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The influence of CO2 reduction policies on the location choice of chemical companies

Abstract
The reason for this research was an article written by of Bremmer & Vogels (2019, January 10) in which among others Hans de Boer, chairman of VNO-NCW, indicated that the Netherlands lose foreign investment due to the difference in CO2 reduction targets between the Netherlands and Europe. Whereby this article specifically addresses the chemical industry. Limited research has been done into the influence of a climate policy on the location choice of a company. As a result, in this research the effect of a CO2 reduction policy, and the associated objectives, of a country on the location choice of a chemical company is examined. Two case studies were conducted for this study, where the investment decisions of Ineos and Borealis to invest in Antwerp were examined. The focus was on the location choice process and the location choice factors. In addition, a general ranking of the most important location choice factors is given and there is elaborated on the role of image in the location choice process. Furthermore, the data is obtained from articles, press releases and interviews. The results show that the difference in CO2 reduction policies between Antwerp and Rotterdam have not played a role in the location choice of both Ineos as Borealis. Moreover, mainly industrial-logistics factors are taken into account, which is also reflected in the general ranking of location choice factors. Additionally, image also plays a role in the location choice process, but the effect should not be overestimated. Lastly, if the Dutch government would like to attract more investment, they need to step up their game regarding their welcome policy.

Key words: chemical companies, Ineos, Borealis, case study, interviews, image, CO2

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1. Introduction

Borealis, a company active in the chemical industry, which has its headquarters in Austria has announced that they are going to build a new factory. Borealis is a producer of propylene and will place a new factory, that converts propane gas into propylene, in the chemical cluster of the port of Antwerp (de Schamphelaere, 2018, October 6). The investment amounts to one billion euros, which makes this investment one of the biggest in Europe, measured in the chemical industry for the last 20 years (Johansson, 2018, October 6). Nevertheless, this investment has already been passed by an investment of Ineos. Since, Ineos is going to build two plants in the cluster of Antwerp, consisting of a total amount of 3 billion euros. Whereof 1.7 billion euros goes to the building of a cracker which produces ethylene out of ethane gas. The remaining part is meant to a plant that converts propane gas into propylene, just as the plant of Borealis (de Roo, 2019, January 14).

Both investments received a lot of media attention, but the investments of Ineos in particular. The reason for this is that besides the cluster of Antwerp, the cluster of Rotterdam has tried to attract the investments of Ineos as well. Ineos announced the building of the two plants in mid-July, but the location was unknown yet. From this point both clusters were in the running for the investments. Unfortunately for the Port of Rotterdam, Antwerp got the preference. According to Frank Beckx, managing director of Essenscia, which is the Belgian branch organization for among others the chemical industry, attraction of investments mainly consists of providing incentives. Consequently, the government takes part in the negotiations as well, because these incentives are related t among others fiscal policy (Walraven & Joosten, 2019, February 4). Another part of incentives is providing subsidies. Ineos has the opportunity to receive 16 million euros of subsidies consisting of among others educational support and research projects (Truyts, 2019, May 24). However, Pooler (2019, January 15) describes that the choice for Antwerp has to do with the already present locations of Ineos in Belgium and the good connection of the new location, for example through the present pipeline network. So, there are somewhat different opinions about the choice of Antwerp instead of Rotterdam.

Nevertheless, in the Netherlands some people claim that Ineos and Borealis chose Antwerp over Rotterdam, because of the difference in the CO2 reduction policies. On the one hand, the Belgium government follows the European Agreement to reduce the carbon emissions by 40% in 2030, with respect to the emissions of 1990. On the other hand, the Dutch government follows a higher target, namely a reduction of 49%. Further elaboration is given in the literature review. An example of someone who believes that the different CO2 reduction policies are the reason for the preference for Antwerp is chairman of VNO-NCW, Hans de Boer. According to

him, the Netherlands miss out on foreign investments due to the higher CO2 reduction objective. Whereby this article specifically addresses the chemical industry. He argues that the higher target of the Netherlands trembles the chemical companies and as a result are a disadvantage for the chemical cluster of Rotterdam compared to other chemical clusters, such as Antwerp. Additionally, the port association of Rotterdam shares the same opinion (Bremmer & Vogels, 2019, January 10). This point of view is also seen as truth by Robert Simons and Geert Koster, city councillors of Leefbaar Rotterdam. Just as Hans de Boer they claim that chemical companies, among which Borealis and Ineos, decided not to locate in Rotterdam because of the CO2 reduction objective of the Dutch government. In addition, they believe that the trend of missing out on investments will continue (NRC, 2019, February 7). However, the question is whether this difference in CO2 reduction objectives has such a big influence on the location choice of a chemical company.

Consequently, this research is about the location choice factors of chemical companies. Which aspects of a location do companies take into account when they decide where to invest? The literature indicates that factors as skilled labour, political stability and the presence of complementary industries are essential for chemical companies. Furthermore, should a CO2 reduction policy of a country not be added to the established location choice factors? Since, this is what has been claimed and suggested in Dutch newspapers recently. Limited research has been done into the influence of a climate policy on the location choice of a company. In addition, the results of these studies are not corresponding. Moreover, the influence of differences between CO2 reduction objectives on the location choice of chemical companies was not specifically examined as well. This research attempts to fill these gaps in the literature with the corresponding main research question:

‘’Are the CO2 reduction policies, and the associated objectives, of countries leading location choice factors for chemical companies?’’

Whereby the following sub research questions serve as the basis of this research. On the one hand, the first sub question mirrors among others the opinion of Hans de Boer. On the other hand, the second sub question gives the most plausible reason for Ineos and Borealis to choose Antwerp, namely the difference in characteristics between the two chemical clusters.

Sub-question 1: ‘’Are Ineos and Borealis located in Antwerp because of the CO2 reduction objective of the Dutch government?’’

Sub-question 2: ‘’Are Ineos and Borealis a better fit in the port of Antwerp because of industrial-logistics factors?’’

Two case studies were conducted for this study, where the investment decisions of Ineos and Borealis to invest in Antwerp were examined. By researching news articles, press releases, reports and conducting interviews with experts and actors of the chemical industry, an as much as possible objective view on the reasons for Borealis and Ineos to locate in Antwerp is given. Whereby the characteristics of the company, other recent investments, characteristics of the planned investment in Antwerp, the location choice process and the location choice factors were taken into account. As a result, the opinions of among others, Hans de Boer and the city councillors of Leefbaar Rotterdam are confirmed or invalidated.

Moreover, the data obtained from the interviews is also used to describe how a general location choice process of a chemical company goes, whether image plays a role and to indicate which location choice factors are the most important for chemical companies. Where the latter can be used by rulers of chemical clusters to make sure they are an attractive location for investments. In addition, the importance of image in the location choice process is relevant, because the CO2 reduction policy is in this case used to sketch the image of the Netherlands as poor. The decisions of Ineos and Borealis to locate in Antwerp took place earlier than the implementation of the policy. Nevertheless, the question is whether image actually plays a role in the location choice of chemical company, because the investments consists of big amounts of money. So, the expectation is that the ratio is more important than phenomena such as image.

Consequently, besides fillings gaps in the literature about the influence of a climate policy on the location choice of a company and more specifically the influence of differences between CO2 reduction objectives on the location choice of chemical companies. This research contributes to the present location choice model theory applied to chemical companies as well, because factors which have received attention in recent years play a role as well. Where the focus is mainly on the CO2 reduction objectives of countries. As a result, the existing theory has been revised, which implies that the existing literature related to the location choice of chemical companies can be extended or replaced by a set of factors which are relevant for the current time.

Furthermore, in order to be able to provide an answer on the research question, it is necessary to give answer on some other questions as well. These and the reasons why these questions are relevant are presented below.

‘’What is a cluster?’’
‘’What is the role of image in the location choice process?’’
‘’What are the established location choice factors for chemical companies?’’
‘’What are the differences between the chemical cluster of Rotterdam and Antwerp?’’
‘’What is the difference between the CO2 reduction policy of the Netherlands and Belgium?’’

The following of this research consists of a literature review where among others, the cluster theory is discussed. Being located within a cluster turned out to be an essential location factors, but what is a cluster and what is the reasoning behind the formation of a cluster? The second part of the literature review describes the process of choosing a location and the role of image in this process. The third part is about the location choice factors which are found by previous studies. Comparing the list of factors with the location factors which came up during the interviews, made it possible to extend or replace the literature. Subsequently, an overview of the clusters of Antwerp and Rotterdam is given. In addition, a sketch of the recent investments in the clusters is provided as well. As a result, it is possible to indicate what the focus and speciality of the chemical clusters are and what kind of companies locate within the clusters. This is an indication for the reason why Ineos and Borealis chose Antwerp over Rotterdam. Since, the industrial-logistics factors of the clusters turned out to be quite different. The remaining of the literature review consist of a further elaboration on the CO2 reduction policies of the Dutch and Belgium government.

Thereafter, the methodology section where among others the following aspects are explained; the background of the case studies, the way the ranking of the location choice factors is composed, the selection of interviewees, the interview questions and the use of the interview data. Followed by the case studies and an analysis of both the results as the executed interviews. Where after the two sub research questions are answered on the basis of the 2 case studies. The results show among others, that the difference in CO2 reduction policies between Antwerp and Rotterdam have not played a role in the location choice of both Ineos as Borealis. Mainly industrial-logistics factors are taken into account, which is also reflected in the general ranking of location choice factors. This ranking and the role of image in the location choice process are discussed after the case study as well. In addition, an advice related to the attraction of foreign investments is given to the Dutch government. Lastly, the conclusion in which an answer is given on the question whether CO2 reduction policies, and the associated objectives, are a leading location choice factor.

