# THE PORT-CITY INTERFACE IN THE DRECHTCITIES

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## Abstract

This research focusses on the port-city interface in the Drechtcities. The industry in this economic vulnerable region is traditionally focused on the maritime sector. Trends in this sector demand a different port-city relationship, a challenge for policy makers. Policy makers attempt to strengthen the maritime cluster and revitalize the waterfronts by investing in human capital. Using location quotients based on jobs in different maritime sectors in the region over the period 2010-2017, the relative strength of industries in the region and the effectiveness of revitalization of the waterfront can be assessed. In general, the location quotients for jobs were positively growing over the years which indicates that the concentration of jobs is increasing compared to other regions, but due to the scope of my research it is hard to draw conclusions regarding the maritime cluster from a broader perspective. Three leader firms in the region employ the majority of the workers in the maritime cluster, which is very positive for the region. A high dependency on a few leader firms could weaken the maritime cluster in the future, if the region is not resilient enough.


*The data in my thesis are made available by Erasmus UPT B.V.*

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# 1. INTRODUCTION

Citizens of port cities tend to identify themselves with the port and are proud of that as well. This long-existing pride is based on the fact that ports were previously located within the city center, which consequently affected the life of most of the citizens in the city. Nowadays ports tend to move away from city centers due to the ever-increasing volumes and the containerization of global trade. Support of the local citizens is essential for ports to keep their *license to operate*. Historical pride is however not enough nowadays in order to maintain a successful port-city relationship. The port-city relationship is under pressure due to a variety of factors. These factors influence the port-city relationship, and it is contestable whether local citizens benefit from the port and its associated activities.

Cities can benefit in three ways from port activities, it creates employment, it creates economic added value, and it enhances innovation (Merk, 2013). A port close to a city causes negative effects as well for cities. At first, pollution from the port in air, water or noise is an important negative effect that is felt locally (Merk, 2013). Furthermore, growing ports in city areas cause urban congestion, which could lead to significant economic and environmental costs for the urban area (De Borger & De Bruyne, 2011). Next to that, higher truck volumes contribute disproportionately to traffic accidents and this causes extra delays (Giuliano & O'Brien 2008).

In Rotterdam, the congestion and environmental impacts related to the port-industrial cluster are felt, but most of the port jobs are now occupied by workers from outside the city and the connection of urban citizens and businesses to the port is becoming loose. More than 30% of the total area of the municipality of Rotterdam is occupied by the port (Merk, 2013). This land use of ports creates tensions between ports and cities. In Amsterdam for example, there is a strong pressure on transforming parts of the port land in order to develop other urban functions, such as housing and office development (Merk & Notteboom, 2013). With an increasing population and the objective to build one million houses by 2030, the pressure to build within city areas is growing rapidly (Clahsen, 2021). There are three segments for a city region to reap additional benefits from their ports: through maritime service clusters, industrial development and through port-related waterfront redevelopment (Merk, 2013). Each of these ways are affected by the ongoing developments on the area of digitization, globalization, energy transition and urbanization.

These challenges could conflict with the ambitions of ports. Although there seems to be a positive relationship between GDP growth and growth in container volume, port growth does not always lead to a more beneficial situation for its surrounding urban areas (Merk, 2013). Next to that, container throughput and the volumes of crude oil generate less added value compared to general cargo (Haezendonck & Coeck, 2000). This fact did not withhold the port authorities in Rotterdam to expand their container capacity by creating new quays (Verbraeken & Lalkens, 2021).

A reason for this expansion could be the power of large multinational companies active in the ports, these global corporations emerged in the past years in most of the large ports. Through mergers and acquisitions, these corporations expanded their assets and influence in ports (Jacobs, 2007). Local operators and local business connections were replaced by international players, that have a different view of doing business and could be less inclined to fulfill local needs (Martin & Thomas, 2001). This ongoing globalization led to high pressure on port authorities to defend their interests (Notteboom, De Langen & Jacobs, 2013).

## 1.2 The city and the port: different preferences

The forementioned factors could lead to a mismatch between negative factors that have a local impact and economic benefits that tend to leak away to other regions (Hesse, 2006). Larger vessels, containerization and globalization resulted in a separation of port areas from city centers in many port-cities. But separation of functions did not always prove to be the solution. Mixed land-use could provide dynamic advantages for ports as well (Hall & Jacobs, 2012). This can support innovation and growth for the port industry as well for other sectors in the urban economy, it could create a synergy. An example of synergy between port functions and the regeneration of waterfront areas is the business of cruises (CTUR, 2007). It is questionable whether this synergy type is still viable nowadays with the COVID-19 crisis and the growing climate awareness.

Synergies between different maritime companies can result in a maritime cluster, beneficial for both port and city. A cluster is a network of companies within a certain region and within a certain sector, that creates economic value by synergy and crossover effects. The maritime cluster in the Netherlands employed 224.000 workers in 2015, an economically important sector (Dutch Maritime Strategy, 2015). A maritime cluster is unique in the sense that it is on the edge of the port and the city, the cluster is present in both areas. Some trends force policy makers to choose between either the port or the city, but this could affect the port-city relationship.

There are multiple drivers that impact the relation between the port and its city. The port-city relation is under pressure due to current challenges mainly on the area of energy transition, globalization and urbanization. Growing e-commerce leads to a still growing flow of goods from Asia to Europe and North America. Port authorities have to take its local environment into account in these challenging times and cities are pushing for a different role of the port in the future. In the Netherlands, the ports of Amsterdam and Rotterdam are moving away from the cities and the abandoned sites are mainly revitalized into residential areas. An example is the Rijnhaven in Rotterdam, where at least 3500 new houses are planned. This “upgrade” comes at a cost, the international operating company Codrico is forced outside the Rijnhaven and has to look for an alternative location (Van Heel, 2020). This is an example of the growing tension between urbanization and port activities with its impact on its surroundings. It seems that the pressure of urbanization to build houses is currently “winning” from the port activities. Another example is the Haven-Stad plan in Amsterdam, an ambitious plan to build 70000 houses in the port area. Residential areas next to industrial sites creates, unsurprisingly, tensions; environmental regulations will be stricter close to residential areas, which forces some companies out of the port (Port of Amsterdam, 2017).

## 1.3 The “Drechtcities”

Another maritime cluster, but known to a lesser extent, is the maritime cluster in the region Dordrecht – Zwijndrecht – Sliedrecht: the “Drechtcities”. Together with the maritime sites near Kinderdijk and Gorinchem, this will be the geographical focus of my study and I will name the cities combined the Drechtcities. The impact of maritime activities in this region are significant. It is estimated that 21.244 people relating to maritime activities are employed in this region, creating an added economic value of 2.3 billion euros in 2019 (Havenmonitor, 2020). About 10% of the total direct employment and economic added value of all the seaports in the Netherlands originates from the Drechtcities. In the region, companies as Boskalisa and IHC are active. The Netherlands prides itself with the activities of these companies. The world was watching when Boskalis took the lead in the rescue operation of the Ever Given, stuck in the Suez Canal (Sheppard & Dempsey, 2021). Many would argue, even before this operation, that companies such as Boskalis should be preserved for the region. The economic activities in the region, combined with the lack of literature regarding the relation between the nearby cities and the inland ports in this region, makes it a very interesting part of the Netherlands to investigate.

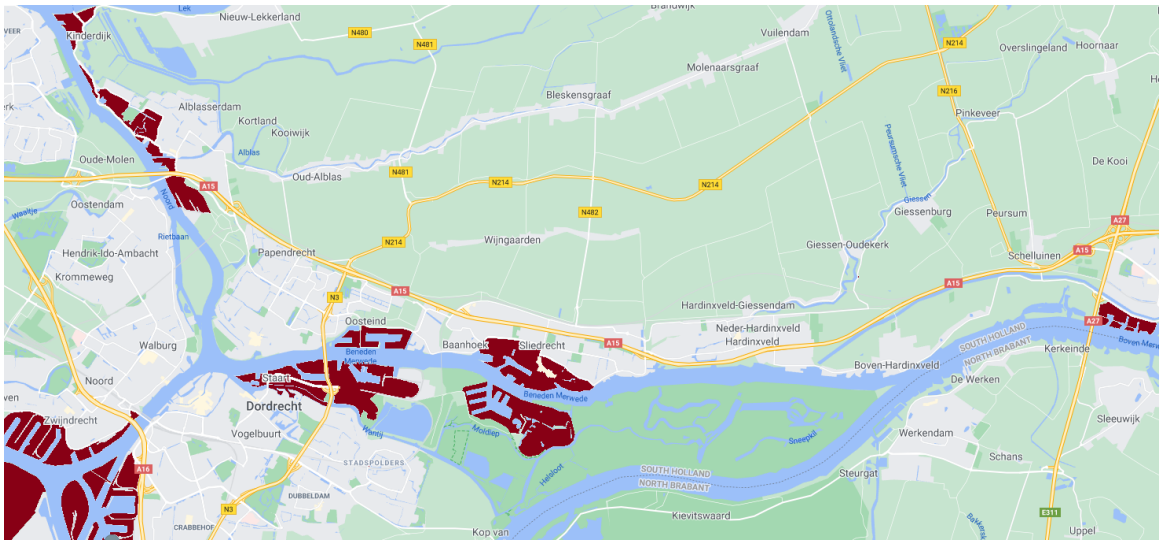



*Figure 1: Geographical focus of my study, port areas are highlighted.*

The Drechtcities and its surroundings were hit hard by the economic crisis in 2008 and the subsequent financial crisis in 2013. Factories closed and many citizens lost their jobs, creating societal tensions and deep-rooted problems. The main reason why this region was hit so hard, is the fact that there is a large presence of manufacturing industry in the region, an industry that is very sensitive to economic fluctuations (Rijksoverheid, 2020). The region is still economically lagging, with a lower growth of inhabitants compared to the Netherlands and an outflux of young high educated inhabitants. There is a challenge for the region to speed up its economic recovery, but the question remains how this can be achieved.

Another major disruption that occurred over the last years in the region, was the commercial and nautical exploitation of the port of Dordecht by the port of Rotterdam from the year 2013. The port of Dordrecht is the most inland seaport of the Netherlands and with a depth of 10 meters still accessible for ocean-going vessels. The focus of the port is mainly on throughput of dry, break- and liquid bulk. What is interesting, is that the Rotterdam port authorities explicitly mention the maritime cluster in the region as strength for the port (Port of Rotterdam, 2021). The strong maritime cluster in the region, as already mentioned, could strengthen synergies between the port and the region and improve the port-city relation. Since 2013, the Port of Rotterdam invested in the port area to strengthen this synergy, together with the municipality of Dordrecht.

## 1.4 Can the maritime cluster strengthen the city and the port?

It is clear the maritime industry in the region is an important industrial sector as it enhances the economic position of the Drechtcities. The economic outlook of the region is not positive at the moment, despite the strong maritime sector. Next to that, it is uncertain whether the strong maritime industry is only dependent upon a few companies, or that the whole region profits from the maritime industry. In my research, I will focus on the city-port relation with respect to the Drechtcities and I will investigate to what extent the region benefits from the port activities. Regeneration of waterfronts is an important tool for policy makers to enhance the value for cities, but it can also increase port value. With an adjacent port, the port-city interface for the Drechtcities is influenced by the relative success of the port and the city. Maritime clusters could improve the output of ports and employ many local citizens, but what is the actual strength and significance of a cluster? This research will focus on the cutting edge of port and city: the maritime cluster. Creating a stronger maritime cluster is beneficial for the port and the city and not for one of the two players. This leads to my research question:

*To what extent did the evolution of ports and subsequent policy interventions regarding the port-city interface impact the maritime cluster of the Drechtcities in terms of employment and is the dependency on the leader firms in the maritime cluster in this region positive?*

To assess the research question, I will first analyze existing literature about the theory behind the port-city interface and crossover effects within the port-cities. Waterfront regeneration is a tool to improve the port-city interface and will be discussed as well. Thereafter, I will describe the port-city interface in the region of my research. Policy interventions that were launched over the years will be discussed as well. After the qualitative part, I will describe my data from the LISA database. I will explain my geographical scope, my scope regarding companies and my database. The steps and benchmarks will be outlined to answer my research question based on the data and to assess the research question from different perspectives. I will conclude with the result section and the conclusion and discussion.

# 2 LITERATURE REVIEW

In this part, I will provide background information that contribute to my research. This section will start with a theoretical review of the port-city relation in the existing literature, whereafter I will highlight some important trends and other developments concerning this topic, on a global and a local scale. The next part will deepen the understanding of the use of the waterfront in port-cities over the years, in theory and in practice. Hereafter, I will describe the port-city interface in the region of my research. The last part of the literature review will focus on the regional policy interventions that are in place in the Rijnmond region.

## 2.1 Port-city interface

The interaction between port and cities is named the port-city interface. A port-city interface nowadays does not have a clear demarcation line between the port and the city, it is an interactive economic system with sometimes a conflict in policy formulation and implementation (Hayuth, 1982). The relationship between the port and the city evolved over the years, due to the evolution of the port and the city. The last years, municipalities and port authorities attempt to improve the port-city relation, but the effectiveness of these attempts is not always clear (Merk & Dang, 2013).

### 2.1.1 A brief history of the port-city relation

This interaction has developed over the past centuries, from a very close relation between the port and city to a much more separated interaction. The relationship between port and city has been perceived as beneficial for both parties if the city could host the maritime activities (Hesse, 2018). This perception changed when the port got separated from the city and the benefits were not reaped by the local citizens anymore. This separation of activities was due to containerization, increasing ship sizes and other technological trends. Nowadays, there is a growing urge to renew the port-city relationship because of the urbanization and globalization, which sheds the city and the port in a different perspective compared to previous times (Merk, 2013). Figure 2 gives a clear overview of the relationship between port and cities over the years. The figure depicts that the expansion of both cities and ports over the years resulted in different ways that ports and cities cooperated with each other. The economic surge from the mid-fifties in western Europe resulted in a retreat of the port from the original waterfront. A clear example is Rotterdam, where the port left the city and moved westwards into newly developed industrial areas closer to the North Sea, leaving old sites as the Rijnhaven and Maashaven abandoned and created new industrial sites as the Europoort. The last years, these abandoned waterfront sites have been regenerated, in Rotterdam and elsewhere, which enhanced the port-city connection according to Hoyle (2000). The question remains what this enhanced port-city integration entails from a port perspective.

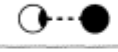
| STAGE | SYMBOL ○ City ● Port | PERIOD | CHARACTERISTICS |
|---|---|---|---|
| I Primitive port/city |  | Ancient/medieval to 19th century | Close spatial and functional association between city and port. |
| II Expanding port/city |  | 19th–early 20th century | Rapid commercial/industrial growth forces port to develop beyond city confines, with linear quays and break-bulk industries. |
| III Modern industrial port/city |  | Mid–20th century | Industrial growth (especially oil refining) and introduction of containers/ro-ro (roll-on, roll-off) require separation/space. |
| IV Retreat from the waterfront |  | 1960s–1980s | Changes in maritime technology induce growth of separate maritime industrial development areas. |
| V Redevelopment of waterfront |  | 1970s–1990s | Large-scale modern port consumes large areas of land/water space; urban renewal of original core. |
| VI Renewal of port/city links |  | 1980s–2000+ | Globalization and intermodalism transform port roles; port-city associations renewed; urban redevelopment enhances port-city integration. |

*Figure 2: overview of port-city relations. Source: (Hoyle, 2000)*

### 2.1.2. Defining the port-city interface

There does not exist one type of port-city, it is a broader definition of cities that are historically connected with their ports. However, a port-city can be defined via a matrix (Ducruet & Lee, 2006). This matrix tells us the level of centrality, which is an urban functional measure, and the level of intermediacy, which is a maritime-based measure. A high centrality and a low intermediacy results in a port-city relation that is focused on the city and not on the port. The diagonals illustrate progression from one type of port city relation to another type of relation. The middle situation is called the *cityport*. This is a balanced situation in where port and city functions are evenly balanced and there is no clear "winner". However, this is most of the times not the case. Rotterdam for example is a *gateway* port, with a heavy dependency on the port, which employs maritime activities mostly in the heavy industry sector. Most of the Drechtcities will be labeled as urban ports. Cities and their ports can shift from position in the matrix, by attracting additional activities or the development of a service economy (Murphey, 1989). However, a shift in the matrix is not always that clear in practice. Local and regional factors could influence the port-city relation causing the port-city evolution to be rather gradual, especially when long-term policies from local authorities are in place. The authors further argue that once one function has become dominant, it becomes hard to shift to another port-city relation (Ducruet & Lee, 2006). This is a challenge for policy makers who attempt to find a balanced relationship between port and city.

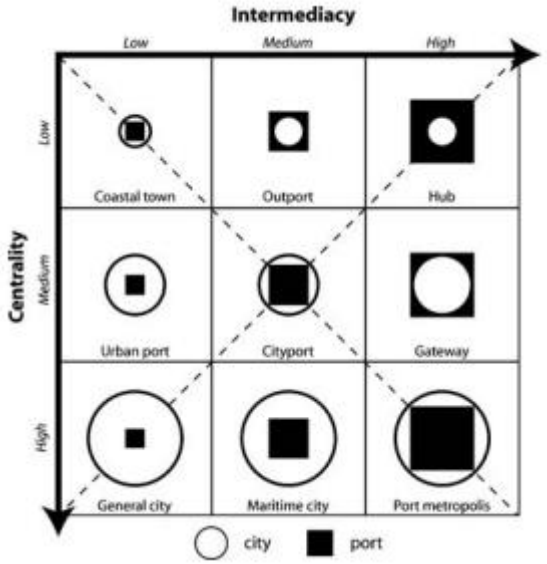



*Figure 3: matrix of port-city relations, Source:( Ducruet & Lee, 2005)*

### 2.1.3 Tensions in the port-city interface

Nowadays, ports are operating as global players in an international supply chain, with a diminishing dependency on local actors. Cities on the other hand started to re-use waterfronts for non-maritime activities to accommodate for the pressure from the urbanization (Hesse, 2018). The port-city interface can now be considered as a 'complex, multi-dimensional entity that consists of layers such as territory, economy, environment or institutions, rather than a single site between port and city' (Merk, 2014). Next to that, the port-city interface is under pressure, because the port and the city do not share common goals anymore due to its geographical and functional separation. This is to lesser extent the case for the Drechtcities, because the port areas are still located close to the cities. Negative impacts are felt in the city whereas the benefits spill over to other regions (Merk, 2013). These factors create tensions between the port and the city, upon which I will elaborate in this section.

Ports are drivers for national economies, gateways for international trade, create employment and generate value for a large hinterland. The larger the port, the more value is added to the local and national economy. On average, an increase of one tonne of throughput results in 100 USD of added value, direct and indirect for the local and national economy (Merk, 2013). Ports also attract certain industries, such as refineries, production and warehouses but also knowledge intensive industries such as brokers. However, these knowledge intensive jobs are more present near airport hubs, attracting high-skilled employees (Button and Lall, 1999). The attraction of industries to a port could result in industry clusters, which could be beneficial for the region and its citizens. This clustering results in employment growth, with a positive correlation between port size and employment (Merk,2013).

However, these positive factors of ports to its adjacent city have a downside as well and are thoroughly analyzed in a report of the Organization for Economic Co-operation and Development (OECD) by Merk (2013). At first, major developments in the port industry have made the way a port operates completely different. Examples of these developments are containerization, automation and economies of scale. The port operates nowadays more capital intensive than labor intensive. An example is the APM terminal on the Maasvlakte II in Rotterdam, a remote-controlled terminal where the loading and unloading process is fully automated (APM, 2021). Next to that, there are nowadays only a few global companies that dominate port activities, through mergers in the past. These factors result in a sector with a high degree of standardization and a sector where competitive advantages can only be obtained by economies of scale (Hall and Jacobs, 2010). The shift from a labor intensive to a capital-intensive industry requires less workers at the site. Due to the concentration of power in the ports, the benefits of the increased productivity could be reaped by a small number of actors.

The higher productivity of ports creates significant negative impacts for its surroundings as well. I will highlight a few negative impacts that are stipulated by Merk (2013) and relevant for my research. The first obvious negative impact of a port nearby is the environmental impact it has on the region. Ocean going vessels emit a lot of polluting gases that are felt locally, such as nitrogen and Sulphur. A vessel emits these two components respectively two and 150-300 times more per tonne kilometer than a truck (Miola et al, 2009). Another negative impact is noise pollution. Port operations are noisy, and the nearby industry is mostly heavy industry as well, creating noise impact. This becomes especially relevant in the port-city relation when cities attempt to mix the city into the port to create more urban spaces, as is planned in Amsterdam in the Haven-stad project. The economies of scale furthermore have an impact on the land use, as port operations are very land intensive. The main concern in this aspect is whether the land could not have been used for other purposes with a higher economic value: the opportunity costs of land. Another negative impact is the traffic density between ports, which causes congestion in cities. This congestion is especially felt in cities in emerging countries, as these cities do not have the appropriate infrastructure.

Globalization of the supply chain puts the port-city relation under pressure. The benefits of the ports are not concentrated in the city whereas the negative impact of the port is mostly felt in that city close to a port. There is a leakage of the economic added value to other parts of the country, or to other parts in the continent (as is the case for Rotterdam). Digitalization leads to the deconcentrating of port-related employment, financial maritime services can be done in Amsterdam just as easy as in the Drechtcities. This mismatch is recognized by policymakers and cities and port authorities strive to find a balance between the port and the city.

### 2.1.4 Crossover effects in the port and the city

The fact that port and cities got geographically separated more and more from each other, does not mean that the port-city interface lost its importance. This importance is however many times neglected by policy makers, the port and the city are regarded as separate spatial entities (Van den Berghe, 2018). In this section, I will highlight the crossover effects in networks in the port-city using the relational approach.

A perspective to analyze the relationship of the port-city is via the relational approach. This is a theory that acknowledges the influence of regions and the fact that these regions are not geographically bounded but that these regions are social constructs (Van den Berghe & Daamen, 2020). The port and the city exist as a structuralized effect, that defines and influences its environment. This means that a company will open a terminal in the port sooner than in the city center because that location offers better accessibility and environmental regulations are less stringent. This structuralized effect is not absolute. This means that when no maritime companies will reside in port areas anymore, the port area will no longer function as port. When problems between ports and cities are occurring in spatial planning, the relational approach to the port-city interface offers the possibility to assess the port-city region as one network instead of two separate networks. A separate view would create biases between the two actors port and city.

Van den Berghe and Daamen (2020) define three aspects of networks: its boundaries, structure and pluralistic nature. Boundaries of networks can be defined according to relational or spatial characteristics. The relation boundary means that a network is defined using a definition or sector: this can be the maritime sector. The spatial boundary is clearly the geographical boundary of a network. The structure of a network is also an important aspect. This can tell us what the dependency of a network is on a few major actors within that network. The third aspect defined by the authors is the pluralistic nature of the network. This entails a broad view, where multiple types of networks within one network are defined and described. I will use these three aspects to define the maritime cluster in the Drechtcities in my analysis. The foundation of networks lies in maritime capital (Jansen, 2019). Maritime capital can be divided into other sources of capital, such as human capital, social capital and the capital of companies. All these sources of capital define the ecosystem in which actors of port cities operate.

The port-city interface can be seen as an interactive economic system, where local and regional clusters can support the economy of the port and the city (Van den Berghe, 2019). It is therefore important to regard the port and the cities as a whole and not solely separately. The relational approach entails that ports and cities define each other's position and that this position is not absolute. Policy makers should have a clear view of the networks of port-cities to determine its policy and different capital sources define the network in which actors are operating. A well-known policy to enhance the position of the city in the port-city interface, is waterfront regeneration.

