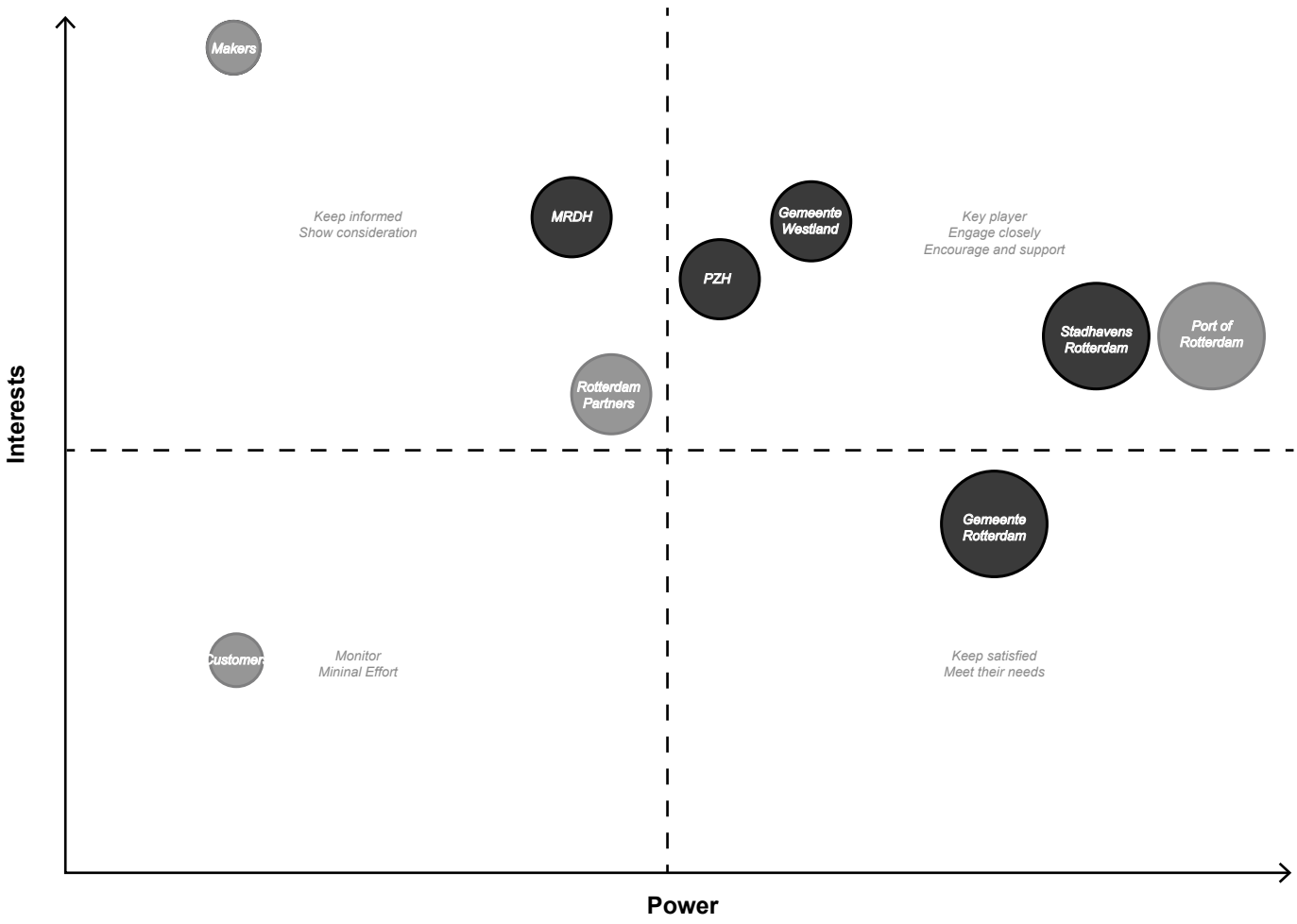
In order to implement the provincial spatial policy, the province has various instruments, of which the Regulation for Space 2014 (Verordening ruimte 2014) is the most important. This regulation is developed in collaboration with the different local governments. It sets rules for municipal zoning plans; zoning plans have to comply these rules, or alternatively, make a case for exceptions. Not all subjects are suitable for inclusion in a regulation. The province can use several instruments if there is a provincial interest, and impose changes on zoning plans to municipalities.[111]