2. Literature review

2.1 Introduction literature review

This section consists of definitions, explanations and elaborations about concepts or phenomena which will come across, in this research. The goal is to provide the direction of the research and to make sure that no misunderstanding arises regarding to the concepts mentioned. The structure is as follows; Firstly, the description of a chemical cluster is presented. Secondly, the process of a location choice and the importance of image is discussed. Thirdly , an overview is given of the location choice theory applied to chemical companies, which factors are leading for chemical companies in the choice of where to locate? Fourthly, The chemical cluster of Port of Antwerp and port of Rotterdam are analysed. What are the differences? What are the similarities? For example the type of companies and industrial relations (cluster relations), the number of companies, the identity of the companies and the facilities. In addition, the recent investments that were performed by the chemical industry in these ports for the last years are listed. The combination of the third and fourth section exposes the speciality and the focus of the clusters of interests, which could also be a reason to choose one cluster above another. Fifthly, a broader elaboration on the CO2 reduction policy of the Dutch and Belgian government is given. What are the agreements and what are the implications for the chemical industry?

2.2 The description of a chemical cluster

In order to provide a definition and description of the concept of a chemical cluster, it is fundamental to give insight in the cluster concept in general before. According to Porter (2000) a cluster is ‘a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities’. This definition is well-known and commonly used by researchers in the field of the cluster concept. For example Ketels (2007) and Ketels & Memedovic (2008) used the same definition for their research. Both papers will be covered further in this section. Ortuzar (2015) has not used the identical definition, but it consist of the same aspects. The definition of an industrial cluster according to Ortuzar (2015) is ‘the regional concentrations of related industries, whereby the clusters consist of companies, suppliers and service providers as well as government agencies and other institutions that provide education, information, research and technical support’. This links to the paper of Morosini (2004), where he mentions that the actors of a cluster share information and connect with each other in order to be able to produce a better overall product.

The aforementioned definitions subsist of three overarching elements. Starting with the geographical aspect, clusters rely on the concentration of the activities. Secondly, the added

value aspect, the cluster consist besides companies operating in the same industry also of companies operating in other industries as well. Nevertheless, these industries are still related to each other. Ending with the business environment, this refers to the specific conditions of a cluster, which are a result of the initiatives of for instance the government, companies, an university or a collective initiative between different actors of the cluster (Porter & Ketels, 2009;Ketels & Memedovic, 2008). The existence of a clusters generates a couple of advantages for the actors within the cluster, which eventually lead to a competitive advantage for the cluster as a whole. Before elaborating more on this, it is important to mention on the back of which idea clusters actually exist.

Porter (1990) made a diamond framework, called the 'determinants of a country's international competiveness'. The purpose of the diamond is to evaluate how the determinants, which are interacting as well, stimulate firms to innovate and as a consequence improve their productivity and as final result increase the international competiveness of their country. Firstly, the factor conditions, which are production factors as high-skilled labour and infrastructure. To create a competitive advantage a factor needs to be on a highly specialised level, since this is more difficult for competitors to obtain than less advanced factors. Secondly, demand conditions, the demand of the home country shows the companies what the future wishes of the customer will be. The more demanding they are, the better it is for the competitive advantage. Thirdly, related and supporting industries, which have to be internationally competitive. Consequently, they are able to supply for the lowest costs and the most efficient way. In addition, it leads to a closer relationship between the producing industry and the supporting industries, which again leads to more and faster innovation. Fourthly, firm strategy, structure and rivalry, which is about how firms are organized and about how fierce the rivalry is. As mentioned, these four interacting determinants force the companies to innovate and consequently increase the international competiveness of their country. Besides the four determinants, the government takes part as well. They are able to influence the actions and the relationship between the actors. For instance by implementing certain policies or giving incentives they could stimulate a higher level of innovation. Aside from the government, another phenomenon with affects the competitiveness, is chance. This refers to the occur of random events that cannot be controlled by companies, but do have an effect on the international competitiveness. The discontinuity which is created by a random event, could lead to advantages or disadvantages for other actors. An example of a random event is a very big investment, which came more or less out of the blue. The investment of Ineos in Antwerp, which is discussed later on, links back to chance (van den Bosch, 2017; Porter, 1990).

Anyhow, Porter (2000) mentions that the forming of clusters is an indication of the actual effect of the diamond. As a result, the determinants of the framework are similar to the parties involved in a cluster. As discussed, being part of a cluster generates advantages for the firms within a cluster. Examples are access to information about new trends or new customer needs and the presence of complementarities (Porter, 2000). Advantages like these generate a higher productivity, a higher level of innovation and business formation, which has a positive effect on the competitiveness of the cluster (Ketels & Memedovic, 2008; Ketels, 2007; Porter, 2000). However, a cluster will not grow continuously. On a certain moment, the growth of a cluster will stop and this is the point where the cluster will be in a state of stability or maturity. Maturity if the cluster already exists for a while. A specialised cluster leads to advantages in the state of growth. However, specialisation could also lead to path dependency or lock-in effects, when a cluster enters the state of maturity. In this phase the actors are already present in the cluster for a longer time and have made agreements or formed relationships with each other. This implies that the actors are dependent on each other and do not feel the need to innovate, because the companies have everything they need within the cluster. This mind set makes it difficult to adapt to new customer wishes and as a result difficult to switch to potential new markets. Consequently, the cluster is locked in their own specialised industry. Eventually, a cluster will come in a state of decline if the players of the clusters do not innovate. Change is the key for a cluster to keep in a state of stable maturity (Chapman, 2005). So, being within a cluster and obtaining the advantages, as for example the presence of complementarities, is not the formula for continuous success.

Anyway, besides the general advantages of being within a cluster, in case of companies operating in the chemical industry it is convenient to be part of a cluster for some other reasons as well. Firstly, the products are most of the time carried as bulk. In addition, the source of the materials, for example natural gas, is not located next to the final market. The combination of these two factors makes the transportation of the goods costly. This provides an explanation for the fact that the value added in the chemical industry consist mostly of the cost of transportation. As a consequence, firms over the total value chain choose to locate on the same location, in order to reduce the cost of transportation (Porter & Ketels, 2009; Ketels, 2007). Another reason why it is interesting for chemical companies to locate in a cluster is, because of the capital insensitive character of the industry. The start-up costs are high it implies that companies will be on a specific location for a longer time, which is a desirable situation for the development of a cluster and cooperation between actors. Since, a company would like to obtain all the advantages of that specific location, because they would not be eager to change their location on a shortly basis (Ketels,2007).

Thirdly, the presence of suppliers is even more important in case of companies active in the chemical industry. Since, the chemical industry is a perfect example of were the phenomenon '' industrial ecology / symbiosis'' plays a role. Frosch & Gallopoulos (1989) describe this as ''an integrated system in which the consumption of energy and materials is optimized and the effluents of one process, serve as the raw material for another process''. So, the by-products and the rest production which are the result of the production of the main products of one company can be used as materials by another company. This implies that is more convenient for producers of chemicals to locate close to each other and locate within a cluster. In the cluster there is supply of heat, water and other utilities, what makes it an attractive location for start-ups. They only have to plug in and they are able to play. This implies that they can start right after locating within the cluster. Furthermore, the phenomenon ''industrial ecology'' is developed to obtain a cleaner industry, by reducing waste. A well-known example of an industrial symbiosis is Kalundborg. Among others, a power station, the city, a refinery, fish farms and a lake are all linked to each other via rest products. For instance, bio-treated waste water from the refinery goes into the power station, which on their turn provide the city of Kalundborg with heat (By, et al., 1995). Another example of an industrial symbiosis initiative was a shrimp farm in the port of Rotterdam, whereby they used the heat of a company nearby (Baas & Huisingh, 2009).

Although, the chemical industry is capital intensive, Ortuzar (2015) concluded that the chemical industry has the highest employment multiplier of the industries being researched. This implies that the hiring of people in the chemical cluster has an strong positive effect on the people hired in other clusters. The high employment multiplier is a result of among others the goods and maintenance needed for big clusters. The goods will not be sourced within the same region and the maintenance needed, generates employment for other industries (Ortuzar, 2015). In addition, the last remark of chemical clusters is about the distinction of different types of chemical clusters. The chemical cluster phenomenon as a whole consists of seven different kind of clusters, namely basis chemicals, processing chemicals, leather tanning, treated garments, special packaging, refractories and ammunition. Furthermore, four other types of clusters are also strongly linked with the chemical clusters, namely plastics, oil and gas, analytical instruments and biopharmaceuticals (Ketels,2007). Altogether, among others the general cluster concept and the characteristics of a chemical cluster are discussed. In the next part the location choice theory applied to chemical companies is discussed, which factors are leading besides the discussed advantages of locating within a cluster?

2.2 The role of image in the location choice process

Before going into the location choice factors of chemical companies, the role of image in the choice of a location is described. The reason why the factor image is discussed separately, is because imago is a factor which is difficult to measure. Consequently, it is not a factor which can be described as a location choice factor and for that reason is not part of the next section about the location choice factors of chemical companies. Anyhow, as discussed in the introduction, the CO2 reduction policy is an instrument of making the image of the Netherlands appear bad. In addition, the following of this section confirms the importance of image in the appreciation of a region. This makes the influence of image in the location choice process essential to take into account.