## 2.2 Waterfront regeneration in the port-city interface

One way to cope with the trend of a growing separation between the port and city, is to regenerate the old waterfronts. Waterfront regeneration could even enhance crossover effects between the port and city and thus improve the port-city interface (Merk, 2013). Waterfront regeneration has a narrower focus than the port-city interface, as waterfront regeneration is only considering the part of the city close to the water. In this part, I will first describe waterfront regeneration in general and give some examples. Thereafter, I will describe the use of maritime clusters as waterfront regeneration, which is relevant for my research area. I will also highlight some problems with waterfront regeneration and especially regarding the existing literature.

### 2.2.1 Waterfront regeneration over the years

Hoyle (1989) describes waterfront redevelopment as 'an outcome of the interaction of factors operating on the port-city interface, itself an expression of wider land-maritime interrelationships.' Waterfront regeneration is an urban development that emerged in the 1960s in the United States, whereas it is nowadays a worldwide phenomenon due to the shipping trends and the new needs that accompanied these trends (Butuner, 2006). Waterfront regeneration can improve the image of the port-city and improve the port-city interface. The image of port-cities was usually that of an industrialized, polluted city where low-skilled laborers resided close to their working places. Waterfront regeneration plays an important role for a port-city to create new opportunities for the port-city, jobs in other non-industrial sectors can be realized. An example is Baltimore, where 15000 jobs were realized in the tourism sector as a result of waterfront regeneration (Millspaugh, 2001). The regeneration in Baltimore was mainly focused on tourism, but the redeveloped area can serve more functions, it can be redeveloped in a residential, retail, innovative, commercial or recreational area. The most recent redeveloped waterfront areas have a mixed land use where some of the functions are combined. Most of these redeveloped areas do not have a focus on maritime related activities (Merk, 2013).

From previous examples of waterfront regeneration, it can be derived that the most successful waterfront projects have a diversification of land use functions, including port related activities (Merk, 2013). A challenge that arises when land is redeveloped, is how the project can become profitable. Residential functions are usually preferred by private investors because of the good financial outlook. On the contrary, low-level commercial areas for innovative companies or parks could lead to a deficit during the project when only private interests are participating in the projects (Brown, 2009). Therefore, public funding is usually a part of the project when a mixed land use of the regenerated area is proposed.

Waterfront regeneration projects usually begin with a master plan, which guides the process and where different actors are involved in (Millspaugh, 2001). One of these actors can be the local port authority. The port authority can have substantial interests in the regeneration, especially when some port activities remain in the area (Charlier, 2009). Regeneration of waterfront areas can lead to synergies between port functions and the city, a beneficial situation for both port and city. The most familiar synergy between port and city is the cruise industry. Cruise terminals are established in a regenerated area, an example is the cruise terminal in Rotterdam at the Kop van Zuid, and as a result the tourism sector and consumption in the city is getting a boost (CTUR,2007). This synergy can also be obtained by strengthening the maritime service cluster that support port activities.

### 2.2.2 Maritime clusters as waterfront regeneration

Maritime clusters could play an important role in waterfront redevelopment by stimulating innovation and attracting businesses to settle in the regenerated area (Asheim et al., 2006). Porter (2003) defines a cluster as "an array of linked industries and other entities important for competition". Four factors determine the clusters: (i) the presence of clients, (ii) specialized suppliers, (iii) industrial interdependence and (iv) certain competition between the firms. A cluster can create collaborations, which leads to knowledge spillovers and other positive externalities, such as the presence of qualified labor (Koschatzky, et al. 2001). Furthermore, a cluster is geographically bound, and the public sector is somehow involved in the innovation strategy of the cluster. Policy makers initiate actions in three areas in which they try to enhance clusters, (i) initiatives regarding the firms (e.g. tax cuts), (ii) initiatives regarding interactions (e.g. cooperation university and local companies) and (iii) initiatives regarding technology hubs (Doloreux & Shearmur, 2009).

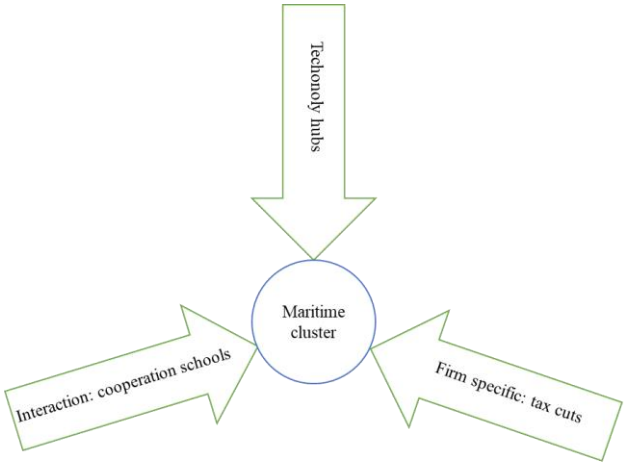



*Figure 4: policy tools to enhance maritime cluster (own display)*

The collective dimension of clusters is beneficial for its users, due to the influence of the cultural, economic and institutional environment on the cluster (Asheim et al., 2006). Doloreux and Shearmur (2009) define best practices to create successful maritime clusters in Canada. These best practices are applicable in Europe and The Netherlands as well. The first best practice is that policies must rely on existing economic specialization and on already existing infrastructure and institutions. A second-best practice is the need of geographic concentration of the area, to create interaction and dynamics.

### 2.2.3 Problems with waterfront regeneration

One of the main concerns regarding waterfront regeneration is how synergies can be obtained. Doloreux and Shearmur (2009) define this problem for Canada as well: there was not much sign of spontaneous innovation or networking between firms before policies were implemented, which led to policy objectives that could not be fulfilled. Enhancing waterfront redevelopment by stimulating maritime clusters is thus only viable in locations with an existing concentrated maritime industry and near an urban area. Synergies do not come alone. Merk and Dang (2013) assessed the effectiveness of policies regarding waterfront regeneration as well. They found that transportation and R&D policies are the most effective and policies aimed at creating port-city synergies are the least effective. The reason for this is that added value for a city comes mostly from port activities and not from specific port-city policies.

Another major issue that can be deduced from the literature is that local inhabitants do not benefit from the regenerated area: this area has a target audience coming from elsewhere. Regeneration projects in urban areas could lead to conflicting visions between local citizens and policy makers that want to create a marketable story. A successful urban development plan should fit into the identity of the place, rather than being forced upon it (Miles, 2005). This is not always the case, as Doucet (2010) describes regarding Rotterdam flagship regeneration projects, with the regeneration of the *Kop van Zuid* as most common project. Doucet describes that the overall benefit of flagship developments is more limited than is usually claimed by the municipality and its investors. It is many times uncertain how the regenerated area is used and who is the ultimate end-user. The projects are beneficial for a relatively small group. The author suggests that this is because projects are conducted via a neoliberal approach: each vacant piece of land should be put to its maximum economic use. Next to that, most projects are focused on profit, image and investment and not on social gains for example.

This "neoliberal" approach is relatively new and is seen by more authors as a significant problem for the inhabitants of the regenerated area. It could lead to the loss of waterfront character, removal of traditional working areas and living places and problems with land use mix because of standardization of development schemes for profit maximization (Jones, 1998). More important: it does not solve the underlying deep-rooted urban problems in the area. An example is Gunwharf Quays in Portsmouth, with the building of the Millennium Tower as flagship project. The only new jobs where low-paid jobs, whereas the region suffered from poverty, insufficient housing, long waiting list for houses and low educational levels (Cook, 2004). Another downside of the "neoliberal" approach is the dependency on private parties for the development of the area (Loftman & Nevin, 1996). Private parties do not have a focus on the distribution of the newly created wealth in favor of the residents, a pro-active government is needed.

Improving the maritime cluster by waterfront regeneration cluster could lead to some problems that are recognized in the literature. At first, creating successful synergies is hard to obtain. Second, the local citizens do not always benefit from the new area, this could be the case when not a lot of new jobs are created. Third, the privatization of projects leads to profit maximization and not to distribution of welfare. Monotonized sites with only profitable land use could be the result when the government does not actively play a role in the development of the regenerated site. Next to these problems that are recognized in the literature, I would also add that most waterfront regeneration projects focus on the city and not on the city and the port. Maritime clusters can be a booster for the port and the city, under the right circumstances. Maritime clusters are geographically bound and should be fit in an already existing infrastructure to attract businesses. Policy makers have some tools to strengthen the maritime cluster and I will analyze in the next sections whether these tools are used by policy makers in the Drechtcities. Regeneration of waterfronts by enhancing the maritime cluster looks at first as a viable option for this region, there is an existing maritime industry, and the industry is relatively concentrated. Policy makers should be aware that the maritime industry adds significant economic value to the region. Therefore, a classical regeneration focused on city development rather than port development might result in a worsened port-city relationship.

### 2.2.4 The challenge of waterfront regeneration for the port-city interface

Waterfront regeneration is seen as a good way to enhance the urban environment for cities. In the previous section, I highlighted some problems regarding waterfront regeneration mainly focused on cities. The effect of waterfront regeneration for urban environments has been the focus of policy makers and of most of the literature. This urban perspective is criticized by some authors, because it could endanger the port-city interface in the long term (Van den Berghe, 2019). Waterfront regeneration is a policy tool that could endanger the port-city interface, based on two arguments.

First, the urban perspective ignores the interactions that take place within the maritime cluster of a port-city. As I described in section 2.1.4 Crossover effects in the port and the city), the relational approach entails that the port-city interface should be seen as an interactive economic system. There is no social and an economical port-city interface, the perspective should be holistic (Van den Berghe, 2019). Waterfront regeneration from an urban perspective ignores the existence of clusters in the region that support the maritime activities. An example is the service sector for commodity chains, that is strongly present in the port-cities Rotterdam and Hamburg (Jacobs, Ducruet & De Langen, 2010). When these network effects are not taken into account during waterfront regeneration, it could deteriorate the port-city interface on the long term.

Second, the regeneration of quays and other port sites into urban areas is permanent. This has the following implications. First, regeneration does not entail that port services are disappearing, these services usually take place in a site closer to the sea. This means that the port is regionalized, and the scope of the port-city interface is rescaled, as the goods will continue to flow through the same port (Notteboom & Rodrigue, 2005). Second, the innovative power of the maritime cluster in the port-city interface could be under pressure due to the lack of space at the waterfront when the focus is solely on urban development. Third, sustainability developments could change the way old port sites are used. The circular economy could increase the demand for quay use for materials, such as old iron, waste and building materials.

Van den Berghe (2019) further suggests that there is a lack of understanding within the literature of how both urban and port development could be driven by effective policy interventions and planning. This lack of understanding makes it uncertain what the economic strength is of linkages between ports and how port-cities are affected during port-city planning and waterfront regeneration (Ducruet, 2011). The urban perspective could endanger the port-city interface: it ignores maritime clusters and the regeneration could lead to misuse of waterfronts.

## 2.3 The port-city interface in the Rijnmond region

In a port-city interface there are multiple actors, such as the municipality, the port authority and maritime companies, that each play a different role and have different needs. The announcement of the proposed larger role of the port of Rotterdam in the port of Dordrecht initially led to high expectations: a doubling of economic activity and hundreds of extra jobs would be created (Vleugel, 2011). The port of Rotterdam is responsible for the development of the port area since 2013 and the port authorities claim that the public areas have been revitalized, the number of businesses has been increased and investments have been made to the port area (Port of Rotterdam, 2021). In a further extent, I will analyze whether these claims hold. The significant influence of the port of Rotterdam in the region makes it relevant to briefly describe the port of Rotterdam.

The port of Rotterdam nowadays is a semi-public organization, held by the municipality of Rotterdam and the Dutch government and has the structure as depicted below. This structure entails that important decisions made by the port are backed by the municipality and the state, which has a significant influence on the port-city relationship in the Rijnmond region. The structure of the port of Rotterdam is called the landlord model. The business model of a landlord port is simple: income is generated by leasing land owned by the port and by charging fees for incoming ships (Verhoeven, 2010). An effect of this could be that the port only focusses on these sources of income and neglects its surroundings.

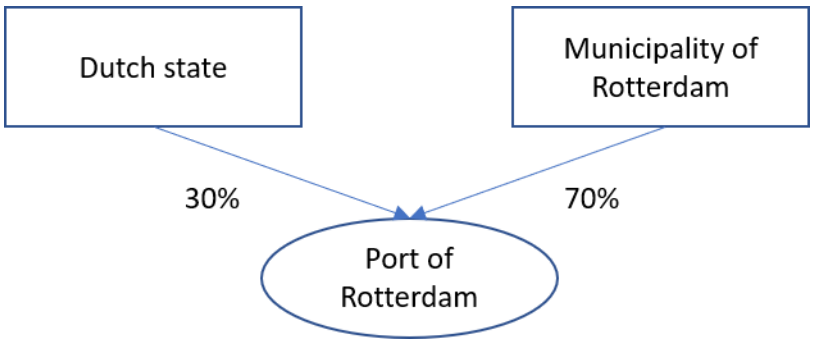



*Figure 5: Structure of the port of Rotterdam*

### 2.3.1 The Port of Rotterdam: moving towards the sea

The growth of the port of Rotterdam commenced in 1872, with the opening of the *Nieuwe Waterweg* (Aarts et al, 2012). This ensured an entrance to the North Sea without locks, which gave a competitive advantage compared to the port of Amsterdam. At the beginning, the port was situated near the city center, but the port steadily moved towards the west. The evolution of the port is very similar to the model of different port-city interfaces by Hoyle (2000) as depicted in figure 2. The move westwards already commenced before the second world war with the realization of the Waalhaven and Eemhaven, but this took a huge leap after the second world war. The Netherlands had to be rebuilt and the port of Rotterdam functioned as a backbone of the reconstruction. New sites as the Botlek and Europoort also had a major industrial component, the largest chemical complexes in Europe were built at these sites. The move westwards has just been completed with the realization of the Maasvlakte II in regenerated land from the North Sea. Started in the city of Rotterdam, the largest container vessels berth nowadays on land that was a vast sea in the past.

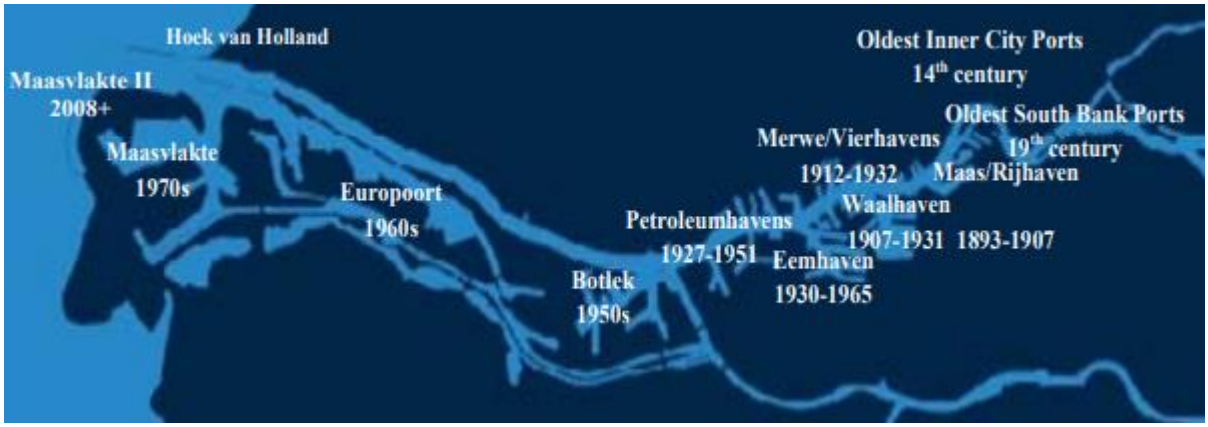



*Figure 6: The port of Rotterdam is moving westwards outside the city (Aarts et al, 2012)*

Worldwide trends forced the port outside the city and westwards to the North Sea. This had and still has an enormous impact on the port-city relationship. The geographical separation of the port and city and technological developments caused high unemployment rates in the city of Rotterdam, whereas old sites were left abandoned and unused (Aarts et al, 2012). Nowadays, a worker who lives in the city of Rotterdam and works at the Maasvlakte, has to travel around 50 kilometers to get to his job. Not surprisingly, most of the workers at the port of Rotterdam are residing in villages to the west of the city and not in the city itself. The port-city relation in Rotterdam is exemplary for other port-city relations as it is almost a blueprint of the theoretical model of Hoyle (2000).

### 2.3.2 The port of Dordrecht: inland seaport

The shipping manufacturing industry and Dordrecht have been closely related since hundreds of years. Next to its flourishing manufacturing industry, the port also grew significant after the second world war due to its good connectivity. The geographical location of the port of Dordrecht gave the port a competitive advantage for inland water transport to Germany. The seaport of Dordrecht is the only port area in the region that accommodates sea-going vessels and traditional port-activities as transshipment and storage of bulk and liquid goods. This good connectivity was not left unattended, as the port of Rotterdam announced that it would exploit the port area of Dordrecht in 2011 (Port of Rotterdam, 2011). This year, the port of Rotterdam announced that the public areas in the port of Dordrecht would be exploited by the port of Rotterdam as well (Port of Rotterdam, 2021a) Nowadays, the port prides itself with the proximity of the city of Dordrecht, causing the maritime manufacturing industry to profit from the port and citizens to work at the port (Port of Rotterdam, 2021b). The port explicitly mentions improving of the climate for maritime services and industries as an objective. The port-city relation between the port of Dordrecht and the municipality is different than the relationship in Rotterdam. Due to its proximity, citizens are able to travel shortly to their work, in contrary of the majority of the workers coming from the city of Rotterdam. Besides that, Dordrecht already had a shipping manufacturing industry before the economic surge of the last centuries. This could mean that the port-city relationship is strong, due to the historical connection between the port and the city. An adjacent port could also create dynamic lock-in effects for the region (Hall & Jacobs, 2012). This is an interaction effect whereby a cluster creates dynamic advantages for the port and the city, but this interaction effect is also sometimes neglected by policy makers during urban planning.


*Figure 7: The current port area of the port of Dordrecht (Verhage, 2011)*

### 2.3.3 Maritime manufacturing industry in the Drechtcities

The port of Dordrecht has a longstanding tradition of ship building, but the question remains to what extent that industry is still viable nowadays. A quick look at this industry is important to assess whether policy makers should focus on the improvement of the maritime cluster in this region to improve the port-city connection. The maritime manufacturing cluster, with companies as IHC and Damen active in the Rijnmond region, created an economic added value of 2 billion euro's in the whole Rijnmond region in 2017, which was an increase of 900 million compared to 2002 (Kuipers, 2018). It is safe to say that the maritime manufacturing cluster still plays a vital role in the Rijnmond region, uncertain is however how this economic added value is localized in the Drechtcities. The ship manufacturing industry is a labor-intensive sector (Nijdam, 2010). Companies active in this sector thus employ a lot of workers compared to the capital-intensive classic port functions such as transshipment and storage. This is an advantage for the region, but the region can also be hit hard when a ship manufacturing company has to close.

The maritime industry of the Drechtcities has four main sectors; (i) maritime technology, (ii) ports and logistics, (iii) inland shipping and (iv) ship manufacturing (Kuipers, van der Lugt & Nijdam, 2009). In the study of Kuipers, Van der Lugt & Nijdam (2009), strengths and weaknesses of the region and its maritime cluster were defined, I depicted the most important strengths and weaknesses in the figure below.

**Strengths**

- Agglomeration advantages
- Presence of high-tech leader companies
- Knowledge based maritime cluster

**Weaknesses**

- Only a few key companies
- Limited physical growth opportunities
- Lack of skilled personnel

*Figure 8: Strengths and weaknesses of the Drecht region (own display based on Kuipers, van der Lugt & Nijdam, 2009)*

### 2.3.5 Leader firms in the Drechtcities

A high dependency on a few companies could create vulnerability for the region when one of those companies decides to abandon the region. Next to that, firms could be locked into existing industry activities and lose their capacity to innovate, which could create a regional economic downturn (Hall & Jacobs, 2012). On the other hand, the effect of leader firms on its surroundings could be beneficial as well. A leader firm is a "*leading company that add positive effects to the cluster by doing business in such a way that also the local business community benefits from their presence*" (Nijdam, 2010). Using the study from Nijdam (2010), I define 3 main effects. At first, a leader firm as lead user coordinates production networks: it stimulates the whole production chain. Its prominent position in the market motivates the whole production network to keep innovating, as their demand is sophisticated. Langerak, Kuipers & Manshanden (2017) recognize this effect for the maritime cluster in South-Holland as well, mainly in the area of product innovation. Secondly, the leader firms enhance clustering. Through transfers of knowledge via networks and by combining different technologies from different suppliers, leader firms enhance the clustering in a region. Thirdly, its leading role is beneficial for the local labor market. The reputation of leader firms can attract skilled workers towards the region and the whole production chain requires labor of course.

The study from Nijdam depicts several leader firms in the Drechtcities as well. I will describe their main characteristics briefly. These companies are selected based on size, market position, knowledge, entrepreneurial skills, location and behavior. This study was conducted more than ten years ago, so my quantitative analysis will analyze whether these companies still function as leader firms in the Drechtcities. The first company is IHC. This ship manufacturing company is the lead user in the production network and explicitly strives to improve the transfer of knowledge with its suppliers. Through participation in educational programs, IHC strives to improve the labor market. IHC still exists in the Drechtcities nowadays, but a large refinancing and restructuring operation was needed in 2020 to keep the ship manufacturer alive (FD, 2020). This tells us that even leader firms could face heavy weather, and this could potentially harm the maritime cluster. On the other hand, the rescue operation was probably occurring because IHC was a leader firm: it made itself essential for the region. The second leader firm in the Drechtcities is Boskalis. This offshore company is located in Papendrecht and is also a customer of ship manufacturer IHC for specific types of vessels. This is an example of clustering of leader firms.

When looking at the port-city interface in the Drechtcities from a qualitative perspective, a clear and strong relationship exists between the local citizens and the maritime cluster. Due to its proximity and the presence of leader firms, the maritime cluster is strongly connected to the adjacent villages and the existence of a leader firm has several advantages for the regional economy. Leader firms in the Drechtcities enhance the innovation climate in the region, whereas the smaller companies are rather conservative (Langerak, Kuipers & Manshanden, 2017). However, overdependence on a company could make the region vulnerable for economic shocks. Globalization of supply chains resulted in the move of labor-intensive labor towards the far east. It is uncertain whether the remaining ship manufacturing companies will continue the labor-intensive work from a high-wage country as the Netherlands. The question remains to what extent policy makers intent to improve the weaknesses in the region.

## 2.4 Policy interventions in the Drechtcities

During the past years, several policy documents, visions, strategies and initiatives have been initiated that concern the Drechtcities. One of the most important policy interventions over the last years is the Dutch Maritime Strategy, that defines the maritime strategy in the Netherlands for the years 2015-2025. The goal of the Dutch Maritime Strategy is: "*An international and sustainable maritime position for the Netherlands, achieved by an integral cooperation between the national government and the maritime cluster on a basis of a shared maritime strategy*". To strengthen the maritime cluster, policy areas are defined that are relevant to the maritime cluster. These policy areas are human capital, innovation, trade, accessibility, safety and environment and security and stability. I will focus on the policy areas human capital, innovation, trade and accessibility, because these policy areas are the most relevant to assess my research question. The Dutch Maritime Strategy will serve as a road map for the analysis of the other more regional policy interventions. I will describe each policy intervention and will assess whether the four policy areas are touched upon in the regional policy intervention. This will give an overview of the focus of the policy interventions in the Drechtcities. I am aware that some policy interventions took place before the Dutch Maritime Strategy, but this won't affect my results as the policy areas are rather general than specific.