Metropolitan Region Rotterdam-The Hague
This is the result of a joint initiative by 23 local authorities. The local authorities work together to improve accessibility and strengthen the economic business climate; as such, it has been formed to counterbalance the role of the province in regional decision making in those issues, and give more power to the large cities of Rotterdam and The Hague. Municipalities part of this metropolitan region are: Albrandswaard, Barendrecht, Bernisse, Brielle, Capelle aan den IJssel, Delft, The Hague, Hellevoetsluis, Krimpen aan den IJssel, Lansingerland, Leidschendam-Voorburg, Maassluis, Midden-Delfland, Pijnacker-Nootdorp, Ridderkerk, Rotterdam, Rijswijk, Schiedam, Spijkenisse, Vlaardingen, Wassenaar, Westland, Westvoorne and Zoetermeer.



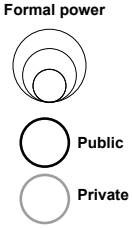
Actor map

This scheme show the constallation of main actors opperating in Rotterdam and their interests in terms of urban manufacturing.



Power / interest map

An synthesis of how actors have been positioned in terms of power and interest related to the theme of urban manufacturing.



The Metropoolregio Rotterdam
The Hague has an approved policy framework for European cooperation, and is working on a Roadmap for the implementation of the set-up goals. Metropoolregio Rotterdam The Hague has internal working group for preparing policy documents and screening opportunities, and a regional knowledge exchange platform with the 23 municipalities. Its main document so far is the Roadmap to the Next Economy, which presents a vision for a transition of the region to the so-called Third Industrial Revolution.

Rotterdam Partners[112]
Rotterdam Partners is an entity that emerged from a merger of Rotterdam organizations linked with city marketing, investing, and urban economic development. Its main activities are the programs on: Networks, Marketing & Communication; International Trade & Investment, offering information and services for international entrepreneurs and employees (expats) on choice of location, fact finding missions, introductions to relevant networks and assistance in areas such as taxes, healthcare, permits and laws and regulations; Convention Bureau & Tourism and hospitality. It is a network organization of which several initiatives stem, being the most relevant:
The International Advisory Board (IAB) is formed of international leaders from science, industry and the public sector.
Rotterdam Economic Partners (formerly the Rotterdam Economic Council), which contribute to economic policy, in alignment with the Board of Mayor and Aldermen and the management of the municipality.
R'damse Nieuwe is a network of young professionals has been set up to stimulate the active involvement of young people in the development of the Rotterdam economy.

Gemeente Westland / HOT Coalition
In close collaboration with the Province of Zuid Holland, the municipality of Westland is developing visions and strategies to improve the liveability of the glasshouse area while maintaining its large, productive horticultural cluster. Here an important actor is the HOT Coalition. This organization includes The Federation of Fruit and Vegetable Organizations (FVO), Royal Flora Holland, the Provinces of Noord and Zuid Holland, the Gemeente Westland, the Ministry of Economic Affairs, and Rabobank. This coalition emphasizes: a revolving fund for energy transition, adjustments to space-for-space regulation, design (and adjustments) of possible transport subsidies, a cluster-friendly way of economic expropriation, improvement of enforcement policy for the purposes of restructuring glasshouses, forms of equalization, development rights and possibly tax measures, a new way of dealing with planning rights, and raising capital from EU Green Funds or other unlikely sources of financing.[113]

APPENDIX 2: MAPPING DATA

Separate Industry Maps
Each dot represents an individual business registered with the NACE code related to the described industry
Source: ORBIS database [web]

Manufacturing Maps Urban Regions
The maps give an overview over industrial land use in each urban region.
Source: Land use data BBG2012; accessed via "Data Archiving and Networked Services – DANS" in April 2018. [web]

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