Researchers P. H. Pellenbarg and W. J. Meester conducted a research about the location preferences of Dutch entrepreneurs for the first time in 1983. Thereafter, they have repeated the study three times, in order to show the developments of the preferences. The research method remained unchanged and every time they have used a sample of 2000 Dutch companies. Whereby they showed the participants a map, which consisted of 70 different villages and cities. In addition, they asked the participants to rate each of the places, based on possible business locations if they would have to change their current situation. The first three studies showed that four factors determine the location preference, namely the preference for a central location, living preference, culture and agglomeration (Pellenbarg, 2012; Meester & Pellenbarg, 2006). Firstly, the preference for a central location refers to distance to the market. Secondly, the living preference implies that people rate their own city as the best, followed by cities located nearby. Consequently, cities where the distance is large, are assessed as poor (Meester, 1999). Thirdly, the entrepreneurs are more attracted to places where there is a possibility to agglomerate. Fourthly, the factor culture refers to the fact that Dutch entrepreneurs from above the rivers tend to judge the cities below the rivers as bad and vice versa (Pellenbarg, 2012; Meester & Pellenbarg, 2006).

The reason why entrepreneurs prefer more known locations over unknown locations is quite logical. Since, they experienced living there and they do not know how this experience in a different city would be. Additionally, it is harder to imagine whether the next location will be conform their wishes (Pellenbarg & Knoben, 2012). As a result, the opinion about the other places is less based on facts. In addition, the perception / external image, is probably different than the reality / internal image (Pellenbarg, 2012). Yet, the Dutch entrepreneurs base their ranking on the image they have of the different locations (Pellenbarg, 1985).

Nevertheless, it is not sure whether imago plays a role in the chemical industry as well. Since, the investments are most of the time very costly and meant for the long term. So, the expectation is that the ratio is more important than factors like image. To be able to reject or confirm this idea, this research examines whether image actually plays a role in the location choice process of chemical companies. The information is attempted to be gathered through interviews, because it is an abstract concept that little has been written about.

2.3 The location choice factors for chemical companies

This part will be about which factors are leading for chemical companies in the choice of where to locate. The definition of chemical companies refers, in this research, to companies which are active in the chemical industry and where the producing of chemicals is their main business. In the previous section a couple of location choice factors for chemical companies have already been discussed, such as access to information of new customer needs and the presence of complementarities. These factors are generated by the forming of clusters and apply to all kinds of industries. Furthermore, in case of the chemical industry specifically, locating within a cluster makes it possible to take advantage of the rest products of other companies and is a good choice due to the capital intensive character of the chemical industry. Altogether, these are just a few examples of advantages of being located within a cluster. In the following, other advantages are added and attention is paid to factors which are not necessarily related to a cluster, but are important location choice factors as well. This ultimately leads to an overview of factors which chemical companies take into account when choosing their location.

2.3.1 Skilled labour / level of education

Starting with one of the most, in the literature, mentioned factors influencing the location choice of industrial companies, namely skilled labour or sometimes identified as the level of education. Wakasugi (2005) has researched the factors that influence the location choice of Japanese firms in China. The data consists of several different industrial industries, including the chemical industry. He found that besides industry agglomeration, the Japanese firms place high value on the availability of skilled labour. In addition, Burpitt & Rondinelli (2004) concluded that foreign owned firms which would like to locate in the United States are influenced by the level of education and skilled labour as well. Education is among others a factor which also came up in the research of Blair & Premus (1987), who reviewed earlier findings related to the location choice of industrial companies. Consequently, skilled labour / education level turns out to be and were an important factor affecting the location choice of industrial companies. Firms active in the chemical industry are part of the industrial sector as well. Consequently, this factor is essential for chemical companies too. Additionally, the chemical industry is driven

by very complicated and advanced processes, so the availability of skilled labour is probably even more important for chemical companies in particular.

2.3.2 Taxes

Another aspect which Blair & Premus (1987) discovered, is the relevance of taxes. Just as skilled labour, taxes turn out to be an important location factor in different researches over time. For example Friedman, et al. (1992) have researched the location aspects of multinationals regarding the formation of manufacturing plants in the United States. Among others state and local taxes turned out to be a factor which deters the multinationals to locate somewhere with high taxes. However, this does not apply to all kind of taxes, the corporate tax has according to Friedman, et al. (1992) no influence on the location choice of multinationals. However, Lu & Yang (2006) concluded that corporate tax incentives do have an effect on the location choice of manufacturing firms. They conducted a similar research, as Friedman, et al. (1992) regarding manufacturing firms in Asia. As a result they concluded that corporate tax incentives is ranked on the second place of most important factors determining the location of Taiwanese manufactures.

In addition, another form of taxes relevant for the location choice of companies are the taxes related to carbon emissions. CO2 taxes are part of environmental policies quite often and it turned out that companies take the environmental policies of a country into account when deciding on their location. For example Brunnermeier & Levinson (2004) concluded, based on a set of studies, that differences in environmental policies affect the location choice of companies. Furthermore, List & Co (2000) found the same result. The location of a new plant turned out to be related with the environmental policy, which the government has implemented. Both studies showed that companies were more willing to locate in a less environmental strict country. However, a recent study of Kirkpatrick & Shimamoto (2008) shows that Japanese companies are more attracted to countries which have implemented a strict environmental policy. The stability and transparency of a certain policy outweighs the measures related to the policy. Altogether, there is no clear result whether the environmental policy affects the location choice. Nevertheless, this research will contribute to this part of the location choice factors by researching the influence of a CO2 reduction policy and the associated objectives nowadays.

2.3.3 Political stability

After all, taxes in general prove to be a relevant aspect in the choice of where to locate for industrial companies. Nevertheless, the most important location condition in the research of Lu & Yang (2006) is political stability. Ramasamy, et al. (2012) describe in their research what

the aspects of a political instable country are, namely lack of rules, corruption or disparity. Nevertheless, political stability also refers to the following of a consistent policy. An example of a country which came into disrepute on this aspect is the Netherlands. The Dutch government would like to close among others three coal plants which were developed only a few years ago. The Eemshavencentrale, property of German company RWE, opened in 2015 and is one of these plants (Reijn, 2019, May 14). As discussed earlier, the chemical industry is very capital-intensive and the building of the Eemshavencentrale showed this as well. The costs of the construction were more than one billion euros. As a result, the owner of the coal plant, RWE, is not amused with the plans to close the coal plants. Consequently, RWE has planned to demand compensation for the possible abrupt closing of their plant (van Santen & van der Walle, 2019, May 3). So, legal certainty, or in other words the following of a consistent policy, is essential for chemical companies. Since, the investments in the chemical industry are very costly.

2.3.4 Availability and Accessibility

Another location choice factor refers to the availability and accessibility of a location. This sounds very evident, but it implies for example to access to the market, access to materials and accessibility by road. Low & Isserman (2009) researched several aspects related to the phenomenon, ethanol. For instance, the problems which the use of ethanol will solve, the development of the area and the location of ethanol plants. The latter is relevant for this research. The conclusion about the location, of ethanol plants in the United States, says that plants are most likely located close to the source of input, which is in this case corn. In addition, accessibility via railway and good infrastructure, especially roads, are essential as well. The same applies for logistic companies in Belgium. Verhetsel, et al (2015) found that accessibility, in this case via road and water, is fundamental for the logistic industry. Besides, the accessibility of inputs and the accessibility of different kinds of transport modes, Friedman, et al. (1992) showed that the access to markets is also important. A conclusion which also came out in the research of Hansen (1987). A lot of manufacturing plants in Brazil are located next to a city, which is their primary market. The reason for this is to lower the cost of transportation. Nevertheless, the a location could meet all the requirements, but the price of the land does matter as well. Verhetsel, et al. (2015) pointed out that for the logistical companies in Belgium the land rent is the most important location factor. In addition, the availability of land plays a role as well. It is not allowed to build a chemical company where ever you want, because citizens will have to deal with negative externalities in that case. As a result, an established chemical cluster needs to have available space. Chemical companies needs large sites and

on a certain point it is not unimaginable that there is lack of space for the construction of a new plant.

2.3.5 Cluster advantages

The abovementioned factors of location choice are not necessarily linked to being part of a cluster. Nevertheless, the following is linked to a cluster, namely it goes through examples of advantages of locating within a cluster and shows that industrial companies do see a cluster as one of the essential location factors. For instance in case of Japanese car manufacturers, Florida (1994) concluded that the most important condition for the manufacturers is to being located next to car assemblers. This refers back to the diamond framework of Porter (1990), car assemblers are in this case the supporting industries. Another interesting fact is that these manufacturers tend to locate in areas with a high manufacturing density, which directly links to the attraction effect of a manufacturing cluster. Furthermore, chemical companies rely on the supply of water, energy and waste disposal utilities (Trivikam, 2017, March 7). These supplies can easily be found in a chemical cluster, since these are supporting industries for the producing of chemicals. The availability of waste disposal utilities refers also back to the concept of industrial symbiosis, which is discussed previously, the waste of one company can be of use for another company.

In addition, Patti (2006) conducted a case study about a chemical company in the United States with the aim of showing the advantages of building on business relationships. The company switched from making raw materials by themselves to a cooperation with a company nearby, whereby the new partner supplies the raw materials. This led among others to lower costs and higher quality of the products. In addition a more relevant consequence for this research, the new cooperation opened the doors of the chemical cluster in the region as well. As a result it increased the influence in the political agenda and increased weight on the education which is being provided. Due to this influence, a company is able to secure that there will be enough skilled labour in the area in order to supply their wish for new employers. These are just some examples of advantages arising from locating within a cluster, the remaining indicates the relevance of a cluster for industrial companies.