At first, I will describe the four policy areas upon which I will focus. Thereafter, I will describe each policy intervention briefly and analyze which policy areas are affected by the policy interventions. The timeline below depicts the policy interventions that I will elaborate upon. The lower side of the timeline depicts specific policy interventions regarding the Drechtcities, the upper side includes policy interventions with a broader scope.

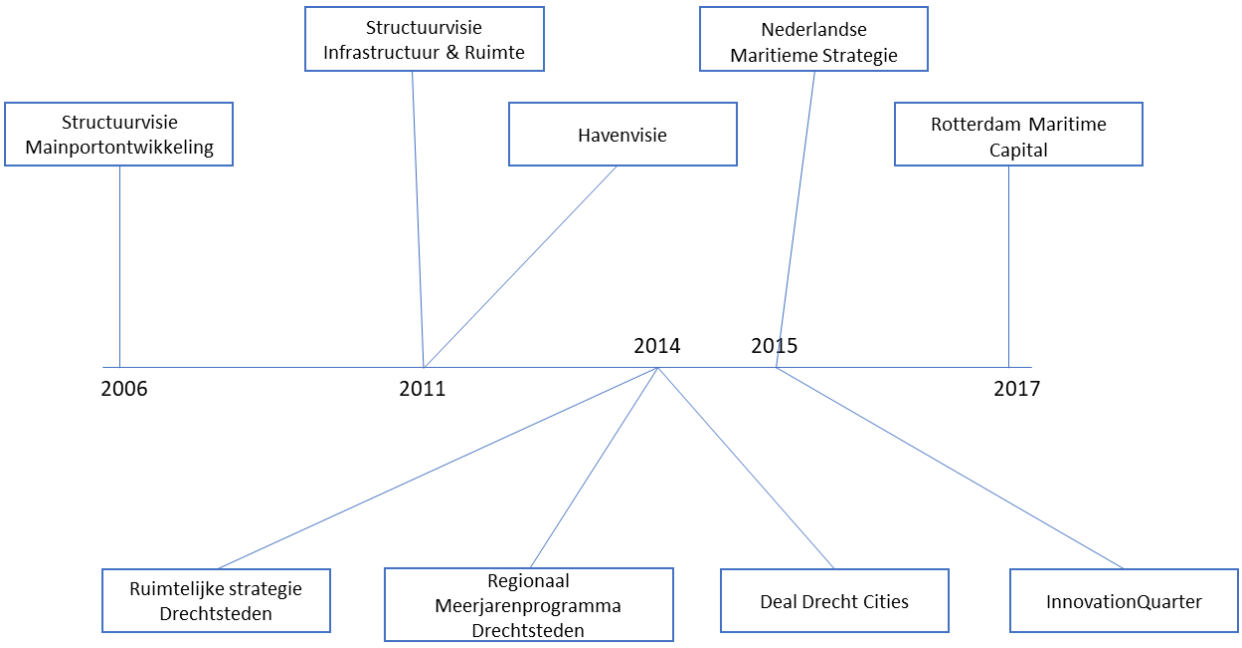



*Figure 9: Timeline of policy interventions affecting the Drechtcities*

### 2.4.1 Policy areas from the Dutch Maritime Strategy

The four policy areas defined in the Dutch Maritime Strategy will serve as four pillars to analyze the other policy documents. In this part I will briefly touch upon each policy area and describe the main characteristics that define each policy area.

The first pillar is human capital. The maritime cluster is operating in an international context, especially for shipping businesses. Due to the lack of available Dutch skilled personnel, the share of foreign workers in the maritime cluster increased over the years. The main goal of the human capital policy area is to find a balance between national and international employees: no overdependence on foreign workers should occur. To achieve this, competent and motivated Dutch personnel must be available, and the current personnel should be retained in the maritime cluster. To increase the pool of skilled personnel, the connection between educational institutions and the maritime cluster should be improved. Increasing labor mobility within the maritime cluster should enhance the human capital pillar as well. The economic added value per company and employee can also be regarded as a factor of the human capital pillar.

The second pillar is innovation. The Dutch maritime sector cannot compete with developing countries in terms of employment costs. The innovative power of the sector is regarded as one of the strengths of the cluster and is essential to compensate for the higher labor costs. The coming years, environmental and social innovations will be increasingly important in the sector. To enable innovation in the maritime cluster, an innovation contract between the industry, knowledge institutions and authorities has been signed to jointly program and fund research. Other examples of innovation stimulations are the fact that the Royal Netherlands Navy is offering opportunities for tests for innovations and tenders of small entrepreneurs are favored. Innovation should be stimulated by goal-based regulation, removing redundant regulations and by more experimentations.

The third pillar is trade. It is obvious that the maritime cluster is internationally oriented, and the Dutch ports are very well connected with the international hinterland. To maintain this position, a level playing field and a supporting instrumentation for export is required. On a national level, the government strives to unitarize maritime regulations via the European Union and other international bodies to improve the level playing field. An example is the carbon emission reduction, where a level playing field is actively pursued by the Dutch government (Rijksoverheid, 2021). Governmental actions should focus on the export, as this is the main factor of the maritime cluster, also in the Drechtcities. On a regional level, more cooperation between sectors enhance trade and thus improves the maritime cluster

The fourth and last pillar is accessibility. To decrease congestion in industrial clusters, maritime transport should be included in the logistics chain. A way to do this is to allocate waterfront areas to businesses that make us of the water, to better utilize the waterfront. The government strives to expand and enhance these waterways, to improve the connectivity. Technological solutions regarding transportation will be stimulated by the government to enhance the connectivity in the maritime cluster.

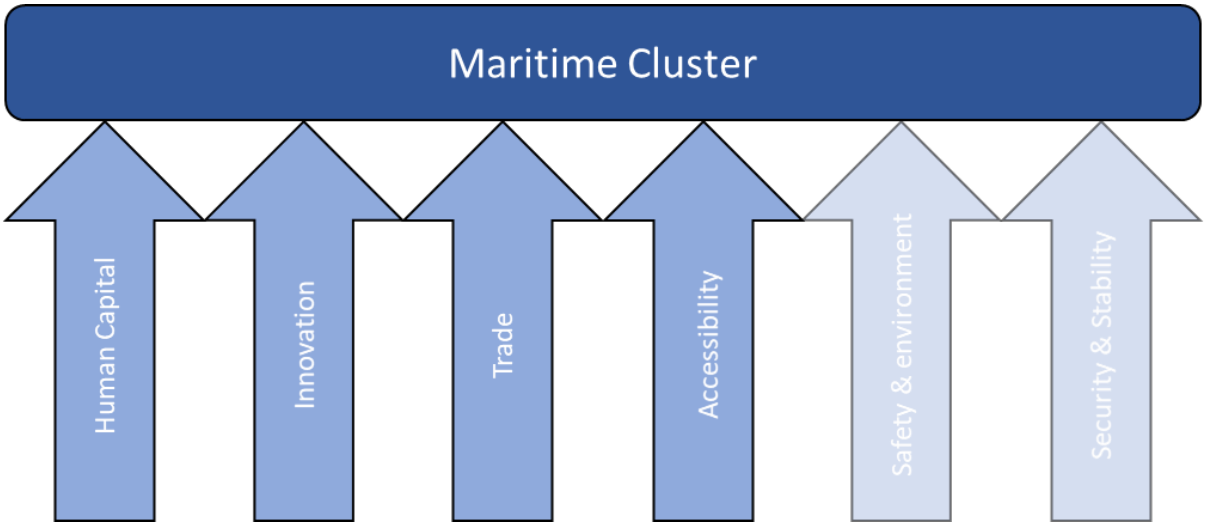



*Figure 10: The four highlighted pillars of the Dutch Maritime Strategy*

### 2.4.2 Policy interventions briefly described

The Dutch government took a clear stance in its policy document "Structuurvisie Infrastructuur en ruimte" from 2011. The national government will not take a leading role in local matters, provinces and municipalities should take this leading role. Instead, the government should focus on the international position of the Netherlands. This passive role of the government in infrastructural projects fits the trend of decentralization, a trend that already commenced in the eighties by privatizations (Van Straalen, van den Brink & Van Tatenhove, 2015). This decentralization did not mean that the national government refrained from any action in spatial planning, as we have seen in the Dutch Maritime Strategy. However, I did mean that local governments had to take a leading role regarding spatial planning. In this section, I will analyze the most important policy interventions as depicted on the timeline. The table on the next page gives an overview of each policy intervention, its stakeholders, ambitions and which pillars from the Dutch Maritime Strategy are used to strengthen the maritime cluster. This table tells us that human capital is the most common pillar in the policy interventions and innovation is the second most used pillar. The focus on human capital is not odd, as the lack of skilled personnel was also one of the observed weaknesses of the region. The policy interventions are described in short thereafter.

| | Stakeholders | Objective | Through which pillars maritime clustering? |
|---|---|---|---|
| **Project Mainportontwikkeling** | National government | To improve life conditions in the Rijnmond region and enhance the strategic position of Rotterdam |   |
| **Havenvisie** | The Port of Rotterdam, national government, province of South-Holland, municipality of Rotterdam and companies in the port region. | To create a global hub and to become Europe's industrial cluster. |    |
| **Rotterdam Maritime Capital** | Municipalities and maritime companies in the port of Rotterdam region. | To stimulate the industrial region and to improve the maritime cluster |    |
| **Ruimtelijke strategie Drechtsteden** | Drechtsteden municipality | To enhance the robustness of the maritime cluster. |   |
| **Regionaal Meerjarenprogramma** | Drechtsteden municipality | To enhance the regional economy by strengthening the maritime sector |  |
| **Deal Drecht Cities** | a.o. Municipalities in the region and port of Rotterdam | Promotion of Drechtcities and stimulation of the business climate |    |
| **Innovation Quarter** | Multiple governmental bodies and municipalities in South-Holland. | To create an attractive business climate for new companies |   |

 Human capital  Innovation  Trade  Accessibility

*Table 1: Overview of the policy interventions and the pillars of maritime clustering*

*Structuurvisie Project mainportontwikkeling Rotterdam*

One document that deepens the broad country level policy regarding infrastructure and public spaces is the older policy document regarding mainport development in Rotterdam (2006). To strengthen the position of Rotterdam as mainport and to improve the quality of life in the region, three objectives were defined: (i) the realization of the Maasvlakte II, (ii) development of recreational areas and (iii) the improvement and redevelopment of current port areas; the most important objective for my research. Especially in the Dordrecht region, optimization of port areas should occur by stimulating the maritime industrial cluster and by improving employment opportunities in the region. Better land use of current port sites is a recurring theme in this document. By incentivizing the current sites, companies should be attracted to the waterfront, what in turn results in more employment for the region. I regard this document as a stimulation for the maritime cluster, as it explicitly mentions the Dordrecht region and the need to improve the current sites.

*Havenvisie*

The "Havenvisie" (port vision) is a document where the ambition of the region for the year 2030 regarding the port is depicted (2011). The renewed document in 2019 is an update of the initial Havenvisie from 2011. To fulfill the visions, three objectives are depicted. At first, the port wants to attract private investments from companies, up to 35 billion euros. Secondly, companies active in containers, liquids and energy sources should be supported by concentrating these companies in existing port areas, including the Dordrecht port region. Thirdly, the city should facilitate the port to become one industrial cluster. To do so, maritime companies should be attracted, and the innovation climate should be enhanced in the region. Smaller companies (companies with less than 250 employees) play a vital role in this ambition, according to the report. Next to that, the innovation ecosystem should be improved. An example is PortXL; a worldwide program to improve maritime innovation.

*Rotterdam Maritime Capital*

This initiative from the municipality and the port of Rotterdam brands the whole region, from Hoek van Holland to Gorinchem, as *Rotterdam maritime capital* (2017). The region wants to reap the benefits coming from a maritime cluster and takes therefore initiatives to enhance this cluster. The innovative power of the port and the maritime history of the region are seen as strengths to create a robust maritime cluster. This initiative can be seen as a platform and is mainly focused on increasing the visibility for all actors in the Rotterdam maritime capital region and on framing the whole region as one. This platform focuses on new trends, such as digitalization and decarbonization, and how companies could cope with these trends. It is obvious that the municipality of Rotterdam sees the maritime clustering as a strength to improve the performance of the city. Regeneration via maritime clustering, a policy that has not been actively pursued by many cities but that has the potential to be successful. This could also be the case for the Rijnmond region, as this region has high unemployment levels and a strong focus on port related activities.

*Ruimtelijke strategie Drechtsteden*

This document has a very regional focus and is therefore very useful in determining the policy interventions for the region (2014). This document is composed by the municipality of the Drechtcities and gives a broad overview of the region's ambitions from different perspectives. One interesting perspective is the awareness of the municipality that the dependency on one industry sector makes the region vulnerable for economic shocks. During the Euro crisis, the regional economy shrunk more than the Dutch average, a reason for concern. The need for diversification of company activities is addressed, but this is not further elaborated upon.

To improve the robustness of the maritime cluster, the same policy tools are used as in other documents; cooperation with educational institutes and enhancing clustering in the region. It is not clear how these objectives should be met; this is described in the next document.

*Regionaal Meerjarenprogramma Drechtsteden 2014-2018*

This program can be seen as a detailed extension of the *Ruimtelijke Strategie Drechtsteden*. To achieve this goal, the following policy measures are taken. At first, new companies should be supported, in finding a good location and through finance options. Second, lobby schemes should be set up to attract governmental subsidies. Third, current sites at the waterfront should be restructured and redeveloped, but with the notion that market parties should take the lead in these redevelopment programs. Fourth, innovation and cooperation with educational institutions should improve. This is done by cooperating in the InnovationQuarte and via the Deal Drecht Cities. These policy objectives sound familiar and ambitious. The theoretical policy tools (through firm specific measures, interaction or technology hubs) to create a maritime cluster are all used. However, the high dependency on one industry sector is not specifically addressed here, which could lead to a very specialized and vulnerable local economy.

*Deal Drecht Cities*

This foundation is merely a result of the previous policy documents, it is about the realization of the goals that were mentioned in the previous documents. This foundation is founded in 2014 and is concerned about the acquisition and promotion of the Drechtcities. Its members are among others the municipalities in the region (including Gorinchem and Schiedam) and the port of Rotterdam. This foundation functions as an umbrella for more initiatives. These initiatives focus on regional development, the Rotterdam maritime capital, smart industry and economic development. An example of a smart industry initiative is the SME-catalysator fund, where subsidy is provided to SME's with innovative ideas in the manufacturing industry.

*InnovationQuarter*

The InnovationQuarter is founded in 2014 as development foundation for the province of South-Holland. The aim of this new foundation is to make South-Holland the 'innovative economic top region' (2015). This foundation is a collaboration of multiple actors; governmental institutions, and, more important, universities in the province as well. A better cooperation between knowledge institutes and companies is their main goal. To improve the innovation strength of the region, the foundation finances start-ups as well. Both action tools are known policy tools to enhance maritime clusters. Although the foundation does not have a specific focus on the maritime sector and the Drechtcities, this foundation could help the region in creating an attractive business climate for innovative maritime companies to settle. The policy tools could improve the performance of the maritime cluster.

### 2.4.3 Similarities in local policy and concrete initiatives

Most of the documents or initiatives have the same objectives. There is a strong willingness to improve the maritime cluster and to become a leader in innovation. As is depict in the table, all the policy interventions are focused on human capital and most of them on innovation as well. The focus of policy interventions in the region is less on the pillars trade and accessibility. This is not surprising, as these pillars are not the main problems of the Drechtcities region, and these pillars relate to "classic" port functions as storage and transshipment. These port functions are not the most significant port functions for the region. Initiatives as the Deal Drecht Cities and Rotterdam Maritime Capital serve as a one-stop-shop for new customers and policies. Policies are more and more regional than local, and the strength of each region is capitalized. Policy makers see the maritime cluster as a way to improve performance of ports and cities in the Rijnmond region.

The tools they use are in line with the theoretical model of Doloreux & Shearmur (2009), namely firm specific measures, via innovation and via cooperation with universities or other schools. There are two concrete examples of the focus on human capital in policy interventions that I will elaborate upon. The first one is the Dordrecht Academy. This is a cooperation between companies and universities and schools in the region to resolve the lack of skilled personnel in the region. Different educational programs, such as engineering and logistics, are offered at the Dordrecht Academy that aims to attract students to the region. This is an important example regarding the human capital pillar, because Dordrecht did not have an educational institution for a long time before the Dordrecht Academy (Dordrecht Academy, 2021). Another example is the Sustainability Factory (*Duurzaamheidsfabriek*). This initiative is also centered around the cooperation of educational institutions and companies. By schooling and reschooling in cooperation with companies, the competitive position of the Drechtcities should be strengthened (Duurzaamheidsfabriek, 2021). This also a clear example of an initiative that strengthens the human capital pillar, a pillar that is weak in the Drechtcities. Over the years, an abundance of policy initiatives was launched in the region that affect the Drechtcities and especially the waterfront. Policy interventions are time-consuming and could be costly, the question rises whether these actions are the right way to improve the local economy.

## 2.5 Conclusion of the literature review for the Drechtcities

Many times, ports and cities are viewed as two separate areas, this neglects the fact that interaction effects take place between the port and the city. Through the relational approach ports and cities are seen as one network. A network can be assessed through three aspects: its boundaries, its structure and its pluralistic nature. Assessing the port-city as one network could prevent a biased focus on the city, and it could prevent harnessing the interaction effects within a network. I could also lead to problems in the future, for example regarding upcoming needs for the circular economy.

The Drechtcities have a longstanding tradition in ship manufacturing. Over the years, the port-city interface in the Drechtcities and in Rotterdam changed. Worldwide trends such as containerization moved the port of Rotterdam away from the city and towards the sea. The port of the Drechtcities did not move significantly over the years, it is still nearby its cities. This creates other port-city interfaces for the two regions. Rotterdam had to cope with abandoned quays, from which a part is now regenerated into urban areas. Regeneration of the waterfront in the Drechtcities is different due to the proximity of the port areas to the urban areas. A regeneration through the maritime cluster is more in line with the local needs in the Drechtcities.

Policymakers in the Drechtcities are aware of the global trends as they try to enhance the maritime cluster in the Drechtcities as a way to regenerate the waterfront and the local economy. The maritime industry of the Drechtcities has four main sectors: (i) maritime technology, (ii) ports and logistics, (iii) inland shipping and (iv) ship manufacturing. The proximity of the port gives an advantage for the Drechtcities to create a maritime cluster. The exploitation of land by the port of Rotterdam in the port of Dordrecht enhanced this idea of one maritime cluster. Leader firms can create significant benefits for the regional economy, but it can also lead to overdependence and a lock-in effect. The rescue operation of IHC tells us that the existence of a leader firm in a region is not self-evident.

Different policy interventions took place over the last years, with the government more and more in the background, municipalities and provinces are in charge at spatial projects. The local authorities did initiate several visions, platforms and foundations with a special focus on the reinforcement of waterfronts in the Drechtcities. Next to that, the extensive influence of the port of Rotterdam in the Dordrecht region has as effect that the whole region is seen as one and some platforms are deployed that offer a one-stop-shop for customers.

Interventions as Rotterdam Maritime Capital are explanatory of the regionalization that takes place. The Deal Drecht Cities is an example of a relational approach of the port-city interface: a holistic view is used to enhance the city and the port.

The maritime cluster is seen as an important economic driver for the vulnerable region. According to the Dutch Maritime Cluster, a strong cluster is built upon certain pillars. Policy interventions in the Drechtcities are centered around the two pillars human capital and innovation. The emphasis on human capital is very interesting, as this is the core topic of my thesis. In the next part of my thesis, I will quantitatively analyze whether this focus had a positive or negative effect on the maritime cluster of the Drechtcities.

# 3. RESEARCH METHODOLOGY

In this part, I will describe my research methodology to quantitively assess my research question. I will start with the core of my analysis, the location quotient, whereafter I will describe how I obtained the data necessary to conduct my analysis. In here, the geographical scope and use of the LISA-database will be described. I conclude with a description of the methods I used to calculate the location quotient for multiple analyses.

## 3.1 Location quotient

A location quotient is a way to assess whether a specific industry is specialized in a certain region. By determining the location quotient, the strengths of industries in regions can be evaluated. A location quotient measures the concentration of a specific industry in one region relative to the concentration of the same specific industry in another region. This mechanism is useful because it is not an absolute but a relative measure, which makes it a solid way to compare the same industry for different regions. The location quotient is a widely used tool, especially in the economic geography. A location quotient is very useful to assess whether an industry became less or more important. A declining location quotient could mean that the importance of the industry, in my research the maritime cluster, erodes in the region. The different policy interventions over the past years could in that case be ineffective. I will use the number of jobs to calculate location quotients and to assess the relative strength of industries in the region. This is in line with earlier research regarding the Rotterdam Makers District (Jansen, Brandellero and Van Houwelingen, 2021). Therefore and because of the available data, I will leave the economic added value, that is also part of the human capital pillar, out of scope. A limitation to the location quotient methodology is that the location quotient itself does not give any explanatory reasoning behind the number (Miller, Gibson and Wright, 1991). Therefore, I will have to analyze the outcome of the location quotient thoroughly and qualitatively as well to find the reasoning behind a decline or rise. The location quotient is calculated as follows:

$$Location\ Quotient = \frac{Share\ of\ maritime\ jobs\ in\ maritime\ region}{Share\ of\ maritime\ jobs\ in\ benchmark\ region}$$

To calculate the share of maritime jobs in both regions, the following formulas apply:

$$Share\ of\ maritime\ jobs = \frac{number\ of\ maritime\ jobs\ in\ region}{total\ jobs\ in\ region}$$

This analysis is done for each of the years 2010-2017. A location quotient higher than 1 means that there is a higher concentration of specific industry in the region than in the benchmark region. A location quotient of 3 means that the concentration is 3 times higher than in the benchmark region. To assess the location quotient, maritime jobs, total jobs in the maritime and benchmark region are needed. This will be explained in the next part.

## 3.2 Data

In this section, I will define my research area and describe my data needed for to calculate the location quotients. I will first elaborate on the geographical scope of my thesis, where I demarcate the waterfront area that I will investigate and where I demarcate the benchmark regions for my analysis. Secondly, I will describe my data use using the LISA-database. Thirdly, some first descriptive analytics will be given of the waterfront region of my research scope, port sites near the Drechtcities.

### 3.2.1 Geographical scope

Regions in the Netherlands are defined by its Corop number. This definition is used by CBS, the Dutch Statistics Bureau. A Corop region is usually smaller than a province but can include multiple cities and villages. Dordrecht, Zwijndrecht, Sliedrecht, Kinderdijk, Alblasserdam and Gorinchem are located in Corop region 30: region Southeast South-Holland. The choice of the Corop regions is relevant, because it functions as a benchmark for my analysis. When analyzing the value of a waterfront, it is not relevant to compare Corop region 30 with a Corop region in Limburg for example. However, only comparing within the Corop 30 region could also lead to insufficient results. Therefore, I included Corop region 29 in my analysis as well. The main city in Corop region 29 is Rotterdam and the region includes the whole port region to the west of Rotterdam. The Corop region 29 is named Groot-Rijnmond. A comparison with another port region could be very useful in order to find unique elements of the region I investigate.


*Figure 11: Corop 29 and Corop 30 highlighted*

The geographical scope of my research focuses on the port sites in Dordrecht, Zwijndrecht, Sliedrecht (the Drechtcities), Kinderdijk, Alblasserdam and Gorinchem. I included the last three port sites as well, because famous shipbuilders such as Damen and IHC are residing there. Excluding these areas would not give a comprehensive overview of the maritime cluster in the region, as I expect that these shipbuilders create a lot of employment for the region. To demarcate my geographical scope, I used postal codes on the number level. These postal codes regions are obtained via the website *postcodebijadres.nl*. The postal codes that are covered by this demarcation, are depicted below.

These codes cover all the port sites in the region, as can be seen in the appendix. I use the same port site definition as in the *Ruimtelijke Strategie Drechtsteden* report (2014). I conducted an extra sanity check on Google Maps to ensure that no large maritime companies would be excluded in my research by using these postal codes. The highlighted port areas on figure 12 are all covered by these postal codes, which I believe will give a comprehensive overview of the maritime cluster in the region.

| | **Location** | **Postal Codes** |
|---|---|---|
| 1 | Dordrecht | 3316 |
| 2 | Merwedehavens | 3313 |
| 3 | Kinderdijk | 2961 |
| 4 | Zwijndrecht | 3336 |
| 5 | Oosteinde | 3356 |
| 6 | Sliedrecht | 3361 |
| 7 | Gorinchem | 4202 |

*Table 2: maritime locations and postal codes in the Corop 30 region.*

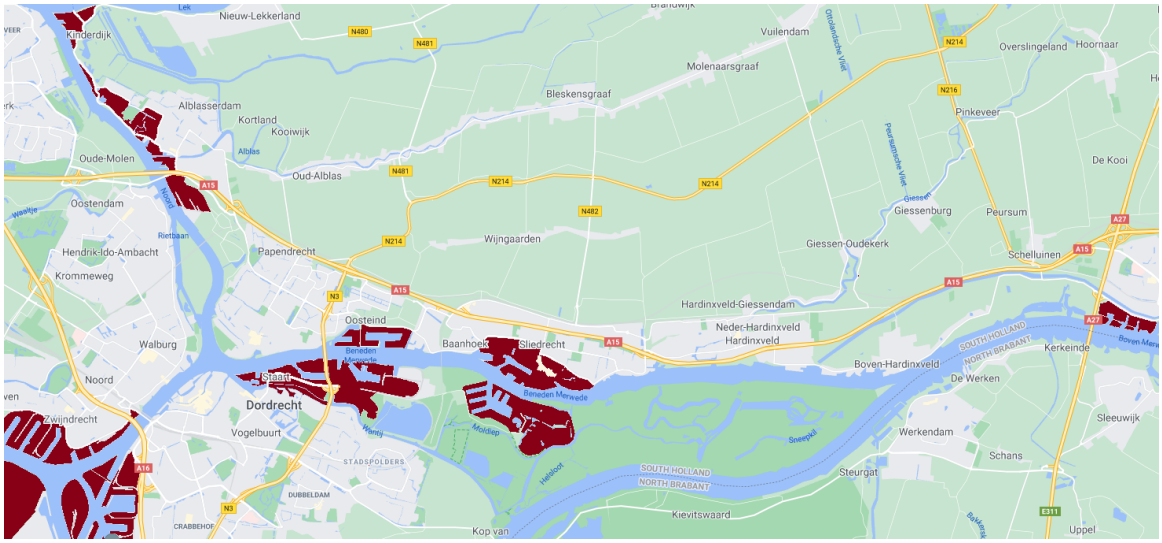



*Figure 12: Waterfront sites in the Corop 30 region.*

### 3.2.2 Waterfront areas in Corop 29 region

To perform a part of my analysis, I need to exclude waterfront areas in the Corop 29 region. I followed the same approach as in the Corop 30 region. I used the website of the port of Rotterdam to ensure that my chosen postal codes were in the port region. The only difference is that these postal codes will eventually be used as benchmark in my analysis, whereas this is of course not the case for the waterfront areas in the Drechtcities, which are my core topic.

| | Location | Postal Codes | | Location | Postal Codes |
|---|---|---|---|---|---|
| 1 | Rotterdam vierhavens | 3029 | 7 | Europoort | 3198 |
| 2 | Rotterdam RDM | 3089 | 8 | Maasvlakte | 3199 |
| 3 | Vondelingenplaat | 3196 | 9 | Schiedam – haven | 3114 |
| 4 | Charlois – Waalhaven | 3087 | 10 | Schiedam - haven | 3115 |
| 5 | Pernis | 3195 | 11 | Vlaardingen Oostwijk | 3134 |
| 6 | Botlek | 3197 | 12 | Vlaardingen Vettenoordse Polder | 3133 |

*Table 3: maritime locations and postal codes in the Corop 29 region.*

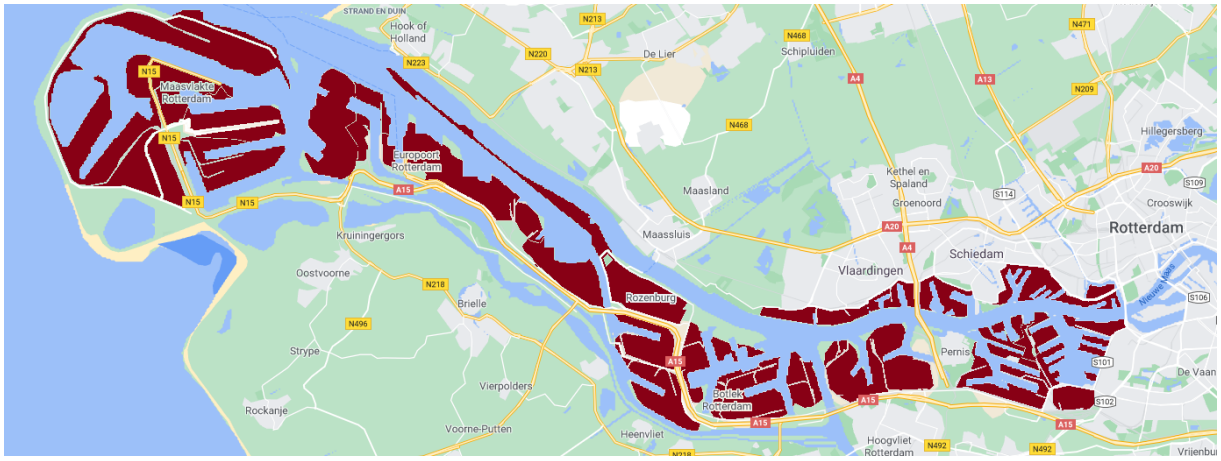



*Figure 13: Waterfront sites in the Corop 29 region.*

### 3.2.3 Maritime cluster definition

To define the maritime cluster, I use the SBI-codes as depicted in the Dutch Maritime Cluster Monitor 2020. This is a monitoring study regarding maritime activity commissioned by the ministry of Infrastructure and Water Management. In my research, I will exclude the sectors regarding fishery and leisure because my research is centered around the maritime services and the manufacturing industry. SBI-codes are codes that describe the main activity of a company. Every company in the Netherlands that is subscribed to the Chambre of Commerce has a SBI-code. The SBI-codes thus provide a very complete overview of all the companies in the regions I will analyze. In the table below, the main activities that I will analyze are depicted. The main activities that represent the maritime cluster are ship manufacturing, shipping, inland shipping, water engineering and ports; below are more specific activities within those segments.

| Sector | ISB Code | Company activity |
|---|---|---|
| Ship manufacturing | **3011** | Commercial ship manufacturing |
| | **3012** | Sports and recreative ship manufacturing |
| | **3315** | Ship repair and maintenance |
| Sea shipping | **5010** | Shipping (passenger and ferry) |
| | **50201** | Shipping (cargo and liquid bulk) |
| | **50202** | Shipping (towage) |
| Inland shipping | **5030** | Inland shipping (passenger and ferry) |
| | **50401** | Inland shipping (cargo) |
| | **50402** | Inland shipping (liquid bulk) |
| | **50403** | Inland shipping (towage) |
| Ports | **52101** | Tank storage |
| | **52102** | Cold storage |
| | **52109** | Other storage (including distribution centers) |
| | **5222** | Service over water |
| | **52241** | Load- unloading and transshipment ocean shipping |
| | **52242** | Load- unloading and transshipment non-shipping |
| | **52292** | Weighting and measuring |
| | **52291** | Forwarder, shipping agent, charter and other intermediaries |
| Water engineering | **4291** | Water engineering (waterbouw) |

*Table 4: ISB codes and maritime activities*

### 3.2.4 LISA database

The dataset that I will use to conduct my analysis is from LISA. LISA is a foundation that merges data from different provinces and municipalities into one dataset. Because provinces in the Netherlands are responsible for the registration of companies and employment, this dataset can be viewed as complete. The LISA database provides data regarding the company, its address, its activity using the ISB code, its coordinates and the employment at the company. It is a unique database in the sense that it combines economic and geographical data, which is necessary for my research.

The data in my research are annual data, running from 2010 to 2017. I use the LISA database from the Corop regions 29 and 30. I accessed the database using Excel. Thereafter, I created two extra variables; one for the company count and one for the postal codes at the number level, by extracting the letter from the numbers. In the Corop 29 region (which is Groot-Rijnmond) I observe 152361 companies and in the Corop 30 region I observe 40231 companies. Because each entity that subscribes itself at the Chambre of Commerce is automatically counted in this dataset as a company, the total number of companies will not be sufficient, the job variable will tell more. The postal codes at the number level gives me a more comprehensive overview of the companies within the different regions.

Using the *pivot table* function in Excel, I can retrieve descriptive statistics and start my analysis. This function gives me the opportunity to obtain yearly data about the employment grade and the number of companies for each maritime cluster segment.

### 3.2.5 Job definition

In my further research, I will make use of the term jobs when analyzing employment. The LISA database defines the term jobs as the total number of fulltime and parttime employees at a company (LISA handbook, 2018). A fulltime employee is an employee who works more than 12 hours. The database does not clarify what the total employment of fulltime and parttime employees is measured in FTE. When the ratio between parttime and fulltime differs significantly between companies, a measurement problem could occur. However, because I compare the same job sectors within a relatively small region that result in a location quotient (which is relative), I do not believe that this is a serious problem. Therefore, I believe that the total number of employees, fulltime and parttime, will give a comprehensive overview of the employment at a company. This will thus provide meaningful insights in the maritime activity and maritime cluster in the region.

## 3.3 Steps and benchmarks

In this part, I will describe my methodology regarding my research to assess the strength of the maritime industry over the years. Because only data about the region itself will not give answer to the question of the competitiveness of the maritime cluster in the region, I will use different benchmarks in my analysis to give a good insight in the competitive strength of the maritime cluster in the Drechtcities. To compare different regions, I will describe the steps I took to obtain my results.

### 3.3.1 Steps

To calculate the formulas and the location quotient for each sector and for each benchmark, the following steps are repeatedly conducted in Excel.

I. The total number of jobs in the designated waterfront area is calculated using the postal codes demarcation.
II. The number of maritime jobs in the designated waterfront area is calculated using the ISB-codes and the postal codes demarcation.
III. The total number of jobs in the benchmark region is calculated using postal codes.
IV. The number of maritime jobs in the benchmark region is calculated using the ISB-codes and the postal codes.

These steps are repeated for the number of companies as well. After the repetition of these steps, I find the location quotient for the maritime cluster for jobs and for companies. To assess which sectors perform better than other sectors, I split the maritime cluster into the sectors shipping, ship manufacturing, inland shipping, water engineering and ports using the ISB codes. For each sector separately, I repeat step 2 and step 4. Step 1 and 3 remain the same.

### 3.3.2 Four different benchmarks

Using the location quotient, it is important to choose the benchmark region. I decided to conduct four different analyses with four different benchmarks. I will do this to get a good insight in the industry on the waterfront of the Drechtcities. Different perspectives also give me the opportunity to assess what the competitive strength is of the maritime cluster in comparison to other regions. Companies in the waterfront region will not only compete with their neighbor but also with a company at the shores of the North Sea due to the digitization and the expansion of the port of Rotterdam. The meaning of a location quotient is dependent on the benchmark region that is used. Therefore, different benchmarks give good insights in the maritime cluster of the Drechtcities. I will perform the next analyses, following the steps from above for jobs and companies repeatedly:

I. First, I will calculate the location quotient using the Corop 30 region as benchmark. This is in the same region as the waterfront. This will give insight in the relative power of the waterfront for the maritime cluster for the region it is located in. I expect that the location quotients are high here. The Drechtcities municipality has control over the majority of the Corop 30 region.
II. In the second analysis, I will calculate the location quotient using the Groot-Rijnmond region (Corop 29) and the Drechtcities (Corop 30) as benchmark. Competitors more downstream the rivers and outside the Corop 30 region will be included in this regression. This analysis will give insight in the concentration of maritime firms compared to a large sample of other port areas. In this analysis, all companies of the Groot-Rijnmond region and South-South-East Holland will be included, which gives a good insight for me to assess the importance of the maritime cluster for the region.

III. The third analysis will use the same benchmark as in the third analysis, but in this analysis, I will exclude the port region in Rotterdam. This is done to get a good overview of the strength of the waterfront in the Drechtcities compared to the whole Groot-Rijnmond region without the dominant port of Rotterdam.

IV. In the fourth analysis, I will use the port of Rotterdam area as benchmark and compare the competitiveness of the sectors in the port of Rotterdam with the waterfront in the Drechtcities. As the whole region is more and more acting as one, it is interesting to see what the relative difference is between the two waterfront regions. A higher grade of regionalization could also lead to more competition between the firms. The waterfront region in Rotterdam that I included is highly industrialized, which could mean that the location quotient of the waterfront region in the Drechtcities will be low.

# 4. RESULTS AND ANALYSIS

In this section, I will provide results for each part of my analysis. Because the pillar human capital is a factor in each policy intervention in the Drechtcities, it is interesting to see what the actual strength is of the maritime cluster in terms of employment. At first, I will give a brief overview of the region in terms of jobs and companies. Thereafter, I will perform and display my four analyses separately to find meaningful insights. For each analysis, I will begin with the location quotient of jobs for the waterfront region in the Drechtcities. Next, I will provide the more in-depth analysis regarding each segment separately. For the numbers behind the graphs, I refer to the Appendix. After the results of the four analyses, I will make a comparison between the different types of analyses.

## 4.1 An overview of the current situation in the Drechtcities

In this section I will briefly describe some data regarding the waterfront region in the Drechtcities. For the sake of clarity, I will use the term "waterfront" for the region within the Drechtcities that fall within the postal codes 3316, 3313, 2961, 3336, 3356,3361 and 4202: the port sites in the Drechtcities. The number of maritime jobs, as defined by the ISB-codes, and the maritime companies in the waterfront region are depicted below. The overall pattern of the number of companies is quite stable over the years, whereas the number of maritime jobs in the waterfront region has a negative trend at first, but a positive trend from 2013 onwards. This positive trend could be because from that time the port of Rotterdam exploited the port of Dordrecht. Another factor could be the recovery of the economy after the Eurocrisis.

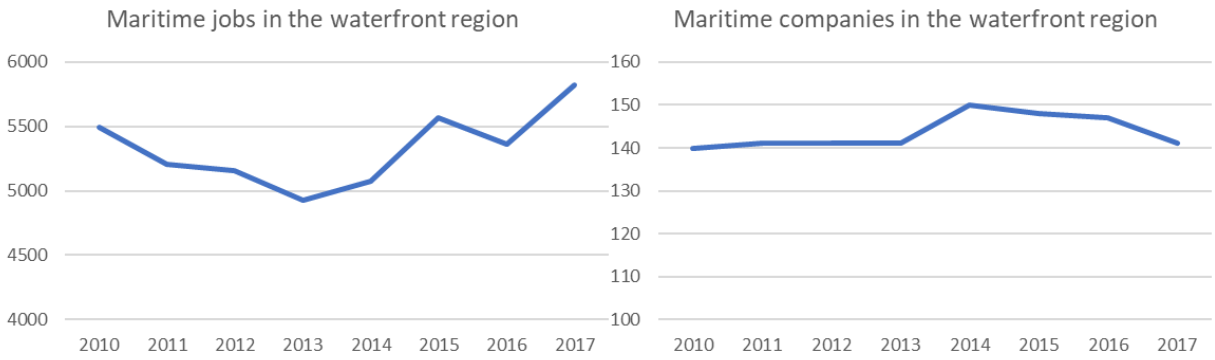
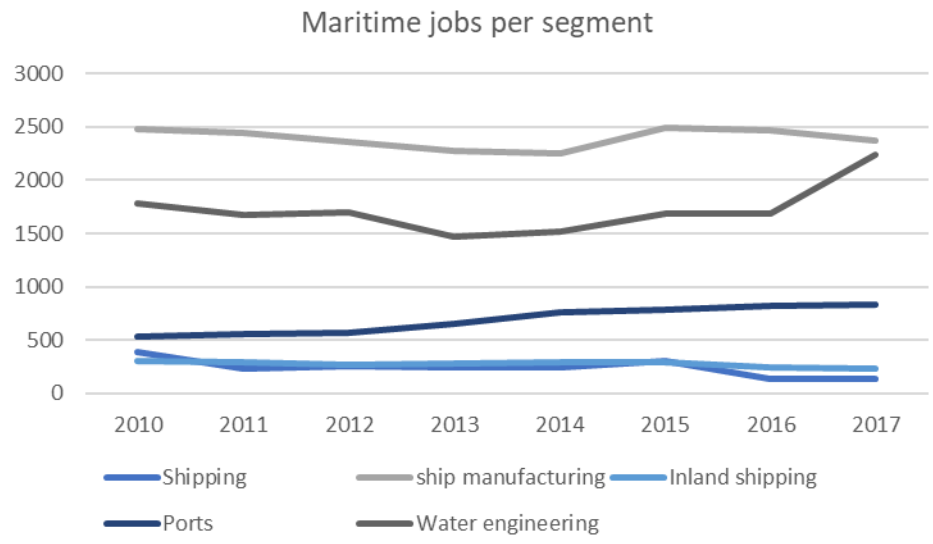
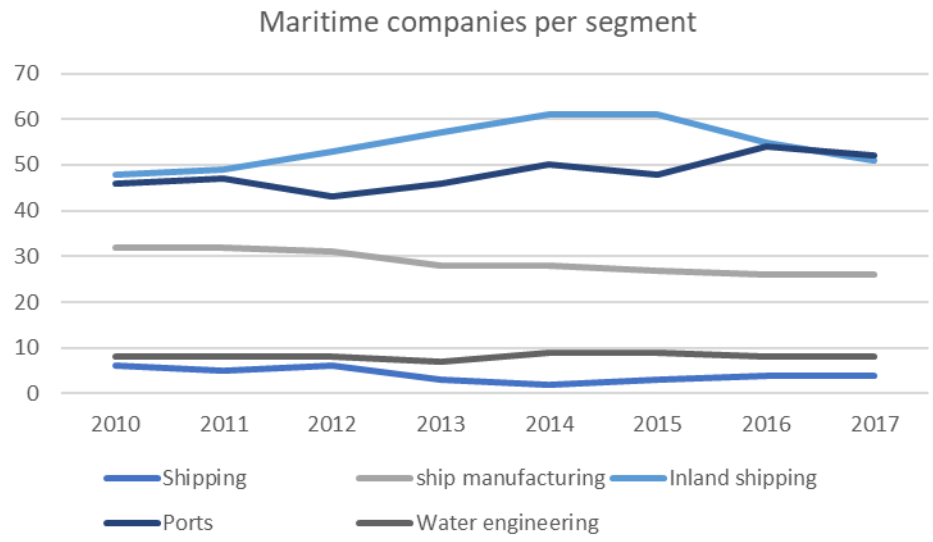
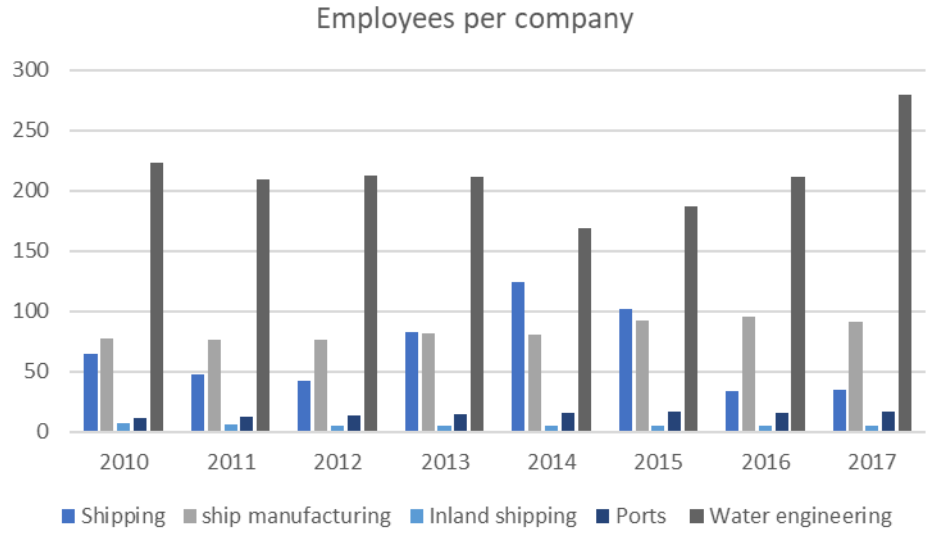


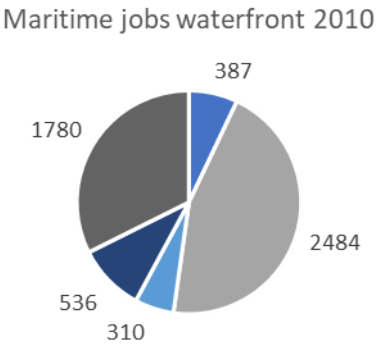

*Figure 14: maritime jobs and companies in the waterfront region.*

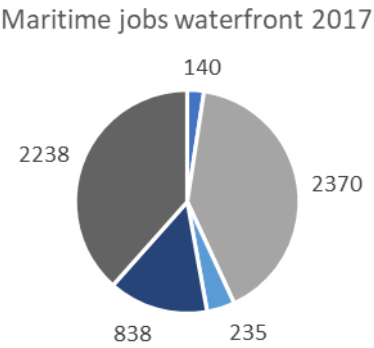
The total number of maritime jobs and companies does not tell us which sectors are dominant within the waterfront region. To assess this, I split the jobs and companies into the five maritime sectors. These sectors are shipping, ship manufacturing, inland shipping, ports and water engineering. Figure 15 gives interesting insights in the industry in the Drechtcities. For maritime jobs, there are clearly two dominant sectors: the ship manufacturing sector and the water engineering sector. This is not surprising, because the region prides itself with the residence of leader firms Boskalis and IHC. Interestingly, the companies give another image of the region. The sectors inland shipping and port are the most dominant ones, when only the number of companies are considered. The number of water engineering companies is around ten, which confirms that a few leader firms have a major impact on the regional employment levels. To give a better insight in the average size of a company per segment, I divided the number of jobs by the number of companies per year. That gives the result as depict in the lowest diagram in the figure. This diagram confirms that there is a lot of difference between the sectors in relation to employment. The average employment at a company active in water engineering in 2017 was 91, whereas the average size measured in jobs of an inland shipping company was only 5 that year (see Appendix). This does not surprise, as inland shipping companies are mostly family-owned businesses.