Head, et al. (1995) have researched, just like other researches discussed before, the location choice of Japanese manufactures. The research question, whether these manufactures in the United States are guided by industry agglomeration in the choice of their location, turned out to be confirmed. The same applies to manufacturing plants in Brazil. Besides the access to the primary market, the agglomeration economies have a strong attraction effect for the localising

of new plants (Hansen, 1987). Furthermore, clusters attract both new firms as established firms considering a new founding, which applies for the existing industry of the cluster. Nevertheless, clusters of a specific industry are appealing for new industries as well. This implies that due to a cluster, both the cluster itself as the industries in the region grow, which leads to higher economic development for the area. However, this is outside the scope of this research (Delgado, et al., 2014; Delgado, et al., 2010).

2.3.6 Overview of the location choice factors

To summarize, the perfect location for chemical companies meets the all the requirements remarked in table 1. Nevertheless, it is almost impossible to find a location which has all these factors, so companies consider which factors they value the most. For some companies access to the source of input is more important than for other companies, for example the ethanol plants. Although not all the studies mentioned above focus on the chemical industry specifically, but more on other industrial industries, it is likely that the overview of location factors would not differ much. Since, all the industries are highly developed, capital-intensive and consists of big plants. Furthermore, it is important to note that in this research the concept chemical companies refers to companies which are producing chemicals. In the literature review no distinction has been made between the nature of the investments and the location choice factors. For example in the report of Suurs & Roelofs (2014), there is a clear separation in the importance of location aspects divided in three groups of investments, namely commercial, experimental and research investments. The results show among others that if a company wants to build a research centre it is important to have a high level of skilled labour. In case of a commercial related investment, the availability of feedstock is more essential. Such a division is made later in this research when the results of the interviews show that the importance of certain factors is indeed related to the type of investment. In case of the literature review it was decided to keep it broad to sketch a complete picture of the location factors. Anyhow, the definition and explanation of the chemical cluster combined with the location choice factors of chemical companies provides an overview of the chemical industry. Consequently, the following section of the literature review presents an insight in the chemical clusters of interest, namely the chemical clusters of Rotterdam and Antwerp.

Table 1 overview location choice factors chemical

Skilled labour
High level of education
Low taxes
Mild CO2 tax / environmental policy
Political stability
Access to markets
Access to input
Access by road, railway and water
Availability of large sites
Legal certainty / consistent policies
Low land rent
Agglomeration industries / cluster: close to supportive industries, input in the political agenda, input in education, access to information about new customer wishes, lower transport costs, investor friendly attitude, a common goal, industrial symbiosis and accessibility of water, energy and waste disposal utilities.

2.4 The chemical cluster of Antwerp and Rotterdam

Since, the concept and the advantages of a chemical cluster are being explained, it is time to dive into the chemical clusters of port of Antwerp and port of Rotterdam. The focus of this section is on the differences and similarities of the clusters. These can for instance be found in the type of companies, the number of companies, the identity of the companies, the facilities or in the industrial relations. Both the cluster of Rotterdam as the cluster of Antwerp are discussed, where after there is elaborated on the similarities and differences.

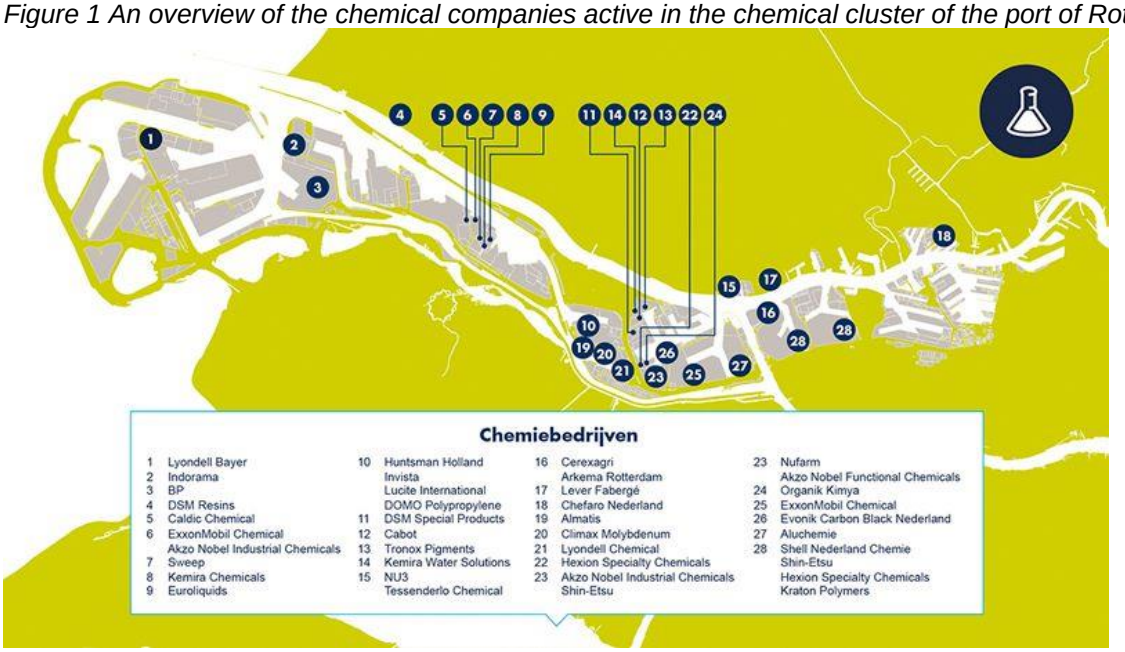
2.4.1 The chemical cluster of the Port of Rotterdam

Starting with the emergence of the chemical cluster, which began in the period after World War Two. The port of Rotterdam needed a couple of years to reconstruct and repair the damage, which was the result of the war. Nevertheless, expansion plans were conducted in this period as well. This expansion was executed between 1950-1960 and the added area is called the Botlek. The construction of the Botlek was also accompanied by strong growth in the chemical and refining industry (Welters & de Langen, 2001). Dow Chemical was one of the first companies which decided to locate in the Botlek. This area grew out to the centre of the petrochemical industry, in the port of Rotterdam, which it still is (''de Botlek'', n.d.). Another important expansion of the port of Rotterdam was the building of Europoort. This made it possible for the port of Rotterdam to handle the biggest ships. The main focus of this new area was on the handling of crude oil and the remaining on other bulk goods. Consequently, the port of Rotterdam became the main port in the field of oil. Furthermore, a lot of companies were interested in investing in Rotterdam, in this period. An example of a company which was

interested is BASF, nowadays one of the main players in the chemical industry. Nevertheless, the port of Rotterdam rejected them and for that reason they located in the port of Antwerp. In the period between 1970 and 1980 the Maasvlakte was constructed and as a result the container throughput increased rapidly. Nevertheless, people became more aware of the negative externalities which are a result of the activities, which take place in a port. The environmental consciousness rose. Consequently, the investment climate became less attractive, especially for the chemical industry. In addition, the industry expanded no more. However, in the period between 1990 and 2000 the number of investments in the chemical, energy and refinery industries increased again, partly due to the investment of Shell in order to reconstruct their refinery in Pernis (Welters & de Langen, 2001).

The chemical cluster of Rotterdam, nowadays, is an extensive network of all kind of players, whereby a distinction can be made between four different subgroups. Firstly, the products and services related to oil and oil products. Secondly, the products and services related to chemicals, biofuels and edible oils. Thirdly, the products and services related to gas, power, coal and biomass. Fourthly, the services and products related to pipelines and utilities (Port of Rotterdam, 2016). According to the data of 2015 of the port authority itself, the groups are build up as follows; the group of oil and oil products consists of five oil refineries, six refinery terminals and eleven tank terminals designated to oil products. The group of chemicals, biofuels and edible oils subsist of 45 chemical companies, six biofuel plants, five vegetable oil refineries and seventeen designated terminals. Followed up by three gas fired power plants, the same amount of coal and biomass fired power plants, one natural gas terminal and 86 wind turbines, which is the content of the third group. The last group is related to utilities and consists of four industrial gases and water plants, six steam and power plants, about 1500 kilometres of intercompany pipeline network for oil and chemical products and one waste processing site (Port of Rotterdam, 2015). In addition, the chemical cluster of the Port of Rotterdam is supplemented by ship-to-ship transfer facilities, the Multicore pipeline system, companies specialised in the warehousing of dangerous goods and companies which are responsible for the cleaning of the tanks. The multicore pipeline system, is a network of four pipelines under the control of the port of Rotterdam and Vopak Chemical EMEA, which lend this network to interested companies (Port of Rotterdam, 2016). All the aforementioned facilities together form the chemical cluster of the port of Rotterdam. Underneath an overview of the chemical companies active in the chemical cluster of Rotterdam is presented.

Figure 1 An overview of the chemical companies active in the chemical cluster of the port of Rotterdam



Source: the Port of Rotterdam, Facts and figures energy port petrochemical cluster

Besides the composition of the chemical cluster, the total square meters of the sites and the number of employees linked to the discussed facilities are an interesting addition to indicate the focus of the cluster. Table 2 shows the facilities combined with the number of employees and the total square meters of sites they occupied in 2015 (Port of Rotterdam, 2016). In order to compare the results and to specify the focus of the chemical cluster, the results are described as percentages as well.