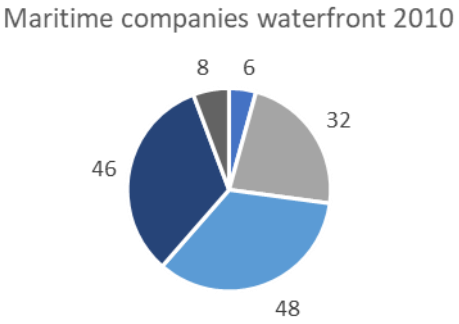


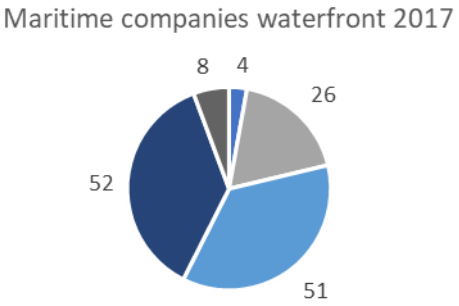




*Figure 15: Maritime jobs and companies in the waterfront region per segment and average number of jobs per company*

## 4.2 The first analysis: competitiveness compared to the Corop 30 region

This analysis focuses on the relative strength of the maritime cluster in comparison with the whole Corop 30 region, South-South-East Holland, the region of the Drechtcities. This will give meaningful insights in the value of the waterfront for the region. The location quotients of both jobs and companies increase during the years 2010-2017, which is positive. The location quotient for jobs looks very positive, the concentration of jobs in the maritime cluster in the waterfront is more than 2.5 times higher than in the whole region. The company location quotient also has a positive trend, but the location quotient is lower than the location quotient for jobs.

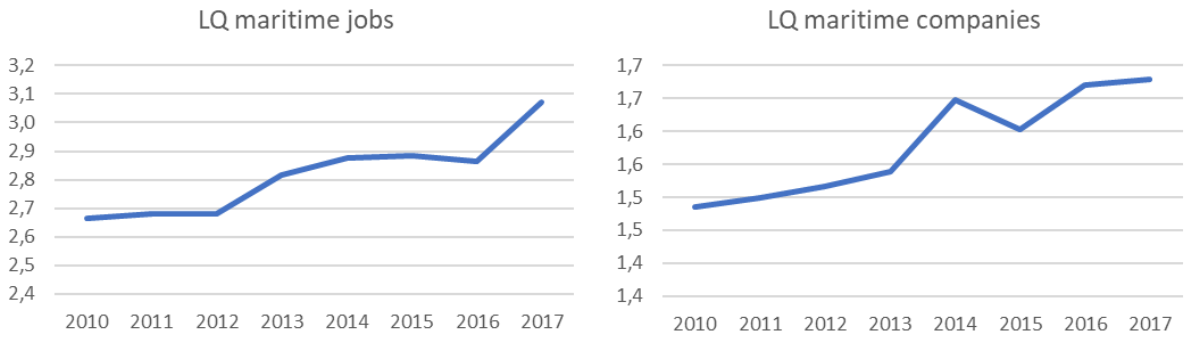



*Figure 16: location quotient of maritime jobs and companies for the Drechtcities region (Corop 30).*

When analyzing the location quotient per segment, I find some interesting insights. The location quotient of companies and jobs follow approximately a similar pattern for each segment. At first, the location quotient for inland shipping for both companies and jobs is low, for jobs even lower than 1. This means that there are relatively more people employed in the whole region than at the waterfront area. A reason for this could be that inland shippers are not registered at the waterfront per se, the registration of the family-owned boat is probably at another place. The two high location quotients are for ship manufacturing and water engineering. This is according expectations, as the leader firms are active in the waterfront areas. For the numbers of the actual location quotients, I refer to the Appendix.

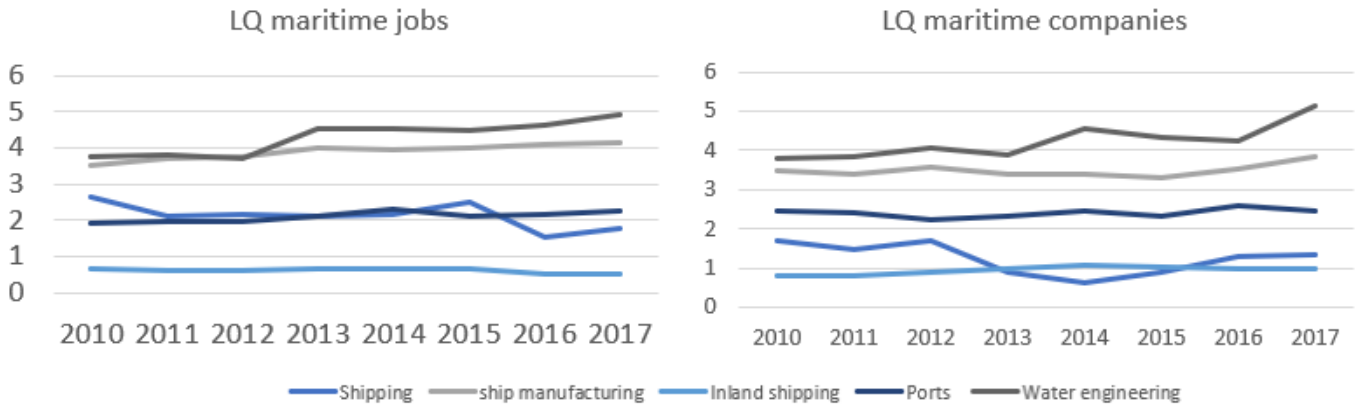
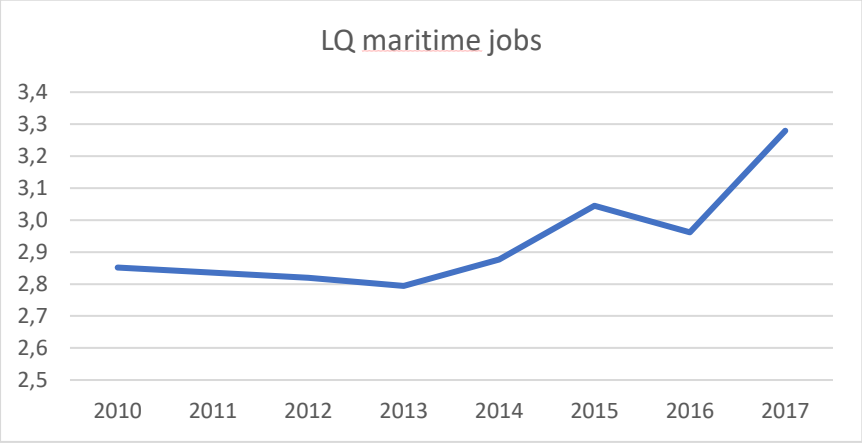



*Figure 17: location quotient jobs and companies per segment for the Drechtcities region (Corop 30).*

## 4.3 The second analysis: competitiveness compared to Corop 30 and Corop 29

Rotterdam Maritime Capital of Europe: the new platform where the whole region from the North Sea till far in South-East Holland is displayed as one. This trend of regionalization has impacted the way the different municipalities in the region are operating. Next to that, the port authorities of Rotterdam gained influence in the Drechtcities over the last years. This can create advantages for customers of ports as the whole Rotterdam Maritime Capital region could function as a one-stop-shop. Next to that, the maritime cluster can be reinforced by more cooperation between the different regions. On the other hand, it is uncertain what this collaboration means for the companies: does it bring extra customers, or does it only bring extra competition? Although the Rotterdam Maritime Capital of Europe platform has been launched in 2017, analyzing data from before still gives us an insight in the competitive position of the waterfront region.

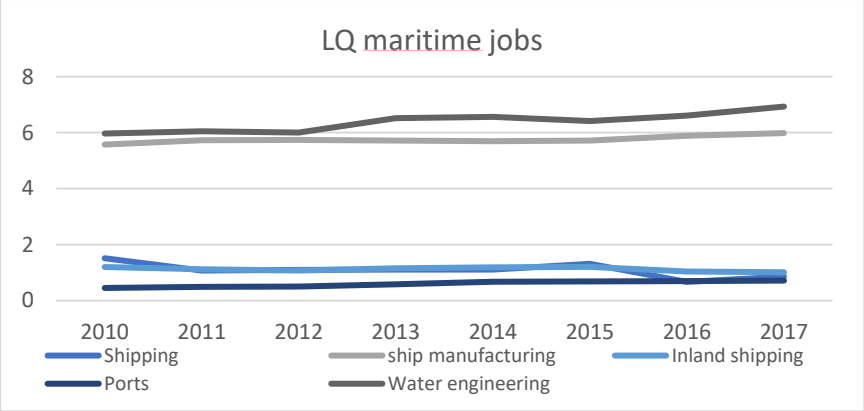
The location quotient of maritime jobs increases over the years and the location quotient is even higher than in the first analysis. A reason for this could be the abundance of companies in the Groot-Rijnmond region (Corop 29), where the proportion of maritime companies is not as high as expected. The location quotient of maritime companies has a similar pattern as the location quotient for maritime jobs. Therefore, I decided to include the results of the companies in the Appendix from now on. Next to that, I included the location quotients of the waterfront region compared to the Groot-Rijnmond region (only Corop 29) in the Appendix as well.




| Year | Average LQ |
|---|---|
| 2010 | 2,85 |
| 2011 | 2,84 |
| 2012 | 2,82 |
| 2013 | 2,79 |
| 2014 | 2,88 |
| 2015 | 3,04 |
| 2016 | 2,96 |
| 2017 | 3,28 |

*Figure 18: location quotient of maritime jobs for the Drechtcities and Groot-Rijnmond (Corop 30+ 29).*

The location quotients for jobs for each segment separately give a different image of the concentration of jobs. At first, the location quotients for ship manufacturing and water engineering are high, with an average of 5,76 and 6,39 over the years. This reflects the unique position of the Drechtcities regarding these sectors. Second, the other three sectors do not have high location quotients. Shipping and inland shipping have a location quotient slightly above 1, what means that there is no significant concentration power in the waterfront region of the Drechtcities for these sectors. The ports sector has a location quotient which is below 1. This is not very surprising as these activities, such as storage and transshipment, are mostly seaport activities and the port site in Dordrecht is the only site that could accommodate these activities. These activities are clearly more present in the port area of Rotterdam, a port that can accommodate all types of seagoing vessels.

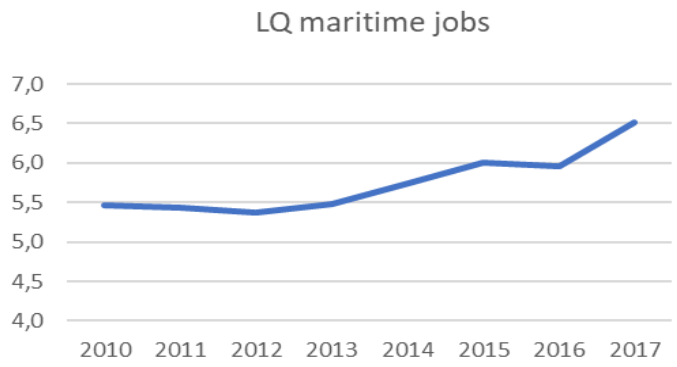



| Sector | Average LQ |
|---|---|
| Shipping | 1,09 |
| Ship manufacturing | 5,76 |
| Inland shipping | 1,13 |
| Ports | 0,60 |
| Water engineering | 6,39 |

*Figure 19: location quotient jobs per segment over time and average for Corop 29 + Corop 30*

## 4.4 The third analysis: leaving the port of Rotterdam area out of scope

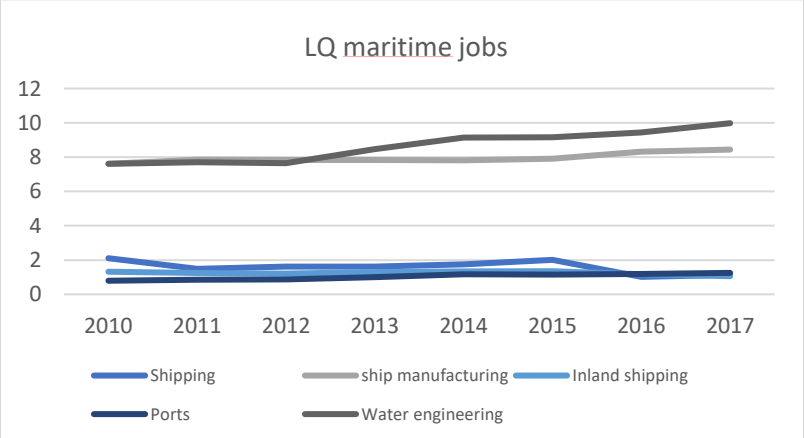
This part will focus on the strength of the waterfront in relation to the total region (Corop 29 + Corop 30) without other waterfronts. I conduct this analysis to assess what the strength of the maritime cluster is in relation to normal economic activities. The exclusion of the port of Rotterdam region will give insight in the economic concentration power of the maritime cluster in the whole region. As there is a trend towards regionalization, the concentration power of the maritime cluster compared to the normal economy in the whole region becomes increasingly important for policy makers. As expected, the location quotients of both jobs and companies (in Appendix) increase significantly compared to the previous analysis that included the port of Rotterdam (a location quotient of 6,51 compared to 3,28 in 2017). The very high and increasing location quotients mean that the regional economy without the port of Rotterdam has a very strong dependency on the Drechtcities in relation to the maritime cluster. The strength of the waterfront for the maritime cluster in the whole region is strong.




| Year | Average LQ |
|---|---|
| 2010 | 5,47 |
| 2011 | 5,43 |
| 2012 | 5,37 |
| 2013 | 5,49 |
| 2014 | 5,74 |
| 2015 | 6,00 |
| 2016 | 5,96 |
| 2017 | 6,51 |

*Figure 20: Location quotient of maritime jobs for the regions Corop 29 + Corop 30 without port of Rotterdam.*

The location quotients per segment are interesting. At first, all the location quotients increase, which makes sense. The key sectors ship manufacturing and water engineering have very high quotients but the classic port-related industries have a coefficient that is not increasing that much. This is pretty odd, as I expected that the exclusion of the port of Rotterdam area would lead to much higher figures. The small size of the port of Dordrecht for the whole region of Corop 30 might be the cause of these low numbers, as this is the waterfront regions at the Drechtcities have apparently not a highly dense shipping and port industry. I will discuss this result further in chapter 5.



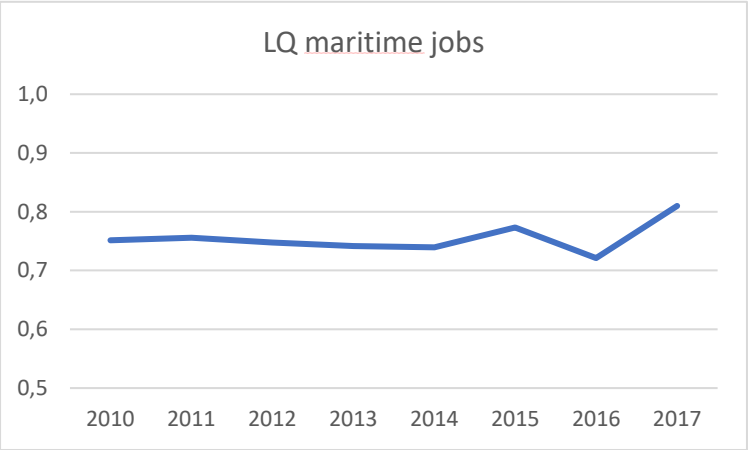

| Sector | Average LQ |
|---|---|
| Shipping | 1,59 |
| Ship manufacturing | 7,95 |
| Inland shipping | 1,25 |
| Ports | 1,04 |
| Water engineering | 8,64 |

*Figure 21: location quotient jobs per segment over time and average for Corop 29 + Corop 30 without port of Rotterdam*

## 4.5 The fourth analysis: a quick comparison between the waterfront in the Drechtcities and the port of Rotterdam

In this part, I will make a comparison between the "classic" port region in Rotterdam and the waterfront region in the Drechtcities. The waterfront region in Rotterdam is depicted in section 3.2.2 Waterfront areas in Corop 29 region). Due to the regionalization trend, the port area from Maasvlakte II till Gorinchem is more and more framed as one. This was observed in several policy interventions as well. It is interesting to see what the concentration of companies is when the waterfront region is compared with the port area in Rotterdam. I will assess to what extent the port areas compete and whether the increasing cooperation is beneficial for the concentration of maritime jobs in the region.

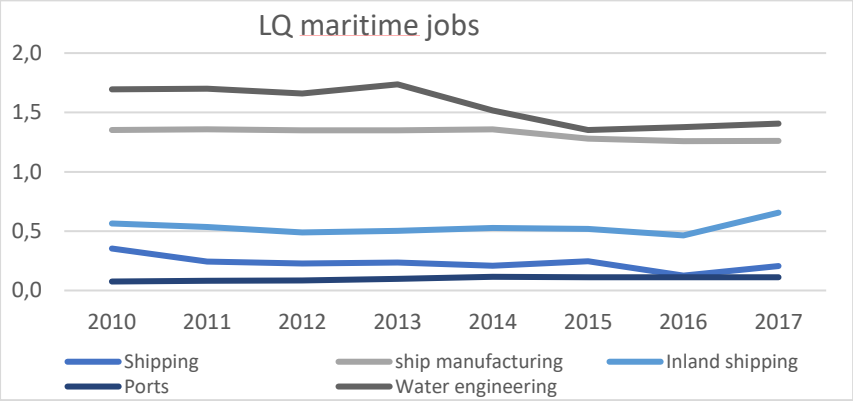
We see that the overall location quotient for jobs is lower than 1, which means that on average the concentration of maritime jobs is higher in the port of Rotterdam region. This is not a surprise, as a lot of big terminals and other shipping port areas are located in the port of Rotterdam. The expansion of the port, west of the city towards the North Sea, also entails that residential areas are not nearby these sites, except from some villages, which influences the location quotient as this measures the concentration of maritime companies and jobs.




| Year | Average LQ |
|---|---|
| 2010 | 0,75 |
| 2011 | 0,76 |
| 2012 | 0,75 |
| 2013 | 0,74 |
| 2014 | 0,74 |
| 2015 | 0,77 |
| 2016 | 0,72 |
| 2017 | 0,81 |

*Figure 22: Location quotient of maritime jobs for port of Rotterdam.*

The location quotients per segment give interesting insights. At first, the sectors shipping, inland shipping and ports have a location quotient lower than 1 regarding employment. This does not surprise, as the Seaport of Dordrecht is the only port location where the “classic” port functions are still in business in the waterfront region in the Drechtcities. The two prides of the region, ship manufacturing and water engineering, have a location quotient larger than 1, this confirms the image that the leader firms play a major role in the Dutch maritime industry. The concentration of maritime jobs in the Drechtcities for the sectors water engineering and ship manufacturing decreased compared to the Port of Rotterdam region with 17.1% and 6.6% respectively. This could be a sign that some large companies with multiple locations decide to shrink the number of business locations, to follow the trend of one port for the whole region. This location quotient is not as high as it was in the other analyses, probably because of the existence of these type of companies at the waterfront of Rotterdam as well. Port activities in the Drechtcities are less clustered than in the Port of Rotterdam region.




| Sector | Average LQ |
|---|---|
| Shipping | 0,23 |
| Ship manufacturing | 1,32 |
| Inland shipping | 0,53 |
| Ports | 0,10 |
| Water engineering | 1,55 |

*Figure 23: location quotient jobs per segment over time and average for Port of Rotterdam*

## 4.6 Leader firms in the Drechtcities

In this part I will assess which firms are the main drivers behind the employment numbers in the Drechtcities and whether the leader firms from the theoretical framework, IHC and Boskalis, are still the leader firms in the region in terms of employment. By analyzing the different companies in the maritime cluster in the waterfront region in the Drechtcities, I deduced three leader firms in the region: IHC, Boskalis and Damen. Important to note is that my definition of leader firm is only based on employment figures and not on other variables as was done by Nijdam (2010). These three leader firms employed 61.7% of the maritime jobs in the maritime cluster in the Drechtcities on average in the years 2010-2017. The largest firm in terms of employment was Boskalis, offering over a quarter of the total jobs in the maritime cluster on average. The figure below on the left depicts the total number of jobs over the years. The figure on the right depicts the average share of jobs compared to the whole maritime cluster in the Drechtcities. In the following, I will analyze the three leader firms using the statistics from the LISA database.

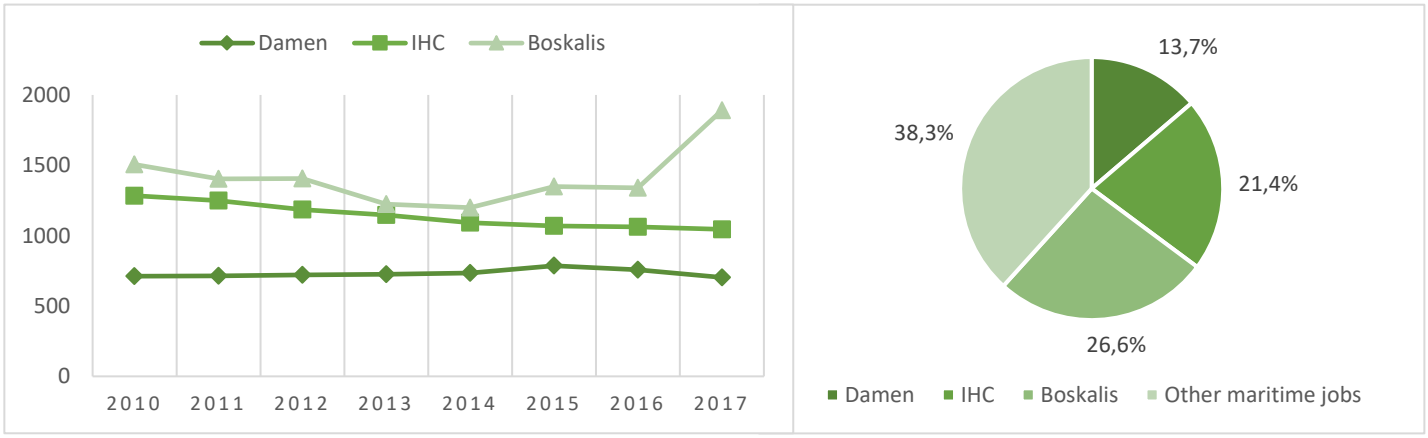



*Figure 24: total number and share of employment for the three leader firms in the years 2010-2017*

### *Damen and IHC*

I will analyze these companies together, as these companies are both operating in the same sector; the ship manufacturing sector. Damen and IHC are responsible for 73.8% of the jobs in this sector in 2017, compared to 80.4% in 2010. The total employment at these two companies decreased as well, with 248 jobs (numbers in the Appendix). In the whole ship manufacturing sector, a decrease of 4.6% (114 jobs) of total employment was observed, what explains the lower share of jobs at these two companies. The total number of jobs at IHC decreased over the years 2010 till 2017 with 18.6% (239 jobs), a clear negative trend is observable in the figure above as well. This might be worrying for the future, especially with the recent refinancing operations in mind. Jobs at Damen remained stable over the years, I observed a decline in jobs of only 1.3% (9 jobs). Despite the negative trend at IHC, these two leader firms play a vital role in the maritime cluster in the Drechtcities with an average share of 78.2% compared to the ship manufacturing sector.

*Boskalis*

The main company in the water engineering sector is clearly Boskalis. On average, 82.3% of the jobs in the water engineering sector stems from Boskalis. In contrary of Damen and IHC, this rate remains stable over the years, allthough the total number of jobs at Boskalis increased with 25.7% (386 jobs). This increase is contributable to a sudden surge in jobs from 2016 to 2017 with 41.1% (551 jobs). This also explains the higher location quotients for the water engineering sector in 2017. Next to that, due to the high number of jobs at the water engineering sector compared to the other sectors, the overall location quotients are also affected by this surge in jobs. The reason for this surge is most likely the acquisition of the offshore activities of VolkerWessels, mainly regarding windenergy (Boskalis, 2016). When I leave the last year out of scope, a decrease of 10% (165 jobs) over the years 2010-2016 is observed. This gives a slightly more negative image to the leader firm Boskalis, when taking the last acquisition out of scope. However, the firm still has a very high rate of jobs in the sector and in the maritime cluster as a whole, and can thus be seen as a leader firm.