Table 2 the number of employees and the total square meters of the sites (2015)

Subgroup	**Site (x 1000m2)**	**Number of employees**
Oil refining	8970 – 25, 93%	3271 – 25,03%
Refinery terminals	3680 – 10,64%	142 – 1,09%
Tank terminals for oil products	3842 – 11,11%	535 – 4,09%
Chemical manufacturing and products	9289 – 26,85%	6167 – 47,18%
Biofuels manufacturing and products	553 – 1,60%	260 – 1,99%
Edible oil refineries	411 – 1,19%	477 – 3,65%
Tank terminals for chemicals, biofuels and edible oils	2908 – 8,41%	843 – 6,45%
Gas fired power plants	250 – 0,72%	107 – 0,82%
Coal and biomass fired power plants	1325 – 3,83%	594 – 4,54%
Wind turbines	…	…
Natural gas terminals	530 – 1,53%	…
Coal and biomass terminals	2307- 6,67%	…
Industrial gases and water plants	483 – 1,40%	634 – 4,85%
Pipelines	50 – 0,14%	40 – 0,31%
Total of the cluster	34596	13070

Source: the Port of Rotterdam, Facts and figures energy port petrochemical cluster

Consequently, a large proportion of the total employees and the total sites in square meters is employed by the refining of oil and the manufacturing of chemicals. This implies that the focus from the past is still applicable nowadays. Since, the Port of Rotterdam became Europe's main oil port after the construction of Europoort. The focus of the port of Rotterdam is confirmed by VNCI as well, which is a branch organization for the Dutch chemical industry. According to them the port focuses on traditional chemistry. The production of basic chemicals and the number of refineries indicate the core business of the chemical cluster of the port of Rotterdam. Nevertheless, VNCI mentions that the production of bio-based chemicals gains ground as well (''Rotterdam-Rijnmond'', n.d.).

The focus is also reflected in the throughput of the chemical cluster. Between the years 2011 and 2015 a strong increase in the throughput of LNG is noticeable. Nevertheless, this is from a low level, which implies that is relatively a small part of the total throughput. The throughput of other products within the liquid bulk and dry bulk category remained more or less constant. When measuring the total throughput of the port, the throughput of crude oil and mineral oil products are ranked on the second and third place (Port of Rotterdam, 2016). However, the throughput of crude oil and mineral oil products decreased in 2018 compared to 2017, where also in this year the throughput of LNG relatively skyrockets (Port of Rotterdam, 2019). This is an indication for the future path of the chemical cluster of the Port of Rotterdam, since this is where the port of Rotterdam aims for as well. The port of Rotterdam sees themselves as the potential LNG hub of Europe (''LNG: import, export and bunkering'', 2018, September 28).

The enrichment of scope towards bio-based chemicals has to do with the energy transition, which is an important point on the agenda nowadays. Samadi, et al. (2016) did, commissioned by the port of Rotterdam, research on the consequences for the chemical cluster of the port of Rotterdam, if there will be worldwide decarbonisation. In addition, they developed four different decarbonisation pathways, which secures that the port is prepared and if necessary can adapt to certain developments. Consequently, in 2018 the port of Rotterdam announced a plan with the aim of becoming a sustainable industrial cluster in order to achieve the required carbon emission reduction. The plan consists of three steps. Firstly, the industry should be more efficient, for example by using the residual heat to heat homes. In addition, plans are made to catch the carbon emissions and store it in the North Sea. Secondly, the current energy system should be replaced, this implies for instance by using electricity instead of oil. Thirdly, the raw materials and the currently fuel system have to change, which implies using biomass or green hydrogen as replacement of fossil fuels (The Rotterdam-Moerdijk industry cluster work group, 2018). The aforementioned wish of the port of Rotterdam to become the LNG hub of Europe links back to these three steps as well. The port is making a lot of investments related to LNG,

since LNG is a cleaner form of fuel (''LNG: import, export and bunkering'', 2018, September 28).

Another recent innovation in the field of energy transition is the Mega-Inliner. The intention is that a bag, the Inliner, is placed in a tank container which makes sure that the tank stays clean after a shipment. This implies that the tank container does not have to be cleaned between different loads. As a result, the waiting times will be lower, the previous load restrictions will be eliminated and it reduces the distance a container needs to bridge. Since, there is no need to go to the cleaning stations. Eventually, this initiative will contribute to the reduction of carbon emissions (''Mega-Inliner: iedere rit een kersverse zuivere tankcontainer'', 2019, July 3).

Nevertheless, in the annual report of 2018, the port of Rotterdam mentions that they will attract refinery and petrochemicals investments as well. According to the port authority it is only possible to become a carbon neutral port by an unbroken stream of investments (Port of Rotterdam, 2019). Consequently, the Port of Rotterdam has planned to redevelop the existing industry, while simultaneously welcoming the sustainable industry with open arms (''All about energy transition'', n.d.). This indicates the future path of the port of Rotterdam regarding their chemical cluster.

The future path is also noticeable in the list of biggest investments in the chemical cluster in the period between 2005 and 2015, which the port of Rotterdam provided (Port of Rotterdam, 2016). The biggest investment in this period is from ENGIE RC, namely of 1500 million euros, in order to build a new coal-fired power plant. The building of a hydrocracker unit is the second biggest investment, worthily 1000 million euros and executed by ExxonMobil. The same amount of money costed the construction of the LNG terminal in 2010. Another initiative related to green fuel is the investments of Abengoa in order to generate a new bio ethanol plant. The last relatively large investment, namely 400 million, is related to the building of a gas fired power plant. The remaining of the investments, between 2005 and 2015, are on a lower scale and mostly related to expansion of operations. Nevertheless, quite some money, namely about 120 million euros, went to the generation of wind parks. Consequently, the list of investments consist of both investments related to a greener future as investments linked to traditional forms of fuel.

To summarize, the composition of the chemical cluster of the port of Rotterdam, the future path and the focus of the cluster are discussed. Additionally, this cluster has some specific utilities which may not be evident to own. Take for example the ship-to-ship transfer facilities or a similar construction as the Multicore pipeline system. Furthermore, the energy transition and

the way the chemical cluster of Rotterdam deals with this transition are explained as well. In the next part of this section, the chemical cluster of the Port of Antwerp is reviewed, in order to indicate the differences and similarities between the two chemical clusters.

2.4.2 The chemical cluster of the port of Antwerp

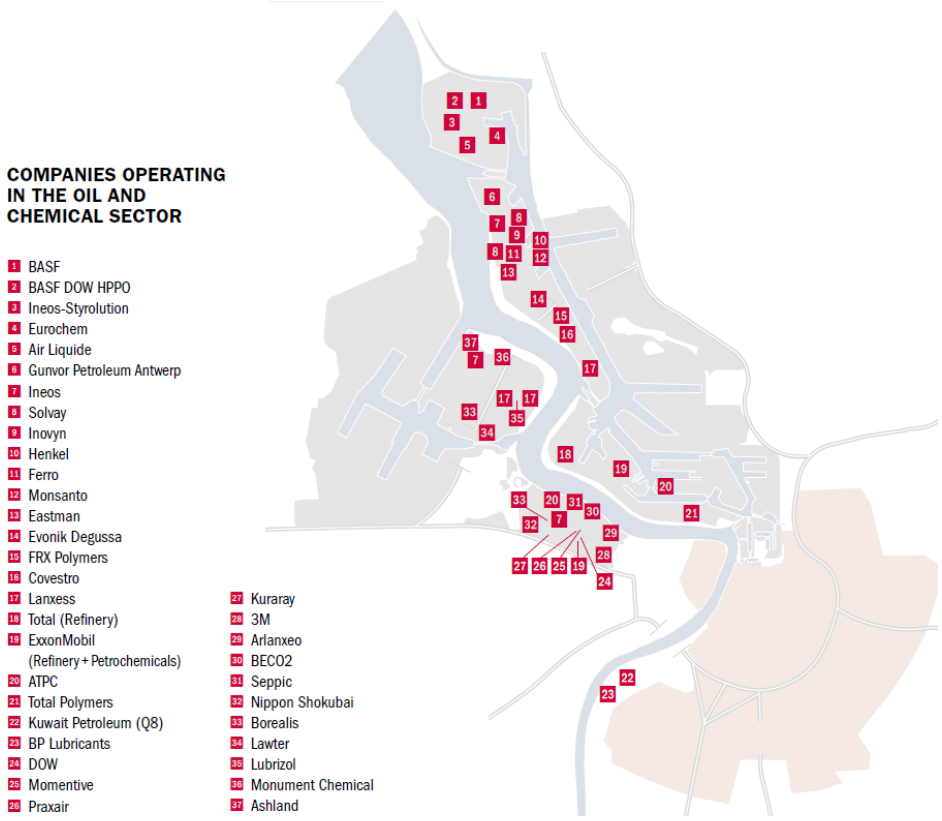
The beginning of the largest petrochemical cluster in Europe goes back to the period between 1900 and 1930. During this period, the first oil refineries located in Antwerp and the port acquired equipment which made the transfer of among others chemicals more efficient. Ten years later World War Two started, which had, just as for the port of Rotterdam, consequences for the port of Antwerp. The port played an important role, for the Germans, because of its favourable location. Nevertheless, the port of Antwerp stayed more or less intact, where the port of Rotterdam needed quite some time to reconstruct the port. Due to the Marshall plan, Antwerp became the largest petro chemical cluster of Europe. Six years after the ending of World War Two, the Petroleumhaven were constructed. As a result, the composition of the throughput changed drastically, because of the increased shipments of oil. Moreover, the period between 1960 and 1970 is characterized by high numbers of investments in the chemical industry. Where BASF were not welcome in the port of Rotterdam, the port of Antwerp welcomed them warmly in 1961. Also Bayer invested in the port of Antwerp in the same year. The same applies for Esso and Total, which placed refineries in the port of Antwerp . Mainly the investment of Bayer and BASF played a significant role in the growth of the chemical cluster. In 1970 the port of Antwerp extends its activities to the left side of the Scheldt among others due to the strong increase in the industrial part of the port (the port of Antwerp, 2016, February 9).

However, the oil crisis stopped the process of further expansions. As a result the chemical industry grew less quickly than before and came in a state of maturity. The cluster had attracted some new investments in the period between 1980 and 2000, but these were mainly of companies which already had locations in the port (Vanthillo, et al., 2018). This implies that the chemical cluster has not welcomed a significant number of new entrants during this period and did not grow in this field. Nevertheless, the cluster is still in a state of stability and it did not come in a state of decline. The reason why the cluster is in a state of stability and not in either a state of decline or growth is due to lock-in effects, a definition which is described in the literature review. According to Vanthillo, et al. (2018) the port of Antwerp consists of both negative and positive lock-ins. An example of a negative lock-in is the reliance of the region on the chemical industry which is located in Antwerp. Since, the chemical industry is such important for the regional economy, it is difficult to take another path. Another reason of the lock-in effect is the high capital intensity of the chemical industry. As a result, the entry and exit

barriers are high, which again implies that switching to another industry is hard. Furthermore, the port of Antwerp has not succeeded in the attraction of research organizations. Consequently, the level of research and development is low in the chemical cluster. The abovementioned aspects are the reason why the port of Antwerp is not far in their adjustment to bio-based chemicals as well. In addition, in Belgium the port of Ghent is currently leading in this field (Hintjes, et al., 2015). Nevertheless, the chemical cluster of Antwerp has managed to attract new investments over the years. The current players of the cluster keep looking for new techniques to improve their production process. As a result they upgrade their installations, which ensures the low marginal costs and the high reliability level of the chemical cluster of Antwerp. Altogether, these factors secure that the chemical cluster remained and will remain in a stable state of maturity (Vanthillo, et al., 2018). The following dives into the current composition of the chemical cluster of the Port of Antwerp.

Since, the port of Antwerp does not provide the exact same information as the port of Rotterdam, it is hard to obtain the same data for the port of Antwerp as discussed for the port of Rotterdam. Nevertheless, by using the data which the port of Antwerp maintains, it is still achievable to provide an overview of the current composition and the focus of the chemical cluster of Antwerp. Starting with the facilities of the cluster. The cluster consist among others of four refineries and three steam crackers, which secure that there will be enough supply of raw materials (''Integrated (petro) chemical cluster'', n.d.). The presence of crackers is something which distinguishes Antwerp from Rotterdam. In addition, the presence of logistic service providers, which are responsible for the handling of oil, chemicals and gasses. The port of Antwerp divides this in liquid bulk, plastic, packed chemicals and gases (''Customised logistics services'', n.d.).. About 30 chemical companies are located in the cluster among which eleven terminal operators which offer more than seven million cubic meters storage capacity on sixteen terminals (''Liquid bulk'', n.d.). Furthermore, they consists of eleven tank cleaning companies and 1300 silos (''Plastic'', n.d.). The logistic service providers in the cluster are not only responsible for the storage of products, but provide other services as well. Services like distribution, labeling or in case of liquid bulk they could heat or mix the liquid when this is desired. These specialized services have among others ensured that the port of Antwerp is known as the hub for packed chemicals and gases (''Packed chemicals and gases'', n.d.). Underneath an overview of the companies operating in the oil and chemical sector in the chemical cluster of Antwerp is given.

Figure 2 Companies operating in the oil and chemical sector in the port of Antwerp



Source: the port of Antwerp, Integrated (petro) chemical cluster

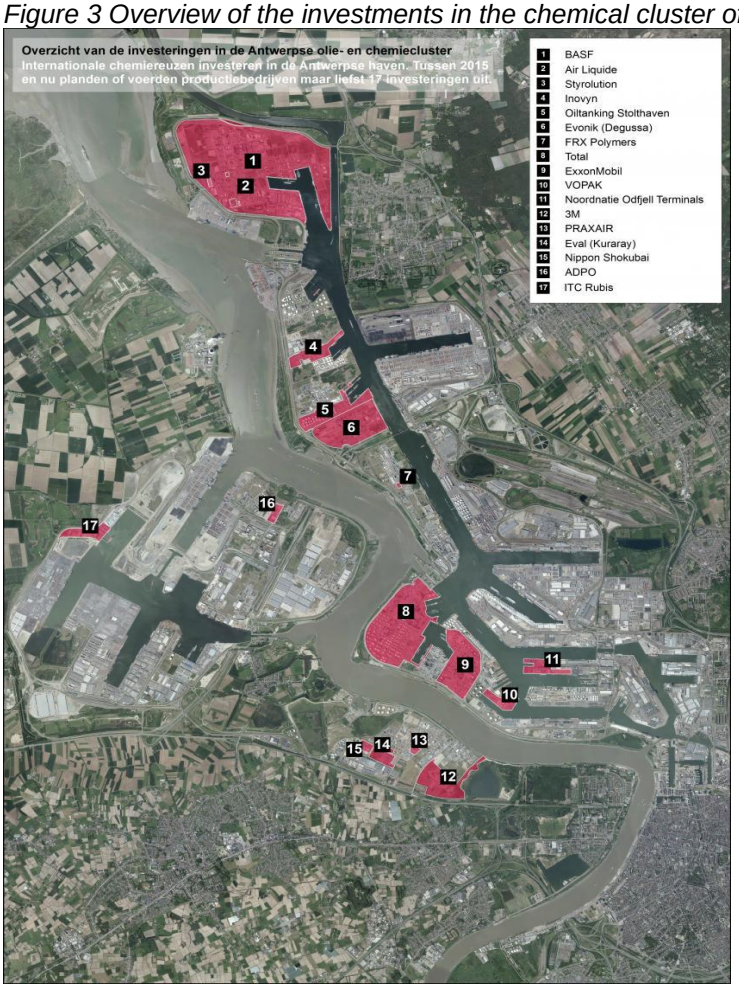
Another important asset of the chemical cluster is the pipeline network of about 1000 kilometres within and surround the region of the port. Where two aspects yield an advantage. Firstly, despite the size of the network is it more about the amount of different products, which these pipelines are able to handle. Antwerp differentiates it selves by handling 57 different product pipelines. However, the second aspects forms the most relevant benefit related to the pipeline network, namely the central location of Antwerp. Since, Antwerp is the heart of the European pipeline network (Trade association C, personal interview, 2019, August 30).

Altogether, this chemical cluster is able produce nineteen million tonnes of chemicals per year and has in addition 40 million capacity available for the refinery (''Integrated (petro) chemical cluster'', n.d.). Consequently, the throughput of liquid bulk for the Port of Antwerp, based on 2018, consists for 72% of petroleum derivatives, 20% of chemicals, 7% of crude oil and the remaining of other products (Port of Antwerp, 2018). This shows that the role of crude oil is less dominant for the port of Antwerp than for the port of Rotterdam. In addition, the port of Antwerp is known for their chemical and advanced chemical industry, where the port of Rotterdam is more known for their refinery and some basic chemical industry. According to Vanthillo, et al. (2018), the companies in the cluster of Antwerp changed during the years from

basic chemicals to more high value added chemicals. A further elaboration is given in the section about the differences between the two chemical clusters.

The latest investments in the chemical cluster of the Port of Antwerp expose the focus of the cluster as well. However, where the port of Rotterdam provides data of investments between 2005 and 2015, the port of Antwerp does not provide data of investments before 2016. The port of Antwerp provides an overview of seventeen investments that chemical companies executed from 2015 till recently (''Integrated (petro) chemical cluster'', n.d.). This overview is provided underneath. Nevertheless, just as for Rotterdam it is possible to provide an overview of the major investments, to indicate the type of companies which are interested in the chemical cluster of Antwerp. In addition, the investments executed show that the investments are mainly upgrades of already existing plants, as was discussed in the research of Vanthillo, et al. (2018).

Figure 3 Overview of the investments in the chemical cluster of Antwerp between 2015 and now



Source: The port of Antwerp

Firstly, the one billion investment of Total in order to innovate the refining and petrochemical facilities. The goal is to be able to adapt to the wishes of this time, for instance to be more environmental friendly (‘’Antwerp: total’s largest integrated complex in Europe’’, n.d.). Secondly, Exxonmobil invested the same amount of money for their investment. The reason to invest was similar to the investment of Total, since the upgraded refinery is able to produce cleaner oil fuels out of residual oil (‘’ ExxonMobil investeert meer dan 1 miljard dollar in zijn raffinaderij in Antwerpen’’, 2014, July 2). Thirdly, BASF has invested 500 million euros ,over a time period of three years, in order to keep the competitors ahead in the polymers industry (‘’BASF plant een grote investering in baanbrekende technologie voor superabsorber’’, 2014, November 26). Fourthly, the expansion of production capacity by Nippon Shokubai, worthily 350 million euros. This company produces among others polymers as well and acrylic acid (De Vlaamse Ondernemer, 2018, November 9). These were the biggest investments of the chemical industry in the cluster of Antwerp, the last 5 years. The following investments are relatively smaller investments, but typical for this cluster. For example Evonik, which innovated their facilities for the production of silica with a 50 million euros expenditure (De Schamphelaere, 2017, August 1). Additionally, EVAL got a contribution of 60 million euros from their parent company to extend the production of ethylene-vinyl alcohol (Gazet van Antwerpen, 2015, February 6). Lastly, a company called 3M which invested in the fabrication of a special kind of glue (Balduyck, 2014, November 23). As a result, the investments show a pattern of being associated with the advanced chemical industry. Besides, the abovementioned investments, Borealis and Ineos has planned to invest in the cluster of Antwerp as well. However, this is discussed in more detail in the case studies later in this research.