## 4.7 A deeper analysis of the results

In this part, I will compare the analyses and I will briefly describe the most notable results per segment. The growth rates of the location quotients for each analysis are depicted below. This is the rate of growth of the location quotient for all the segments combined in the time period 2010-2017. All the growth rates are positive, which is a sign of growing concentration of the maritime cluster in the Drechtcities over these years. The growth rate of analysis 3 is the highest, this is the whole area (Corop 29 + Corop 30) excluding the port of Rotterdam. I already described that the location quotients for this analysis were high as well, so the maritime cluster in the waterfront region has a strong and increasing concentration of maritime activity measured in employment compared to the regions Groot-Rijnmond and South-South-East-Holland (Corop 29 + Corop 30) excluding the port of Rotterdam. The lowest growth rate is observable in analysis 4, the comparison with the port of Rotterdam. The average location quotient was low here as well, especially for the classic port functions. However, a growth rate of 7,8% is positive. It means that the concentration of maritime jobs in the maritime cluster in the Drechtcities is increasing compared to the maritime cluster in the port of Rotterdam area.

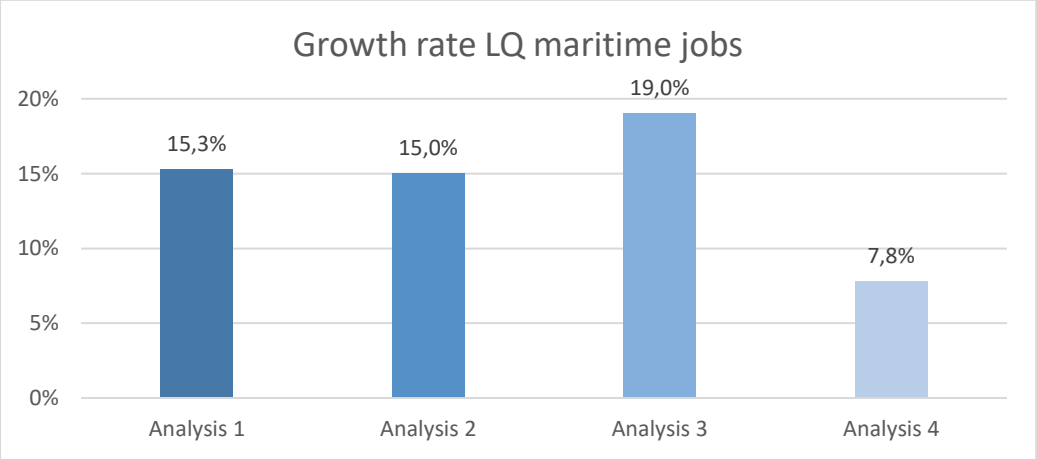



*Figure 25: growth rate location quotients maritime jobs per analysis*

The growth rates per segment measured in location quotients for maritime jobs will tell us more than the overall growth rate figures. The figure below depicts the growth rate for the location quotient of maritime jobs per segment for each analysis. The results are interesting. At first, the shipping growth rates are negative for all analyses. It seems that the exploitation of the port of Dordrecht by the port of Rotterdam was not favorable for this sector. However, we do see a very high increase in location quotients for the port sector. All the analyses are positive and the location quotients in analysis 2 and 3 increased with more than 50% over the years 2010-2017. It seems that the different way of exploitation had a positive effect on the port activities. The fact that the shipping sector decreased could be because the shipping companies decided to move away from the Dordrecht area or the shipping companies now active in the port area are more internationally oriented than before due to clustering of the port region. These companies probably do not have its employees registered at Dordrecht, as this is not a common place for sea-shipping activities. For a further comparison of results per segment and for the growth rates in numbers, I refer to the Appendix. Using the pivotable in Excel, I will attempt to find reasoning behind the growth rates I depicted. I can assess the number of employees per sector and the companies that were active in that sector. This part will be explanatory for the results from the four analyses, after which I can derive conclusions from the data. In this part, I will only analyze the absolute numbers, without the comparison with another region.

The numbers in terms of employment and companies per segment and per SBI-class are upon which I will base my next analysis are in the Appendix as well. Looking at the overall figures of employment in the maritime cluster, I observe an increase of 5.9% (324 jobs) in employment from 2010 till 2017. However, when I analyze each sector separately, I find that only the sectors port and water engineering saw an increase in employment with 56.3% and 25.7% respectively. Employment in the other sectors decreased: for shipping with 63.8%, ship manufacturing with 4.6% and inland shipping with 24.2%.

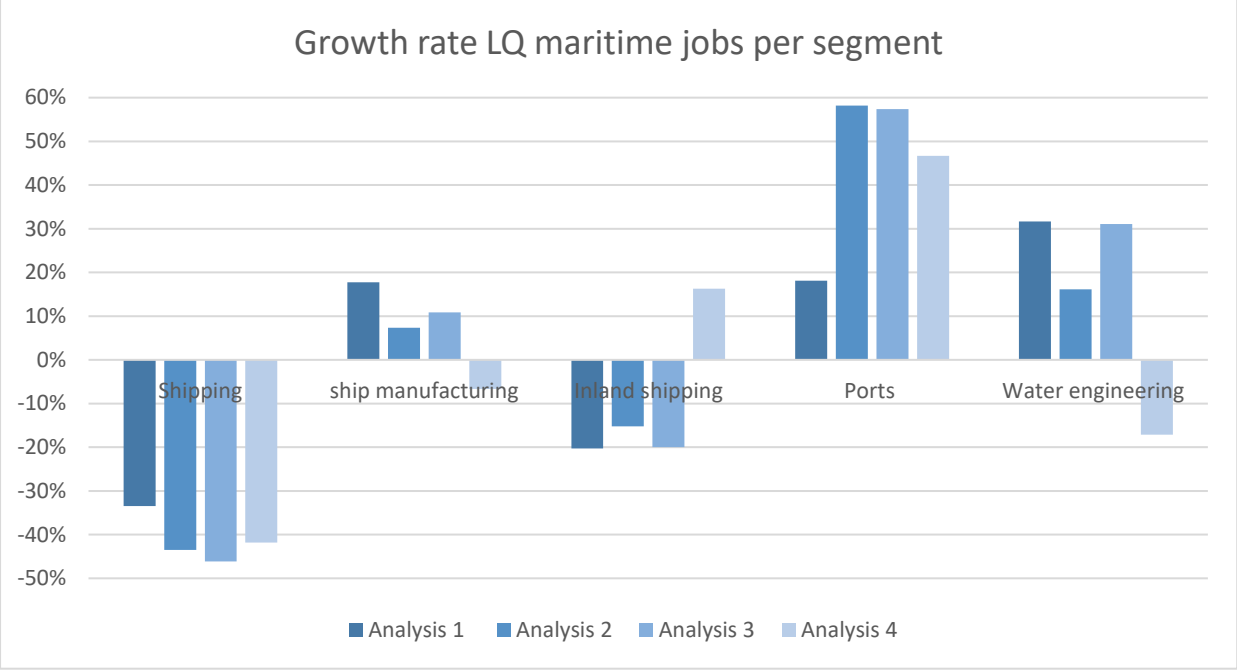



*Figure 26: growth rate location quotient maritime jobs per segment for each analysis*

*Shipping*

This sector had the most negative growth rates of the five sectors. We have already seen that the total number of employees at the shipping sector was low compared to other sectors. This means that a bankruptcy or move away from the waterfront of one company could easily impact the growth rates. A quick look at the data explains the negative growth rates. In the subsector shipping (cargo and liquid bulk, SBI code 50201), the company John t Essberger B.V. had a downfall in employment from 235 to 3 employees from 2015 to 2016. This German chemical shipping company still exists nowadays, but its main activities were moved away from the waterfront in the Drechtcities. The in-house magazine of the company stated that the office in Dordecht will be closed and all activities will be moved to Hamburg, after heavy negotiations with the works council (Essberger, 2016). I conclude that this move impacted the growth rates of the shipping sector significantly, as the sector was not that strong in the Drechtcities in terms of total employment and companies.

*Ship manufacturing*

The ship manufacturing sector is the largest sector in terms of employment in the maritime cluster of the Drechtcities. Its growth rate is positive for three analyses and negative for the last analysis, despite an overall decrease of jobs. Two of the three leader firms, Damen and IHC, are active in this sector and these companies are responsible for 73.8% of the jobs in this sector in 2017, as I depicted in the previous section. These leader firms heavily impact the rate of employment in this sector in the Drechtcities. This could make the sector vulnerable. The decline in jobs at IHC might be a sign that the sector will weaken in the future, but this remains uncertain.

*Inland shipping*

To analyze the inland shipping sector, I will first reiterate that this sector has a low rate of employment per company and the total employment is low for the waterfront in the Drechtcities. This makes that we must put the negative growth rates in perspective. A look into the data confirms that the total employment in the inland shipping sector decreased with 24.2% (from 310 to 235). A decrease with almost a quarter is large, but this is not attributable to a few companies. It seems that the inland shipping sector as a whole is suffering in the Drechtcities.

*Ports*

The concentration of port activities in the maritime cluster in the Drechtcities increased significantly, so it is interesting to see what the main drivers were. The SBI class within the port-sector in the Drechtcities with the highest number of employees is the subsector: Forwarder, shipping agent, charter and other intermediaries (SBI code 52291). The number of employees in this subsector increased with 69.9% from 2010 till 2017 (from 276 to 469). As the number of employees per company is low in the ports sector, this increase is not due to the establishment of one new company. The total number of companies remained relatively stable as well (from 25 to 24), which means that the existing companies attracted more employment or that new companies employed more workers than older companies. Although the overall location quotients were not that high for the port sector, a within comparison between the location quotients over time made clear that this sector was rapidly growing. I observed the highest growth rates in location quotients, with a growth rate of more than 40% for 3 of the 4 analyses. This is a positive sign for the maritime cluster in the Drechtcities, as this increase is within multiple companies. It also seems that the growing role of the port of Rotterdam in the port of Dordrecht did positively impact the ports sector.

*Water engineering*

The total sector saw an increase in location quotients, except for analysis 4 (port of Rotterdam). The waterfront in the Rotterdam port hosts water engineering companies as well, such as Van Oord or other branches of Boskalis, which makes the negative growth rate explainable. With Boskalis as leader firm, this sector is very dependent upon this company in terms of employment. The share of employees working at Boskalis in this sector remains stable around 83%, although the total number of workers increased rapidly in the last year as I mentioned in the previous section. The reason that the total number of workers did increase, but the share did not increase is because other companies were expanding as well. The total number of employees not working at Boskalis increased with 23.7% (from 296 to 366). Although this is still a relatively small number compared to the number of employees at Boskalis, it is a sign of a strengthening of the maritime cluster in this sector. The negative growth rate compared to the port of Rotterdam could be a threat, as there is a possibility that more jobs are moving into that direction.

*The importance of the leader firms*

This part will briefly describe the leader firms in a broader context. These firms employed 61.7% on average of the total workers in the whole maritime cluster. This share did not significantly increase or decrease in my timeframe, which is an indicator that the cluster had the same level of dependency on these three firms in 2017 as in 2010. In the years 2010-2017, the number of jobs at IHC decreased with 18.6%. The number of jobs at Damen remained relatively stable and the number of jobs at Boskalis grew. The location quotients for the sectors ship manufacturing and water engineering grew for three analyses, except with respect to the Port of Rotterdam. This figure could be worrying because the port of Rotterdam region can still be regarded as a competitor in terms of local employment. This holds in my opinion especially for the water engineering sector, as companies in this sector will be mainly active offshore or at an office. I believe that this type of work is easier to move than the shipyards at IHC and Damen. From a cluster perspective, I observed an increase in jobs not at Boskalis in the water engineering sector of 26% (72 jobs). The same is observed in the ship manufacturing sector. I observed an increase of 27% (134 jobs) over the years. The absolute increases in jobs are not that spectacular, but it is an indicator that the sectors profit from the existence of the leader firms in the region. Knowledge is attracted, which is spilled over to other companies. The share of employment compared to the total jobs in the maritime cluster declined from 2010 till 2016, from 63.7% till 58.9%. Due to the acquisition by Boskalis, this number increases in the last year. The trend over the first seven years however is positive in terms of dependency. Although the changes are relatively small, the dependency on the leader firms diminishes in terms of employment.

# 5. CONCLUSIONS

## 5.1 Conclusion

For hundreds of years, the maritime industry in the Drechtcities has been nationally and internationally known. Over the years, the port region has been intertwined with its adjacent cities. Other than in most port-cities, the port did not move away but remained in the territory of the municipalities of the Drechtcities. These Drechtcities are economically lagging compared to the rest of the Netherlands, which makes the region vulnerable. The maritime cluster is regarded as one of the pillars of the regional economy, upon which the region can grow. Due to its proximity to the cities, the port-city interface in the Drechtcities has a unique interface in the Netherlands. Over the years, the function of the ports obviously changed, and policy makers intended to enhance the port region to strengthen the regional economy.

Local policy makers also must deal with global and national trends. One of these trends is urbanization. An increasing pressure rest upon the shoulders of policy makers to create space for residential projects. This space can be found on abandoned quays in old port areas, this is a way of waterfront regeneration. Waterfront regeneration has been focused a lot on the urban perspective, favoring bricks over ports. Maritime companies and its workers could not benefit anymore from the regenerated area when the port is forgotten. Another challenge in the port-city interface is that urbanized regenerated quays will permanently function as a non-port area: this might lead to problems in the future when the water could be used for the circular economy for example.

The major challenge for policy makers in the port-city interface is to enhance the interactions within an existing maritime cluster in a port-city. This maritime clustering is one of the ways to reap benefits from a port-city relation as waterfront regeneration. In a maritime cluster, multiple companies depended on each other are active within a geographical scope. The port-city interface is also heavily impacted by the way ports operate. Ports have been dramatically changed over the years. Fully automated terminals, a few global players that operate the terminals and the environmental impact on its surroundings creates challenges for the city to reap benefits from the port: the port-city interface is under pressure. In this part, I will answer my research question and assess whether the effort of the Drechtcities regarding the port-city interface had the desired effect.

*To what extent did the evolution of ports and subsequent policy interventions regarding the port-city interface impact the maritime cluster of the Drechtcities in terms of employment and is the dependency on the leader firms in the maritime cluster in this region positive?*

To answer the research question, I will first discuss the port-city interface in the Drechtcities. Local and regional factors influence the port-city relation, this is observable in South-Holland as well. The port of Rotterdam is continuing to expand towards and into the North Sea, whereas the port region in the Drechtcities remained at its place. This creates an active port-city interface, an interactive economic system in the region. Although the port of Rotterdam is not entirely within the geographical scope of my research, its influence reaches till the Drechtcities. The main reason for that is that the port of Rotterdam gained significant interest in the seaport of Dordrecht since 2011. The theoretical influence of the port of Rotterdam stretches now from the North Sea till Dordrecht, but its actual influence is much wider.

Another major factor that defines the port-city interface in the Drechtcities is the proximity of the port region and the cities. Other than in Rotterdam, the port regions in the Drechtcities did not move away from the city centers. The geographical locations of the ports in the Drechtcities limit fallback options outside the city, as the ports are located inland. Second, the share of heavy industry (such as refineries) in maritime activities in the Drechtcities is low, which reduces negative externalities by the port.

Policy makers should take the position of the river ports in the Drechtcities into account as a move towards the sea is not viable for an inland river port. Waterfront regeneration from an urban perspective could endanger the maritime cluster as there is no viable fallback option for maritime activities. An urban perspective is not rare for policymakers, as I described in the literature review. Inland ports located on the river shore face other types of challenges than large seaports due to the different nature and scale of the ports and policy makers should be aware of this. These characteristics entail in my opinion that policy makers in the Drechtcities should strive for a port-city relation that is balanced: in the middle of the equilibrium of Durcuet and Lee (2006), with no clear winner for either port or city.

A third factor that defines the port-city interface in the Drechtcities is the maritime manufacturing cluster. This industry has a longstanding tradition in the region. The strengths of this cluster are that it has agglomeration advantages, it is knowledge based and there are high-tech leader companies. This presence of high-tech leader companies (leader firms) is also a weakness, as this means that the cluster could rely upon only a few companies in the region. Leader firms are in general beneficial for the entire cluster. These firms have a coordinative role in the cluster, they set the standards for the level of innovation and they improve networks through transfers of knowledge. Next to that, leader firms attract skilled personnel to the region. In the Drechtcities, I observed three leader firms: IHC, Damen and Boskalis. IHC and Damen are active in the ship manufacturing industry whereas Boskalis is active in the water engineering industry. To keep the leader firms within the region, policy makers should take their position into account.

Crossover effects for ports and cities are crucial in the port-city interface, ports generate employment for citizens. However, policy makers neglected these effects during spatial planning: ports and cities were treated separately which created biases. The focus on urban redevelopment has been dominant in the literature, but this view has been criticized as well, the port-city should be seen through a relational approach, by assessing the port-city as one network instead of two separate entities. This relational approach is explicitly applicable to the position of the Drechtcities due to its scale and proximity to the ports.

The foundation of a maritime cluster lies in maritime capital. Maritime capital is a broader term for other types of capital, such as human capital and social capital. I researched several policy interventions to see how these interventions attempted to regenerate the waterfronts within the port-city interface in the Drechtcities. I analyzed these interventions through the policy areas derived from the Dutch Maritime Strategy: an important vision document that outlines several policy areas to strengthen the maritime cluster. These policy areas are human capital, innovation, trade and accessibility. I derived the following conclusions from the policy interventions. First, the objectives were in a lot of cases based on regional measures. Especially the port-related policy interventions were focused on the Rotterdam maritime region, from the North Sea till Gorinchem. Initiatives as Rotterdam Maritime Capital are a good example of this trend towards a more regional approach of the port-city interface instead of a very local approach. Second, the policy area human capital was recurring in each policy intervention. This is not strange, as the lack of skilled personnel has been recognized as a weakness of the maritime cluster. The Dordrecht Academy and the Innovation Factory are examples of concrete effects of a focus on human capital, which is a very positive sign as this could enhance the maritime capital and the maritime cluster. Third, the need for innovation was also a recurring theme in the policy interventions. This could be because leader firms are pushing for more innovation, in line with the theory. The policy interventions touched upon the three policy tools depicted by Doloreux and Shearmur (2009) to strengthen the maritime cluster, namely cooperation with schools, technology hubs and tax cuts (mainly via subsidy for startups).

The quantitative part of my thesis further clarified the port-city relation in the Drechtcities. Using a timeframe of eight years (2010-2017), I could assess the employment per maritime sector at the waterfront in the Drechtcities. I measured the maritime activity in terms of jobs and number of companies to assess the maritime cluster. The maritime cluster was defined in five sectors: shipping, inland shipping, ports, ship manufacturing and water engineering. Using the LISA-database, I could obtain yearly employment data from companies active in those sectors within the waterfront area in the Drechtcities I selected. I used the location quotient to define the concentration of jobs in the maritime cluster, in relation to different regions as benchmarks. I used four different benchmarks in my analyses, the region of the Drechtcities (Corop 30), this region including Groot-Rijnmond (Corop 29 + 30), this region without the port of Rotterdam area (Corop 29 + 30 – port of Rotterdam) and the port of Rotterdam area alone. These analyses each gave meaningful insights in the strength of the maritime cluster compared to each region.

The maritime cluster in the Drechtcities can be defined as follows, using three aspects from the literature. The first aspect is its boundaries. There is a relational boundary and a spatial boundary. The relational boundary in the Drechtcities is the fact that the cluster is built upon ship manufacturing and water engineering companies, the share in employment of these two sectors is on average 77% compared to the whole maritime cluster. The spatial boundary is the waterfront area I depicted in section 3.2.1 Geographical scope). The second aspect is the structure of the network. The maritime cluster is depended upon three leader firms: IHC, Boskalis and Damen who employed 61.7% of the total workers in the whole maritime cluster. The third aspect is the plurality of the network. The network does not have a high degree of plurality, the share of jobs in the two “top” sectors water engineering and ship manufacturing increased slightly from 77.6% till 79.16% in the timeframe. However, the surge in jobs in the ports sector within the maritime cluster did improve the network. An argument that supports this proposition is the fact that employment in the subsector: forwarder, shipping agent, charter and other intermediaries increased with almost 70%. This is a typical subsector that defines a cluster and the pluralistic nature of the network, this subsector gives an indication of the indirect work that is coming from core port activities.

Regeneration of waterfronts has been widely used by policy makers to give the city a boost. The urban focus of most of the literature concerning this topic neglects the fact that interactions take place within a maritime cluster and that the loss of waterfront for maritime use is permanent (Van den Berghe, 2019). In my research, I analyzed to what extent policy interventions were contributing towards a stronger maritime cluster from a relational approach. This approach is not common nowadays, an example is the urban focused approach of the municipality of Amsterdam. The ports in the Drechtcities evolved in a different way than normal seaports as described by Hoyle (2000) due to its scale and location. The proximity of the cities to the ports creates a strong connection between the cities and its waterfronts. My analysis of policy interventions in this region confirms this view: the human capital pillar was the core of most policies, which creates benefits for maritime companies and the city. Examples as the Dordrecht Academy explicitly educate future workers in the maritime cluster. This is a sign that policy interventions are strengthening the maritime cluster. This also strengthens the port-city from a relational approach: the attraction and the retention of high-skilled workers in the region is beneficial for both city and port. The positive growth of location quotients for all analyses also gives an indication that this focus on human capital paid off. Overall, the factor human capital in terms of absolute employment is not so positive. However, absolute numbers should be put in perspective. As I already mentioned before, the factor human capital also entails the economic added value of a worker. An absolute decline in jobs thus not necessarily mean that the human capital factor has not been strengthened.

The negative rates of the shipping sector are not a major concern, because the shipping sector is a relatively small industry in the Drechtcities and the lower number of subscribed vessels within the Drechtcities does not mean per se that the shipping activity between ports in the region decreases.

It is hard to assess what would have happened if no policy interventions regarding human capital took place. It is likely that the total number of jobs would have been less, as the maritime industry is highly competitive. More likely is that this effect would be observable in the long-term, as most interventions are long-term focused, such as schooling and reschooling. A lack of policy interventions could also deteriorate the relationship between the region and the leader firms. Leader firms are at the forefront of innovation and consequently are in need for skilled workers. A lack of ambition from the municipalities in this area could lead to a separation between the leader firm and the municipality and ultimately the departure of a leader firm. The continuous push for more human capital in the region is therefore in my opinion a good choice. The Deal Drecht Cities is a good example of a unified approach between port and city in the Drechtcities. In a highly competitive, regionalized area, a neglection of the factor human capital could lead to a brain drain and this could seriously harm the region in terms of employment.