Anyhow, the chemical cluster of Antwerp has, just as Rotterdam, to do with energy transition. As a result, the Port of Antwerp would like to become a multi fuel port. Besides the well know sorts of fuel, the port of Antwerp wants methanol, hydrogen gas and electrical energy also to be an option for bunkering (‘’Transition to a multi-fuel port’’, n.d.). This is included in the most recently published annual report of the Port of Antwerp as well, namely the one of 2016. The port authority wants to innovate the chemical cluster on the basis of two goals. Firstly, securing the availability of energy and secondly, promoting the production of biofuels. According to the port authority, methanol is one of the right answers in order to reach the goals. As a result, the authority is eager to find a player in the industrial cluster that would like to control a methanol plant (Port of Antwerp, 2017). The production of methanol is at the moment still in the pilot start-up phase. The port authority is currently working on a pilot project where different actors in cooperation produce methanol (‘’Port of Antwerp brings different players together to produce sustainable methanol’’, n.d.). Another initiative of the port of Antwerp is the cooperation with a

company, called Engie. They are responsible for the construction of a bunkering station meant for ships and vehicles (Port of Antwerp, 2017).

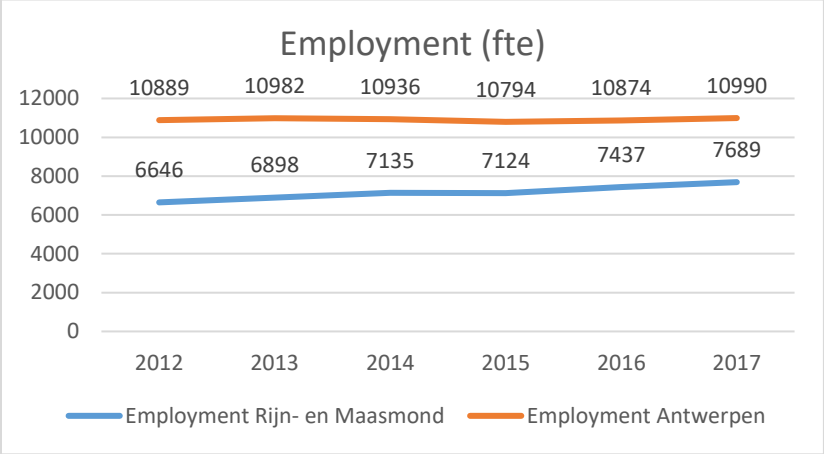
To summarize, the beginning, the current composition, the latest investments, the focus on high value added chemicals and the way the chemical cluster of Antwerp deals with energy transition are discussed. The following describes the main differences and similarities between the chemical clusters of the port of Antwerp and the port of Rotterdam. Since, the differences represent location factors, which are taken into account when chemical companies decide where to locate. The same applies for Ineos and Borealis.

2.4.3 The similarities and differences

Besides the difference in CO2 reduction policy and other location factors, the choice of Ineos and Borealis for Antwerp could also be related to the different industrial-logistics factors which both clusters have. Consequently, it is important to take the differences and similarities of the clusters of Antwerp and Rotterdam into account. Nevertheless, before the in-depth differences and similarities are discussed, an elaboration on the development of the chemical clusters is provided. The three aspects which are taken into account are: employment, the value added and the investments. These values were only obtained from the chemical industry, which implies that the oil industry is not included. Furthermore, the data for the chemical cluster of Rotterdam is obtained from van der Lugt, et al. (2018). Whereby the values of the Rijn- en Maasmond region are collected. Since, an important part of the chemical cluster is included in this area, namely Moerdijk. In addition, Shell Pernis connects Moerdijk with the use pipelines. In case of the chemical cluster of Antwerp, the data is obtained from Gueli, et al. (2019).

Firstly, the graph of the employment, which is provided below. The difference between the employment between Antwerp and Rotterdam is quite obvious, a lot more people are active in the chemical industry in Antwerp than in Rotterdam. Nevertheless, where Antwerp remains more or less constant, an increase in the employment in the cluster of Rotterdam is noticeable. Consequently, the cluster of Rotterdam is currently growing faster than Antwerp in the area of employment.

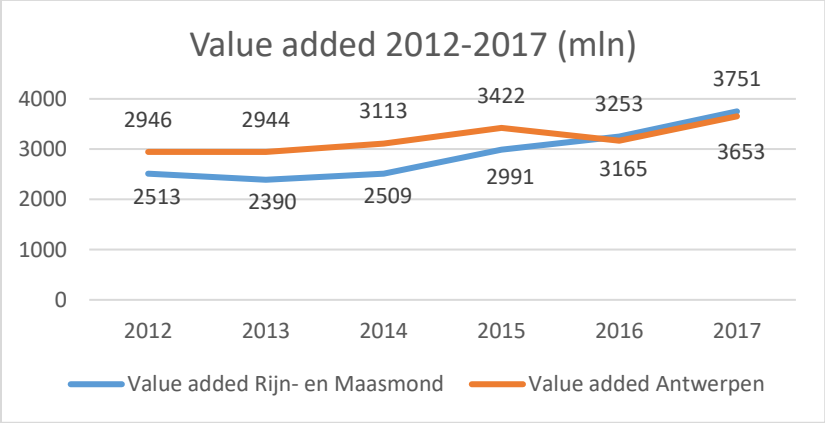
Figure 4 Development of the employment in the chemical clusters of Antwerp and Rotterdam



Source: Gueli, et al. (2019) and van der Lugt, et al. (2018)

Secondly, the development of the value added in the chemical clusters. The graph below shows that the value added of both clusters were more or less the same in 2017. Nevertheless, in case of the value added the same applies as for the development in employment, namely the value added is increasing faster in Rotterdam.

Figure 5 Development of the value added in the chemical clusters of Antwerp and Rotterdam

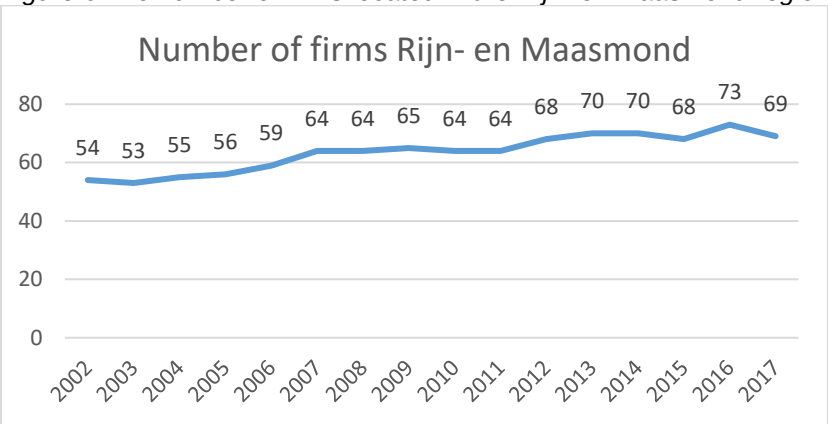


Source: Gueli, et al. (2019) and van der Lugt, et al. (2018)

Thirdly, the investments in the chemical clusters. Unfortunately, it is not possible to sketch a similar graph on the basis of this data. On the one hand, the port of Antwerp provides the amount of money invested over the years. On the other hand, the port of Rotterdam provides yearly the number of firms. The latter is the most interesting, because this shows the number of new entries and exists. Underneath an overview of the number of firms in the Rijn- en Maasmond region during the period 2002-2017 is given. 2017 compared to 2002 shows a positive development in the number of firms. However, since 2012 the number stayed more or less the same. Consequently, the cluster of Rotterdam is currently not growing in the area of new entries. The same applies for the chemical cluster of Antwerp. Since, Vanthillo, et al. (2018) describe that the new investments in the cluster mainly consists of investments which

are meant to upgrade existing installations. As a result, the number of firms in the cluster remains constant as well, which implies that Antwerp does, just as Rotterdam, not grow in this area.

Figure 6 The number of firms located in the Rijn- en Maasmond region



Source: van der Lugt, et al. (2018)

Anyhow, after the elaboration on the developments of the clusters, it is time to dive in the in-depth differences. Although, the exact number of product pipelines is not specified in case of the port of Rotterdam, it is plausible that the port of Antwerp has more different product pipelines than the port of Rotterdam. That is among others, a factor which they use to attract investors. Besides, Antwerp is located more central in European pipeline network than Rotterdam is. The more extended pipeline network is linked to the second difference between the two clusters as well, namely the focus of the cluster. On the one hand, the chemical cluster of Rotterdam focuses more on the refining industry and also partly on the basic chemical industry. On the other hand, the chemical of Antwerp is more oriented towards basic and advanced high value added chemicals. According to the interviewee of Authority A (Personal interview, 2019, July 29) the port of Rotterdam has a refinery cluster where there is some room left for the chemical industry. In the port of Antwerp it is the opposite, which implies that the port consists of a chemical cluster where refining activities are also carried out.