Three leader firms operate in the Drechtcities: IHC, Damen and Boskalis. The globalization trend endangers the continuity of especially the ship manufacturing sector in West-Europe. The refinancing operation of IHC was a clear example of the vulnerability of a leader firm. We have seen that the cluster is not very pluralistic. The figures however show that there is job growth in other companies within the sectors of the leader firms and the share of total jobs at leader firms decreases. A leader firm coordinates innovation, enhances a maritime cluster and it is a job motor for the region. On the other hand, an overdependency on leader firms makes a region vulnerable for economic shocks. At the moment, the leader firms have a very positive effect on the maritime cluster in the region, in terms of employment. The importance of the companies in the region is immense, with more than 60% of the total workers in the maritime cluster employed at these three companies. Next to that, the leader firms have a guiding role in product innovation in the region (Langerak, Kuipers & Manshanden, 2017). However, policy makers should not take this situation as permanent. Although policy makers will not have a huge impact in disruptive company decisions relating to the economic situation or takeovers for example, policy makers can still prepare for this situation. I believe there are two ways to do so. At first, policy makers should strive to make the region essential for the firm. Some steps are taken in this aspect, such as the opening of educational institutions. Second, policy makers should strive to make the cluster more pluralistic to become more resilient when a company decides to leave or goes bankrupt. A good sign is the growing activity in the port sector, a different sector than the leader firms. A complete pluralistic network is not realistic in the Drechtcities, considering its location and its industry. Policy makers should however not lose sight on the other companies that are active in these sectors, as these companies could function as a backup in the maritime cluster. Overall, I believe that the current situation of the leader firms is very positive for the region, but policy makers should be prepared for the future.

In this thesis, I analyzed the port-city interface in the Drechtcities from a qualitative and quantitative perspective. Quantitative analyses in this research area are relatively scarce phenomenon. The Drechtcities are a remarkable area in the Netherlands because of their longstanding tradition with port activities. Trends and developments of the last years made the ports evolve and challenged the port-city interface in the region. The existence of leader firms in the region creates a strong maritime cluster, but the attraction of human capital remains essential for the region to keep the leader firms within the region. The focus on human capital in the policy interventions seems to be beneficial for both city and port, when looking at the number of jobs at different sectors. When the cities and companies will start to reap the benefits from the reopened educational institutions, policy makers should be aware that there is an alternative way of waterfront regeneration. It is not necessary to build high-end penthouses at a waterfront to attract high skilled workers, but a holistic view and subsequent policy interventions focused on the strengthening of an existing industrial cluster can be an alternative. This lesson can be advantageous for every region because the already existing clusters of companies can be strengthened, and this way of regeneration does not limit the waterfront space further for maritime companies. I am aware that this way of regeneration will not hold for all waterfront areas, for example for waterfront areas where there is no maritime activity left. The scale, the inland location and the existence of leader firms in the Drechtcities create an opportunity to regenerate the waterfront area through the maritime cluster and enhance the port-city relation from both perspectives. The policy makers in the Drechtcities did understand this.

## 5. 2 Limitations

In this part, I will discuss some limitations that I faced during my research and that will put the results into the right perspective. At first, the timeframe I researched, from 2010 till 2017, was relatively short. There is always a lag between an event and its consequences. This is also the case in my research. To assess the maritime cluster, I measured the maritime activity in jobs. The number of jobs at a firm is more inelastic than the actual economic output of a firm, due to contracts and legislation for example. I tried to assess the main trends of maritime activity in job numbers instead of year-on-year comparisons. Some of the policy interventions took place in the last years of my timeframe. Therefore, the actual consequences of these policy interventions are hard to assess. This is especially the case for policy interventions focused on innovation and education, as these are long-term projects.

I measured the maritime activity in terms of jobs. This is a narrow approach to measure maritime activity in a cluster. I did not measure the human capital factor in terms of economic added value. Looking at my results, I believe that the number of jobs gives a good indicator of the maritime activity in the region. The limitation using this variable is that I did not measure economic added value of the maritime cluster due to the available data. The total activity measured in economic output could be unaffected by a decline in jobs, due to innovation or efficiency gains. Although I believe that the job indicator is highly explanatory for the port-city relation as the region reaps benefits from more employment, the conclusion about the strength of the maritime cluster in an economic view should be put into perspective. It does not tell the whole story as it leaves the economic added value out of scope. The job indicator is also a bit narrow when it comes to defining the leader firms. Therefore, I made use of earlier research to define the leader firms. I included Damen in the leader firms because this firm was comparable with IHC in terms of jobs. In my research, I did not measure the rate of innovation at companies or as a cluster, I focused on maritime activity. Clusters and leader firms are many times defined in terms of innovation rate in the literature, this was beyond the scope of my research.

The LISA database is a complete overview of the companies within a Corop region, but some things must be considered. The definition of jobs was not specified in FTE's, what means that the number of jobs should not be seen as the number of FTE's working at a firm. Because I compared the same variable between regions, I believe that the results did not lose their explanatory value. The LISA database obtains its variables by interviewing the companies. The number of jobs at a company is not a number that is publicly available, so interviewing is the best option there is. However, this could lead to reporting issues. Some companies might fail to adequately record the number of jobs at their company. Because I analyzed most of the companies as a sector or as a whole cluster, I do not think that a wrongful report of one company affected my results. The number of jobs could suddenly increase by an acquisition, as was the case for Boskalis. When jobs are transferred to the location of the acquiring firm, this does positively impact the maritime cluster. However, this does not always have to be the case after an acquisition, so the reported change in jobs could also be a more theoretical change.

My research was focused upon maritime activity in terms of jobs, due to the available data and in line with earlier research. Maritime clusters are also defined in the way companies interact with each other and companies are interconnected. I did not include this in my analysis. To assess the strength of the whole maritime cluster, an assessment of the interactions between companies would be useful. I also excluded the role of leader firms in the cluster as head of a production chain, as this is beyond the scope of my research. Lastly, my research was only focused on the employment side of the port-city interface. I did not analyze the environmental impact or other factors such as noise pollution of the maritime cluster on the Drechtcities. These factors could impact the port-city interface, mainly from the view of the citizens. This was not within the scope of my study.

## 5. 3 Further research

The Drechtcities are an interesting area for further research. Due to the scope of my research, I could not touch upon all the areas in the maritime cluster of the Drechtcities. Firstly, a research with a wider timeframe would be useful to assess the competitivity of the Drechtcities over a longer time. Next, including innovation variables in research would be beneficial to measure the value of the maritime cluster in another way than in maritime activity. Future research in the role of the reopened educational institutions for the maritime cluster would give interesting insights in the effectiveness of policy interventions as well. An analysis of the port-city interface of the water engineering or ship manufacturing sectors in the Drechtcities, with an in-depth research of the leader firms would give meaningful insights in the strength of the maritime cluster on the long term. Therefore, private data from these companies should be used. An interview-based research focused on the future position of the leader firms in the region would be helpful to assess the resilience of the region. To further assess the maritime cluster, a background study to all non-maritime companies active in the maritime cluster would be interesting. Next to that, a study that measures the interaction effects within the maritime cluster would give meaningful insights as well.

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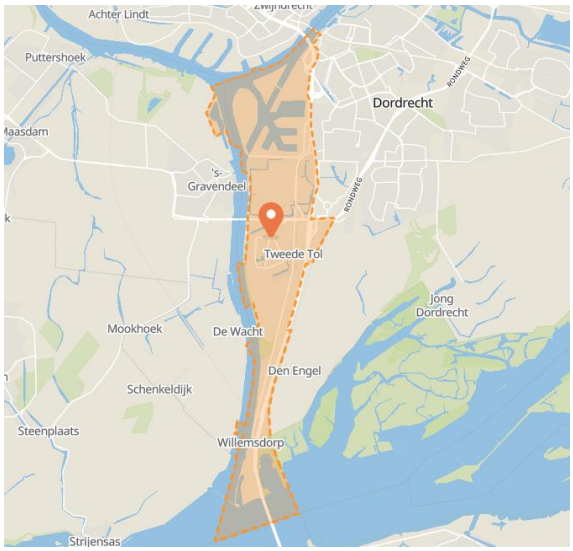
# APPENDIX

## Postal areas

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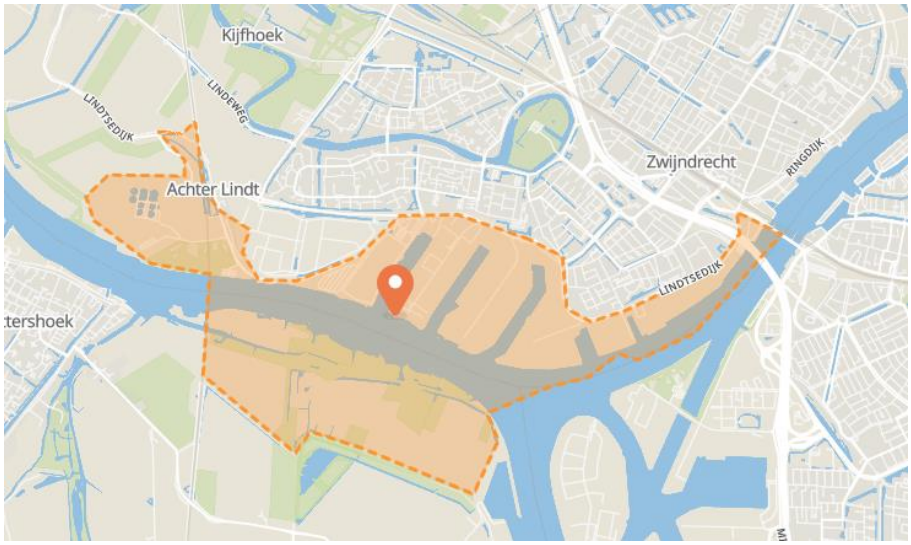
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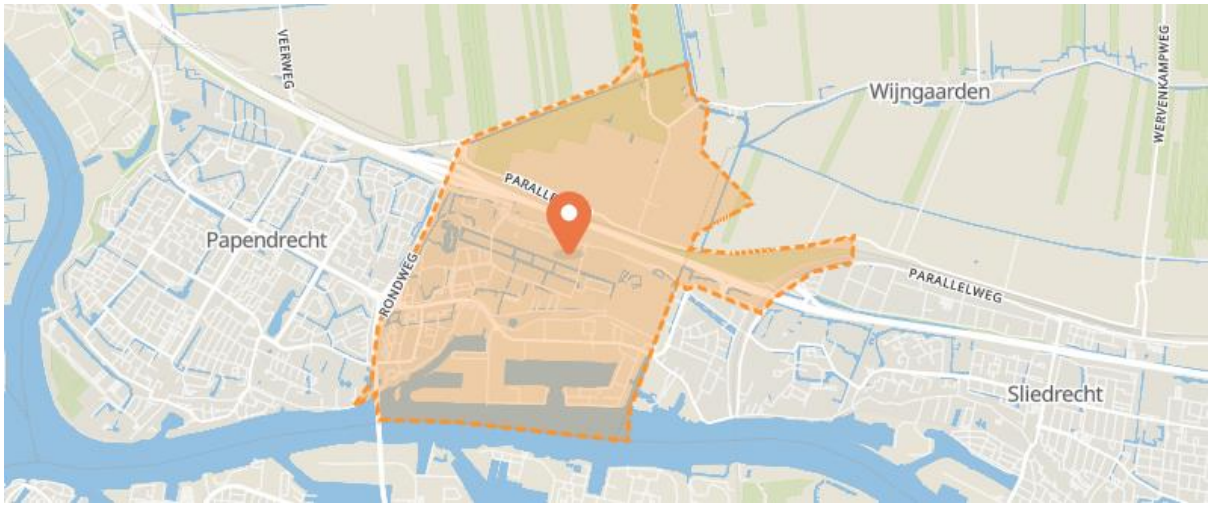
LINDEWEG
Achter Lindt
Zwijndrecht
RINGDIJK
LINDTSEDIJK
tershoek

4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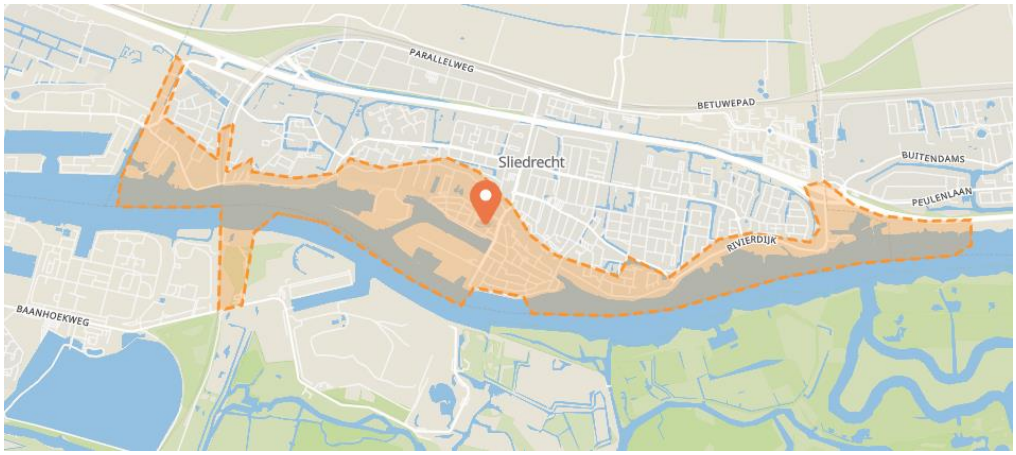
WERVENKAMPWEG
Papendrecht
RONDWEG
PARALLELWEG
Sliedrecht

5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Sliedrecht
BUITENDAMS
PEULENLAAN
RIVIERDIJK
BAANHOEKWEG

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7

## Descriptive statistics

| Jobs | Shipping | Ship manufacturing | Inland shipping | Ports | Water engineering | Total |
|---|---|---|---|---|---|---|
| **2010** | 387 | 2484 | 310 | 536 | 1780 | 5497 |
| **2011** | 238 | 2442 | 288 | 559 | 1677 | 5204 |
| **2012** | 252 | 2365 | 273 | 567 | 1697 | 5154 |
| **2013** | 246 | 2270 | 286 | 651 | 1476 | 4929 |
| **2014** | 248 | 2257 | 288 | 766 | 1515 | 5074 |
| **2015** | 306 | 2493 | 295 | 789 | 1683 | 5566 |
| **2016** | 134 | 2471 | 249 | 817 | 1692 | 5363 |
| **2017** | 140 | 2370 | 235 | 838 | 2238 | 5821 |

| companies | Shipping | Ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 6 | 32 | 48 | 46 | 8 |
| **2011** | 5 | 32 | 49 | 47 | 8 |
| **2012** | 6 | 31 | 53 | 43 | 8 |
| **2013** | 3 | 28 | 57 | 46 | 7 |
| **2014** | 2 | 28 | 61 | 50 | 9 |
| **2015** | 3 | 27 | 61 | 48 | 9 |
| **2016** | 4 | 26 | 55 | 54 | 8 |
| **2017** | 4 | 26 | 51 | 52 | 8 |

| Jobs/company | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 65 | 78 | 6 | 12 | 223 |
| **2011** | 48 | 76 | 6 | 12 | 210 |
| **2012** | 42 | 76 | 5 | 13 | 212 |
| **2013** | 82 | 81 | 5 | 14 | 211 |
| **2014** | 124 | 81 | 5 | 15 | 168 |
| **2015** | 102 | 92 | 5 | 16 | 187 |
| **2016** | 34 | 95 | 5 | 15 | 212 |

| | | | | | |
|---|---|---|---|---|---|
| **2017** | 35 | 91 | 5 | 16 | 280 |

Jobs per SBI-code in the waterfront region

| jobs | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|
| **3011** | 2400 | 2362 | 2281 | 2169 | 2139 | 2364 | 2354 | 2267 |
| **3012** | 12 | 13 | 15 | 14 | 11 | 16 | 15 | 15 |
| **3315** | 72 | 67 | 69 | 87 | 107 | 113 | 102 | 88 |
| **4291** | 1780 | 1677 | 1697 | 1476 | 1515 | 1683 | 1692 | 2238 |
| **50201** | 382 | 233 | 247 | 246 | 248 | 306 | 73 | 70 |
| **50202** | 5 | 5 | 5 | | | | 61 | 70 |
| **5030** | 13 | 14 | 15 | 15 | 15 | 4 | 4 | 13 |
| **50401** | 185 | 166 | 170 | 184 | 170 | 173 | 170 | 150 |
| **50402** | 48 | 37 | 24 | 28 | 29 | 37 | 37 | 36 |
| **50403** | 64 | 71 | 64 | 59 | 74 | 81 | 38 | 36 |
| **52101** | 80 | 85 | 120 | 175 | 49 | 52 | 54 | 54 |
| **52102** | 6 | 8 | 8 | 8 | 10 | 9 | 12 | 14 |
| **52109** | 28 | 32 | 14 | 17 | 197 | 169 | 170 | 161 |
| **5222** | 8 | 12 | 14 | 32 | 41 | 37 | 44 | 44 |
| **52241** | 1 | 1 | 1 | 1 | 1 | 1 | | |
| **52242** | 137 | 141 | 140 | 143 | 151 | 99 | 110 | 96 |
| **52291** | 276 | 280 | 270 | 275 | 317 | 422 | 427 | 469 |
| **Total** | 5497 | 5204 | 5154 | 4929 | 5074 | 5566 | 5363 | 5821 |

Companies per SBI code in the waterfront region

| companies | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|
| **3011** | 21 | 20 | 19 | 15 | 13 | 13 | 13 | 14 |
| **3012** | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| **3315** | 9 | 9 | 8 | 9 | 11 | 10 | 9 | 8 |
| **4291** | 8 | 8 | 8 | 7 | 9 | 9 | 8 | 8 |
| **50201** | 5 | 4 | 5 | 3 | 2 | 3 | 3 | 3 |
| **50202** | 1 | 1 | 1 | | | | 1 | 1 |
| **5030** | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3 |
| **50401** | 38 | 38 | 39 | 42 | 45 | 45 | 41 | 37 |
| **50402** | 2 | 1 | 4 | 5 | 6 | 7 | 7 | 7 |
| **50403** | 5 | 7 | 6 | 6 | 6 | 6 | 4 | 4 |
| **52101** | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 |
| **52102** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **52109** | 6 | 8 | 5 | 7 | 8 | 8 | 9 | 10 |
| **5222** | 2 | 2 | 3 | 4 | 6 | 5 | 9 | 9 |
| **52241** | 1 | 1 | 1 | 1 | 1 | 1 | | |
| **52242** | 7 | 7 | 7 | 7 | 7 | 5 | 5 | 6 |
| **52291** | 25 | 24 | 22 | 22 | 25 | 26 | 28 | 24 |
| **Total** | 140 | 141 | 141 | 141 | 150 | 148 | 147 | 141 |

# Calculations Location quotient

| Analysis 1: JOBS LQ Corop 30 | total jobs waterfront | maritime jobs waterfront | total jobs | maritime jobs total | share maritime jobs maritime region | share maritime jobs total | LQ |
|---|---|---|---|---|---|---|---|
| 2010 | 38283 | 5497 | 183561 | 9887 | 0,14 | 0,05 | 2,67 |
| 2011 | 37684 | 5204 | 186685 | 9613 | 0,14 | 0,05 | 2,68 |
| 2012 | 37682 | 5154 | 185211 | 9453 | 0,14 | 0,05 | 2,68 |
| 2013 | 36928 | 4929 | 183631 | 8699 | 0,13 | 0,05 | 2,82 |
| 2014 | 36255 | 5074 | 180518 | 8790 | 0,14 | 0,05 | 2,87 |
| 2015 | 36643 | 5566 | 179528 | 9449 | 0,15 | 0,05 | 2,89 |
| 2016 | 36679 | 5363 | 184433 | 9411 | 0,15 | 0,05 | 2,87 |
| 2017 | 36682 | 5821 | 187227 | 9669 | 0,16 | 0,05 | 3,07 |

| Analysis 1: Companies LQ Corop 30 | total companies waterfront | maritime companies waterfront | total companies | maritime companies total | share maritime companies maritime region | share maritime companies total | LQ |
|---|---|---|---|---|---|---|---|
| 2010 | 2272 | 140 | 23585 | 979 | 0,06 | 0,04 | 1,48 |
| 2011 | 2352 | 141 | 24883 | 995 | 0,06 | 0,04 | 1,50 |
| 2012 | 2385 | 141 | 25346 | 988 | 0,06 | 0,04 | 1,52 |
| 2013 | 2386 | 141 | 25279 | 971 | 0,06 | 0,04 | 1,54 |
| 2014 | 2423 | 150 | 25697 | 965 | 0,06 | 0,04 | 1,65 |
| 2015 | 2443 | 148 | 25801 | 975 | 0,06 | 0,04 | 1,60 |
| 2016 | 2509 | 147 | 28084 | 985 | 0,06 | 0,04 | 1,67 |
| 2017 | 2527 | 141 | 29167 | 969 | 0,06 | 0,03 | 1,68 |

| Analysis 2: Jobs LQ Corop 29 + 30 | total jobs waterfront | maritime jobs waterfront | total jobs | maritime jobs total | share maritime jobs maritime region | share maritime jobs total | LQ |
|---|---|---|---|---|---|---|---|
| 2010 | 38283 | 5497 | 832791 | 41940 | 0,14 | 0,05 | 2,85 |
| 2011 | 37684 | 5204 | 840568 | 40933 | 0,14 | 0,05 | 2,84 |
| 2012 | 37682 | 5154 | 839965 | 40753 | 0,14 | 0,05 | 2,82 |
| 2013 | 36928 | 4929 | 835499 | 39912 | 0,13 | 0,05 | 2,79 |
| 2014 | 36255 | 5074 | 827808 | 40273 | 0,14 | 0,05 | 2,88 |
| 2015 | 36643 | 5566 | 826098 | 41210 | 0,15 | 0,05 | 3,04 |
| 2016 | 36679 | 5363 | 846239 | 41780 | 0,15 | 0,05 | 2,96 |
| 2017 | 36682 | 5821 | 858561 | 41546 | 0,16 | 0,05 | 3,28 |

| Analysis 2: companies LQ Corop 29 + 30 | total companies waterfront | maritime companies waterfront | total companies | maritime companies total | share maritime companies maritime region | share maritime companies total | LQ |
|---|---|---|---|---|---|---|---|
| 2010 | 2272 | 132 | 104602 | 3025 | 0,06 | 0,03 | 2,01 |
| 2011 | 2352 | 133 | 110408 | 3086 | 0,06 | 0,03 | 2,02 |
| 2012 | 2385 | 133 | 113460 | 3048 | 0,06 | 0,03 | 2,08 |
| 2013 | 2386 | 134 | 114780 | 3008 | 0,06 | 0,03 | 2,14 |
| 2014 | 2423 | 141 | 118134 | 2993 | 0,06 | 0,03 | 2,30 |
| 2015 | 2443 | 139 | 119203 | 2988 | 0,06 | 0,03 | 2,27 |
| 2016 | 2509 | 139 | 129620 | 3029 | 0,06 | 0,02 | 2,37 |
| 2017 | 2527 | 133 | 136408 | 3012 | 0,05 | 0,02 | 2,38 |

| Analysis 3: Jobs LQ Corop 29 + 30 ex. PoR | total jobs waterfront | maritime jobs waterfront | total jobs | maritime jobs total | share maritime jobs maritime region | share maritime jobs total | LQ |
|---|---|---|---|---|---|---|---|
| 2010 | 38283 | 5497 | 767201 | 20138 | 0,14 | 0,03 | 5,47 |
| 2011 | 37684 | 5204 | 775757 | 19714 | 0,14 | 0,03 | 5,43 |
| 2012 | 37682 | 5154 | 776206 | 19754 | 0,14 | 0,03 | 5,37 |
| 2013 | 36928 | 4929 | 771325 | 18766 | 0,13 | 0,02 | 5,49 |
| 2014 | 36255 | 5074 | 763336 | 18604 | 0,14 | 0,02 | 5,74 |
| 2015 | 36643 | 5566 | 765144 | 19374 | 0,15 | 0,03 | 6,00 |
| 2016 | 36679 | 5363 | 784244 | 19235 | 0,15 | 0,02 | 5,96 |
| 2017 | 36682 | 5821 | 796744 | 19424 | 0,16 | 0,02 | 6,51 |

| Analysis 3: companies LQ Corop 29 + 30 ex. PoR | total companies waterfront | maritime companies waterfront | total companies | maritime companies total | share maritime companies maritime region | share maritime companies total | LQ |
|---|---|---|---|---|---|---|---|
| 2010 | 2272 | 132 | 101684 | 2012 | 0,06 | 0,02 | 2,94 |
| 2011 | 2352 | 133 | 107469 | 2065 | 0,06 | 0,02 | 2,94 |
| 2012 | 2385 | 133 | 110488 | 2071 | 0,06 | 0,02 | 2,98 |
| 2013 | 2386 | 134 | 111791 | 2046 | 0,06 | 0,02 | 3,07 |
| 2014 | 2423 | 141 | 115103 | 2032 | 0,06 | 0,02 | 3,30 |
| 2015 | 2443 | 139 | 116161 | 2027 | 0,06 | 0,02 | 3,26 |
| 2016 | 2509 | 139 | 126391 | 2064 | 0,06 | 0,02 | 3,39 |
| 2017 | 2527 | 133 | 133063 | 2047 | 0,05 | 0,02 | 3,42 |

| Analysis 4: jobs LQ PoR | total jobs waterfront | maritime jobs waterfront | total jobs | maritime jobs total | share maritime jobs maritime region | share maritime jobs total | LQ |
|---|---|---|---|---|---|---|---|
| 2010 | 38283 | 5497 | 65590 | 12531 | 0,14 | 0,19 | 0,75 |
| 2011 | 37684 | 5204 | 64811 | 11842 | 0,14 | 0,18 | 0,76 |
| 2012 | 37682 | 5154 | 63759 | 11662 | 0,14 | 0,18 | 0,75 |
| 2013 | 36928 | 4929 | 64174 | 11550 | 0,13 | 0,18 | 0,74 |
| 2014 | 36255 | 5074 | 64472 | 12206 | 0,14 | 0,19 | 0,74 |
| 2015 | 36643 | 5566 | 60954 | 11971 | 0,15 | 0,20 | 0,77 |
| 2016 | 36679 | 5363 | 61995 | 12569 | 0,15 | 0,20 | 0,72 |
| 2017 | 36682 | 5821 | 61817 | 12112 | 0,16 | 0,20 | 0,81 |

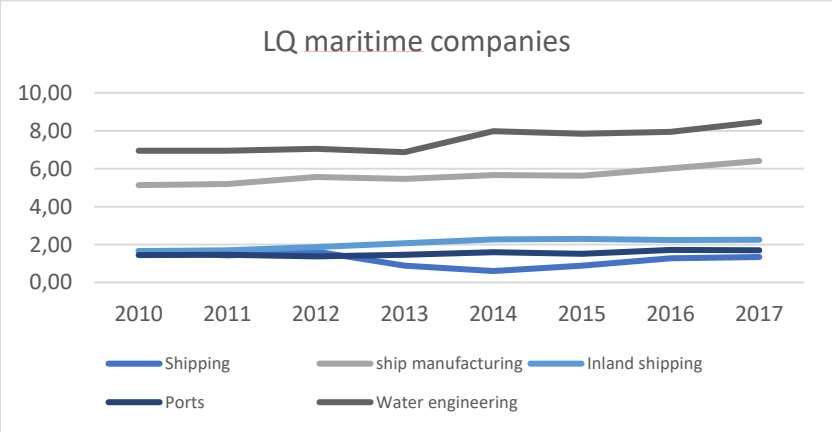
| Analysis 4: companies LQ PoR | total companies waterfront | maritime companies waterfront | total companies | maritime companies total | share maritime companies maritime region | share maritime companies total | LQ |
|---|---|---|---|---|---|---|---|
| 2010 | 2272 | 132 | 2918 | 193 | 0,06 | 0,07 | 0,88 |
| 2011 | 2352 | 133 | 2939 | 191 | 0,06 | 0,06 | 0,87 |
| 2012 | 2385 | 133 | 2972 | 189 | 0,06 | 0,06 | 0,88 |
| 2013 | 2386 | 134 | 2989 | 181 | 0,06 | 0,06 | 0,93 |
| 2014 | 2423 | 141 | 3031 | 185 | 0,06 | 0,06 | 0,95 |
| 2015 | 2443 | 139 | 3042 | 182 | 0,06 | 0,06 | 0,95 |
| 2016 | 2509 | 139 | 3229 | 184 | 0,06 | 0,06 | 0,97 |
| 2017 | 2527 | 133 | 3345 | 179 | 0,05 | 0,05 | 0,98 |

## Analysis 1

| Jobs | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 2,63 | 3,52 | 0,66 | 1,93 | 3,74 |
| **2011** | 2,09 | 3,72 | 0,63 | 1,94 | 3,80 |
| **2012** | 2,16 | 3,78 | 0,60 | 1,95 | 3,73 |
| **2013** | 2,11 | 3,97 | 0,64 | 2,12 | 4,53 |
| **2014** | 2,16 | 3,96 | 0,65 | 2,32 | 4,53 |
| **2015** | 2,49 | 3,98 | 0,64 | 2,10 | 4,50 |
| **2016** | 1,54 | 4,09 | 0,53 | 2,18 | 4,63 |
| **2017** | 1,75 | 4,15 | 0,52 | 2,28 | 4,92 |
| Average | 2,12 | 3,90 | 0,61 | 2,10 | 4,30 |

| Companies | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 1,68 | 3,46 | 0,79 | 2,44 | 3,77 |
| **2011** | 1,47 | 3,39 | 0,81 | 2,43 | 3,85 |
| **2012** | 1,68 | 3,58 | 0,88 | 2,23 | 4,05 |
| **2013** | 0,88 | 3,41 | 0,97 | 2,30 | 3,90 |
| **2014** | 0,62 | 3,37 | 1,05 | 2,45 | 4,55 |
| **2015** | 0,91 | 3,32 | 1,04 | 2,30 | 4,32 |
| **2016** | 1,28 | 3,55 | 0,98 | 2,61 | 4,26 |
| **2017** | 1,32 | 3,85 | 0,98 | 2,44 | 5,13 |
| Average | 1,23 | 3,49 | 0,94 | 2,40 | 4,23 |

## Analysis 2



| Jobs | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 1,47021008 | 11,0218254 | 1,72028721 | 0,38216794 | 12,458312 |
| **2011** | 0,99415366 | 11,1302734 | 1,59709215 | 0,41958832 | 12,558856 |
| **2012** | 1,02425628 | 10,9935021 | 1,5237992 | 0,42907822 | 12,4574112 |
| **2013** | 1,03837675 | 10,3783887 | 1,63649522 | 0,49985713 | 12,8729987 |
| **2014** | 1,0374287 | 10,2015333 | 1,70543888 | 0,58854503 | 12,9604826 |
| **2015** | 1,2487062 | 10,3188541 | 1,75558494 | 0,59541514 | 12,4098332 |
| **2016** | 0,59846209 | 10,7071833 | 1,55836045 | 0,60743706 | 12,8435296 |
| **2017** | 0,78187483 | 10,9090669 | 1,48869578 | 0,62448064 | 13,6665525 |

| Companies | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 1,7254302 | 7,17663212 | 2,61317063 | 1,33902774 | 12,4030925 |
| **2011** | 1,4662367 | 7,41149963 | 2,68743715 | 1,35209295 | 12,12089 |
| **2012** | 1,67932152 | 8,06547377 | 2,9578382 | 1,2811598 | 11,8224235 |
| **2013** | 0,9075217 | 7,95685692 | 3,29448555 | 1,38040101 | 11,4163599 |
| **2014** | 0,60555261 | 8,5455584 | 3,67636441 | 1,50314477 | 13,7339331 |
| **2015** | 0,91029764 | 8,53121924 | 3,80453925 | 1,4382132 | 13,7637004 |
| **2016** | 1,30544234 | 9,14944807 | 3,77250711 | 1,63204666 | 14,076074 |
| **2017** | 1,39141209 | 9,59469383 | 3,83069294 | 1,62621929 | 13,580182 |

| jobs | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 1,52 | 5,58 | 1,20 | 0,45 | 5,97 |
| **2011** | 1,07 | 5,73 | 1,13 | 0,50 | 6,05 |
| **2012** | 1,10 | 5,74 | 1,08 | 0,51 | 6,00 |
| **2013** | 1,11 | 5,72 | 1,16 | 0,59 | 6,52 |
| **2014** | 1,11 | 5,70 | 1,19 | 0,68 | 6,57 |
| **2015** | 1,32 | 5,72 | 1,21 | 0,68 | 6,42 |
| **2016** | 0,67 | 5,89 | 1,05 | 0,70 | 6,61 |
| **2017** | 0,86 | 5,99 | 1,02 | 0,72 | 6,93 |

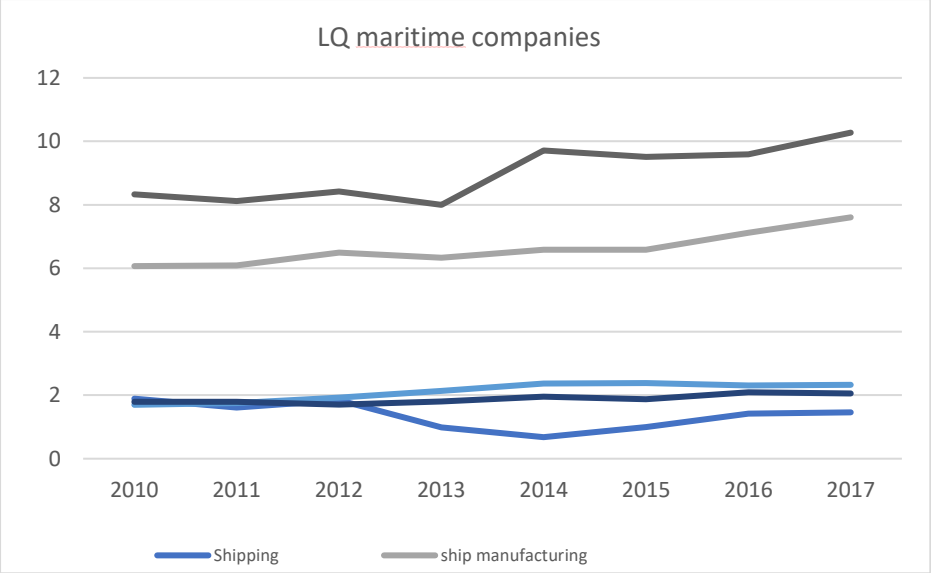
| Companies | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 1,65 | 5,13 | 1,66 | 1,44 | 6,95 |
| **2011** | 1,42 | 5,20 | 1,70 | 1,46 | 6,95 |
| **2012** | 1,62 | 5,57 | 1,86 | 1,37 | 7,05 |
| **2013** | 0,89 | 5,45 | 2,06 | 1,47 | 6,87 |
| **2014** | 0,60 | 5,66 | 2,27 | 1,59 | 7,98 |
| **2015** | 0,89 | 5,63 | 2,30 | 1,52 | 7,84 |

| | | | | | |
|---|---|---|---|---|---|
| **2016** | 1,27 | 6,02 | 2,24 | 1,72 | 7,95 |
| **2017** | 1,34 | 6,41 | 2,26 | 1,70 | 8,47 |

## Analysis 3

| jobs | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 2,11 | 7,61 | 1,33 | 0,80 | 7,61 |
| **2011** | 1,50 | 7,84 | 1,24 | 0,86 | 7,70 |
| **2012** | 1,61 | 7,84 | 1,20 | 0,87 | 7,65 |
| **2013** | 1,61 | 7,84 | 1,30 | 1,00 | 8,47 |
| **2014** | 1,75 | 7,81 | 1,34 | 1,17 | 9,15 |
| **2015** | 2,01 | 7,91 | 1,35 | 1,15 | 9,16 |
| **2016** | 1,02 | 8,32 | 1,16 | 1,19 | 9,45 |
| **2017** | 1,14 | 8,44 | 1,06 | 1,25 | 9,98 |

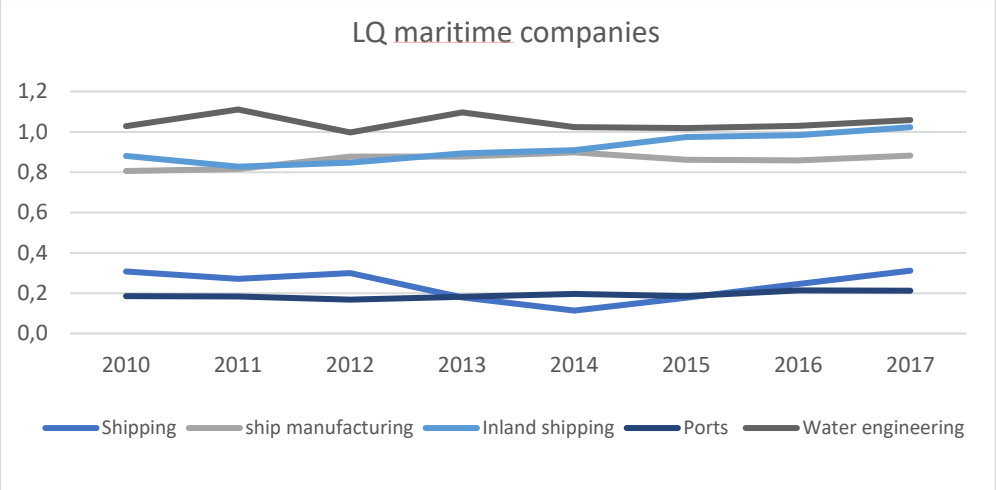
| companies | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 1,89 | 6,07 | 1,70 | 1,79 | 8,33 |
| **2011** | 1,61 | 6,09 | 1,75 | 1,80 | 8,12 |
| **2012** | 1,84 | 6,50 | 1,93 | 1,70 | 8,42 |
| **2013** | 0,99 | 6,34 | 2,13 | 1,81 | 8,00 |
| **2014** | 0,68 | 6,58 | 2,37 | 1,95 | 9,72 |
| **2015** | 1,00 | 6,58 | 2,38 | 1,87 | 9,51 |
| **2016** | 1,42 | 7,12 | 2,31 | 2,09 | 9,60 |
| **2017** | 1,46 | 7,61 | 2,33 | 2,06 | 10,27 |




## Analysis 4

| jobs | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 0,35 | 1,35 | 0,56 | 0,08 | 1,70 |
| **2011** | 0,24 | 1,36 | 0,53 | 0,08 | 1,70 |
| **2012** | 0,23 | 1,35 | 0,49 | 0,08 | 1,66 |
| **2013** | 0,23 | 1,35 | 0,50 | 0,10 | 1,74 |
| **2014** | 0,21 | 1,36 | 0,53 | 0,12 | 1,52 |
| **2015** | 0,25 | 1,28 | 0,52 | 0,11 | 1,35 |
| **2016** | 0,13 | 1,26 | 0,46 | 0,11 | 1,38 |
| **2017** | 0,21 | 1,26 | 0,66 | 0,11 | 1,41 |

| companies | Shipping | ship manufacturing | Inland shipping | Ports | Water engineering |
|---|---|---|---|---|---|
| **2010** | 0,31 | 0,81 | 0,88 | 0,18 | 1,03 |
| **2011** | 0,27 | 0,82 | 0,83 | 0,18 | 1,11 |
| **2012** | 0,30 | 0,88 | 0,85 | 0,17 | 1,00 |
| **2013** | 0,18 | 0,88 | 0,89 | 0,18 | 1,10 |
| **2014** | 0,11 | 0,90 | 0,91 | 0,20 | 1,02 |
| **2015** | 0,18 | 0,86 | 0,97 | 0,19 | 1,02 |
| **2016** | 0,25 | 0,86 | 0,98 | 0,21 | 1,03 |
| **2017** | 0,31 | 0,88 | 1,02 | 0,21 | 1,06 |




## Leader firms

| IHC sum | IHC Beaver Dredgers BV | IHC Global Productions BV | IHC Handling Systems VOF | IHC Holland BV | IHC Merwede Holding BV (Hoofdkantoor) | IHC Parts & Services BV | IHC Offshore Systems BV | Total |
|---|---|---|---|---|---|---|---|---|
| **2010** | 239 | 56 | 54 | 397 | 61 | 465 | 12 | 1284 |
| **2011** | 249 | 56 | | 419 | 76 | 437 | 11 | 1248 |
| **2012** | 254 | 48 | | 459 | 94 | 314 | 15 | 1184 |
| **2013** | 237 | 42 | | 488 | 178 | 202 | | 1147 |
| **2014** | | 37 | | 675 | 199 | 180 | | 1091 |
| **2015** | | 33 | | 597 | 270 | 169 | | 1069 |
| **2016** | | 33 | | 591 | 268 | 170 | | 1062 |
| **2017** | | 33 | | 586 | 265 | 161 | | 1045 |

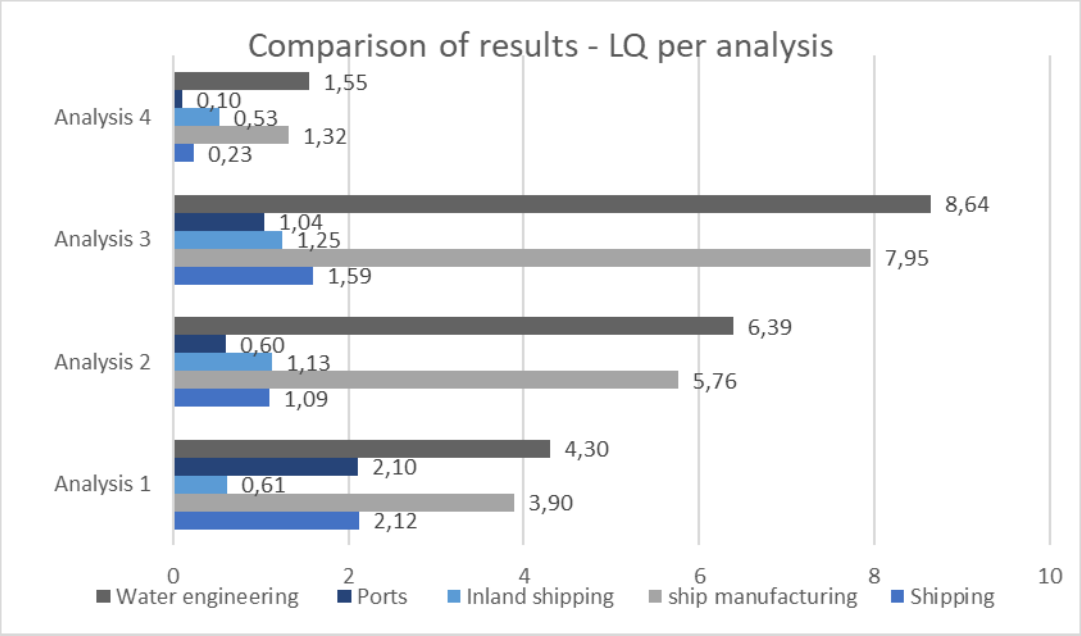
| | Baggermaatschappij Boskalis BV | Boskalis Offshore Subsea Contracting B.V. | Total |
|---|---|---|---|
| **2010** | 1484 | 21 | 1505 |
| **2011** | 1383 | 21 | 1404 |
| **2012** | 1385 | 21 | 1406 |
| **2013** | 1203 | 20 | 1223 |
| **2014** | 1179 | 20 | 1199 |
| **2015** | 1328 | 20 | 1348 |
| **2016** | 1320 | 20 | 1340 |
| **2017** | 1872 | 19 | 1891 |

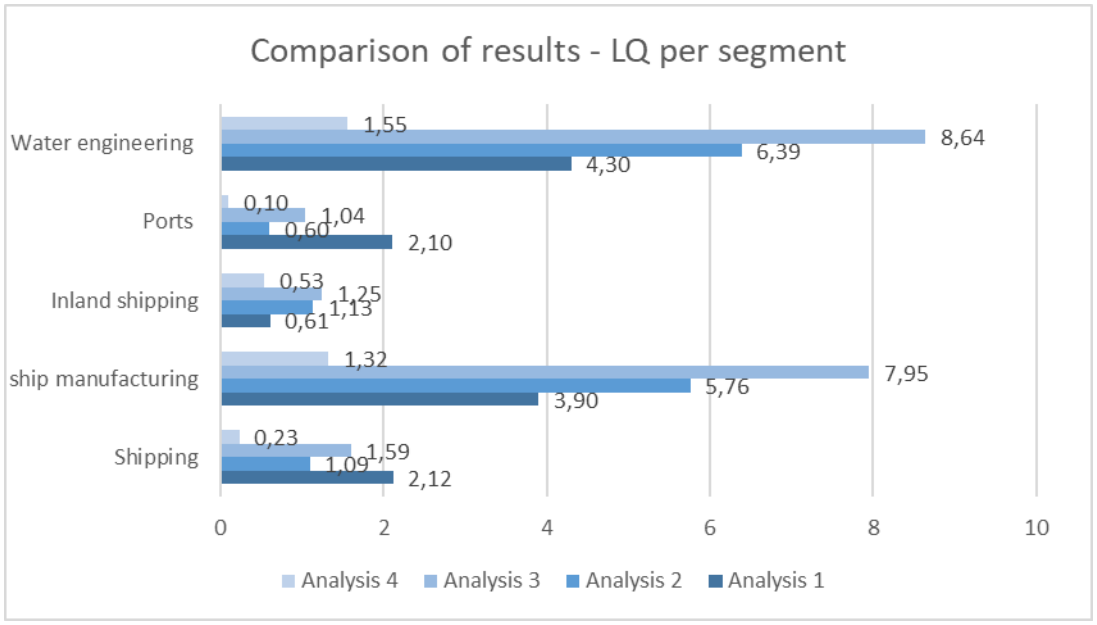
| | Damen | IHC | Boskalis | Total jobs |
|---|---|---|---|---|
| **2010** | 712 | 1284 | 1505 | 3501 |

| | | | | |
|---|---|---|---|---|
| **2011** | 715 | 1248 | 1404 | 3367 |
| **2012** | 721 | 1184 | 1406 | 3311 |
| **2013** | 725 | 1147 | 1223 | 3095 |
| **2014** | 735 | 1091 | 1199 | 3025 |
| **2015** | 786 | 1069 | 1348 | 3203 |
| **2016** | 757 | 1062 | 1340 | 3159 |
| **2017** | 703 | 1045 | 1891 | 3639 |

## Deeper analysis

| | **Analysis 1** | **Analysis 2** | **Analysis 3** | **Analysis 4** |
|---|---|---|---|---|
| Shipping | -33,5% | -43,5% | -46,1% | -41,8% |
| ship manufacturing | 17,7% | 7,4% | 10,9% | -6,6% |
| Inland shipping | -20,3% | -15,2% | -20,0% | 16,3% |
| Ports | 18,1% | 58,2% | 57,4% | 46,7% |
| Water engineering | 31,6% | 16,1% | 31,1% | -17,1% |




Comparison of results - LQ per segment
Water engineering
Ports
Inland shipping
ship manufacturing
Shipping
1,55
8,64
6,39
4,30
0,10
1,04
0,60
2,10
0,53
1,25
1,13
0,61
1,32
7,95
5,76
3,90
0,23
1,59
1,09
2,12
0
2
4
6
8
10
Analysis 4
Analysis 3
Analysis 2
Analysis 1