Nevertheless, the port of Rotterdam is a step ahead of Antwerp when it comes to becoming a CO2 neutral port. Recently three investments were executed or announced, which were related to sustainable production. Take for example the Waste-2-Chemicals factory, which will turn plastic waste into ethanol. Another example is AkzoNobel which has innovated their chlorine plant in order to let it run on wind electricity. Differently, the cluster of Antwerp consists of only one sustainable factory at the moment, namely the one of Avantium (van Heel, 2019, February 10). In addition, the port of Rotterdam is currently leader, in the Netherlands, in the field of bio-based chemicals. However, in Belgium the port of Ghent takes the lead when it comes to the research and production of bio-based chemicals (Hintjes, et al., 2015). Also in

the field of LNG a difference between the chemical clusters of Antwerp and Rotterdam exist. Since, the port of Rotterdam is currently paying more attention to LNG than the port of Antwerp does. Rotterdam wants to become the European LNG hub (''LNG: import, export and bunkering'', 2018, September 28) Where the chemical cluster of the port of Antwerp sees LNG, at the moment, only as alternative fuel (''Energy transition in the port of Antwerp: new impetus for LNG as an alternative kind of fuel for ships'', n.d.). Altogether, the above described differences are a reflection of the attitude of the port of Antwerp against the energy transition.

Ending with the similarities, generally the future path of the chemical clusters of Antwerp and Rotterdam do not differ that much. Both projects of the port of Antwerp, related to energy transition, have characteristics of the three steps set by the port of Rotterdam. Since, they both contribute to other forms of fuel and promote a different energy system. Another similarity is the wish to innovate the chemical cluster, both clusters do not want to replace the current actors of the cluster. The port of Rotterdam has mentioned this in their annual report and in case of the port of Antwerp this is noticeable for example on the basis of the methanol pilot project. The port authority cooperates with different current partners of the chemical cluster. Consequently, this leads to innovation and makes it not necessary to replace the actors of the cluster in order to achieve the energy transition targets. Nevertheless, as discussed, the port of Rotterdam is currently at a further stage of CO2 neutralization through the promotion of bio-based chemicals (van Heel, 2019, February 10). Furthermore, despite of the more or less the same location factors, hinterland, the strong growth in added value over the years and the representing of a few same companies, the chemical clusters do not have a lot in common. The reason why the location factors do not differ much has among others to do with the regulation of the European Union. Take for example the taxation policies and the possibility to offer tax incentives. This possibility is limited, because the European Union has set uniform boundaries to the proportion of the incentives (Authority A, personal interview, 2019, July 29).

To summarize, the main difference of the clusters is the focus. On the one hand, the port of Antwerp is specialised in chemicals and advanced chemicals. On the other hand, the port of Rotterdam focusses more refinery and on base- and bio- based chemicals. In addition, Antwerp is seen as more attractive in the area of the pipeline network. Furthermore, the employment and value added are currently growing faster in the chemical cluster of Rotterdam than in the chemical cluster of Antwerp. This does not apply to the number of new entrants. Since both clusters experience no growth on this aspect. In the next section there will be an elaboration on the difference in the CO2 reduction policies, and the associated objectives, between Belgium and the Netherlands.

2.5 The difference in CO2 reduction policy objectives

In previous parts, among others the location choice factors of chemical companies were discussed. Factors like political stability or the availability of skilled labour turned out to be important for industrial companies. Although these factors could still be essential for industrial nowadays, these location aspects are based on some older studies. In this research it is examined whether the location choice theory should be extended with a factor that is relevant, and linked to customer needs, for this time. More specific, besides the aforementioned location factors, which factor could have contributed to choice of the chemical cluster of Antwerp over Rotterdam as well? In this last part of the literature review, attention is given to a factor which might have been relevant for Borealis and Ineos in their location choice, namely the difference in the governmental CO2 reduction policy, with in particular the objectives.

Starting with, the Belgian policy of the reduction of greenhouse gases emission. The Belgian policy implies in this case the European agreement of the reduction of greenhouse gases emission. Since, Belgium follows the agreements which are made by The European Council and the European Commission regarding the fight against climate change. The deadlines of the agreements are set for 2030. Among others, the agreements include a carbon emission reduction, on territory of the European Union, of at least 40% in respect of 1990. Furthermore, at least 32% of the energy use has to be renewable energy (''Het klimaat- en energiebeleid tegen 2030'', n.d.). These are just two examples of the total set of agreements. The European agreement of the reduction of greenhouse gases emission has a potential effect for the chemical clusters of the Port of Antwerp and the Port of Rotterdam as well. Since, both the government and the port authority will be more strict and as a result will follow certain policies to control the reductions. Consequently, the agreements of the European Union could be a factor which deter chemical companies to locate in the cluster of Antwerp. Since, the chemical industry is not known as a climate friendly industry.

Nevertheless, the Dutch government aims for an even higher carbon emissions reduction of at least 40% in 2030, namely 49% (''Klimaatbeleid'', n.d.). The Dutch government follows, in case of the other agreements, the same guidelines as the European Union has set. The target of the greenhouse emission reduction does, just as for the port of Antwerp, imply that chemical companies might be more willing to locate elsewhere. However, the Dutch government has reinforced this effect by setting an even higher objective. As a result, the chemical cluster of the Port of Antwerp might be more attractive for companies which are bothered by the more ambitious reduction policy. A given that is confirmed by for instance by the chairman of VNO-CNW, according to him the Port of Rotterdam will miss foreign investments due to the higher

target (Bremmer & Vogels, 2019, January 10). On the other hand, for some companies, for example active in the renewable energy industry, a certain policy might be a beneficial location aspect.

Anyway, whether the governmental carbon emission reduction policies, and the associated objectives, are indeed factors which are leading when chemical companies choose where to locate, is answered further in this research. The same applies for the industrial-logistics factors, because the port of Rotterdam and Antwerp turned out to have quite different chemical clusters. As a result, this could also have played a role in the choice of Antwerp over Rotterdam in case of Borealis and Ineos. The next section describes the method of research in order to find out whether the abovementioned assumptions are right.

3. Methodology

3.1 Introduction methodology

In this section a further elaboration on the research method is given. By doing so, it is possible for the readers of this research to repeat it and it clarifies specific choices during the research process. This part consists of aspects as the research question, the sub-questions, example studies, cases and interviews are discussed. Starting with a recap of the research question:

''Are the CO2 reduction policies, and the associated objectives, of countries leading location choice factors for chemical companies?''

3.2 The characteristics and different forms of case studies

In order to provide an answer on this question, case studies are conducted. Yin (1984) describes a case study research as ''an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used.'' Although this definition is old, it is still used in contemporary research often. So, a case study is a research method that is used to research a specific event within its context. In addition, an important characteristic by doing case studies is the use of different sources (Baxter & Jack, 2008). The specific events are in this case the decisions of Ineos and Borealis to locate in Antwerp. Nevertheless, what are the reasons to choose this research method over other methods of research?

Yin (2003) provides an overview of indications when a case study should be implemented. Firstly, if the aim of the research is to provide answers on open questions. For example, why did you use a case study? Or How did you use the data obtained from the case study? Secondly, when it is impossible to affect the choices of the actors which are part of the study. Thirdly, when the context is too relevant not to use it. Fourthly, when the edges between the event and the context are not clear. As a result, all the indicators of when it should be wise to use case studies apply to this research. The aim is to find out why Ineos and Borealis chose Antwerp over Rotterdam. Furthermore, the decision is fixed which makes it impossible to change the behaviour of the actors. Lastly, the context is the most important of the research. Aspects as company characteristics, the negotiations or location factors are all taken into account.

Furthermore, the use of case studies generates also advantages; Zainal (2007) describes that more variables are included due to the including of the context. When an experiment is being

executed, the focus is only on a couple of variables. In addition, it is possible to obtain information about complexities of real circumstances, a possibility which is too hard for a research method as experiments or questionnaires. In case of a questionnaire it is only possible to obtain data about acts. The reason behind certain acts, the complexity, can only be obtained on the basis of case studies. Furthermore, the use of case studies provides the possibility to obtain both qualitative or / and quantitative data. However, this depends on the nature of the case study. More on the different forms of case studies and the one which is applied in this research, later on.

Nevertheless, conducting case studies is sometimes accompanied by disadvantages as well. Firstly, the output of the case study can be too long. Secondly, the outcomes are in general more biased than the outcomes of studies were other research methods were conducted. The reason for this is the qualitative character the study mostly has. Thirdly, the difficulty to generalise the outcomes, since most of the times a case study consists of only one or a couple of samples (Yin, 1984). Consequently, these are aspects to take into account when conducting case studies and eventually at the point of forming a conclusion.

Anyway, two studies are leading in the field of case studies and both have another view on the different types of case studies. Both studies are discussed and thereafter is mentioned which type of case study, in both cases, is conducted in this research. Starting with Yin (1984), according to him the phenomenon case study consists of three categories, namely exploratory, explanatory and descriptive. Whereby exploratory is more or less the first step of a potential theory. If the outcomes of the case study show something interesting, the study could function as basis for other studies in the future. However, it does not necessarily have to be a completely new topic, it can also be a new vision. For instance, by measuring in another way or by adapting other theories (Zainal, 2007). One step further is the descriptive research, the aim of this research method is to find more information about the results obtained from exploratory studies. In addition, it is about describing the specific events or phenomena, of interest, when these arise (McDonough & McDonough, 1997). Lastly, the explanatory case study, whereby a phenomenon is studied in-depth. Eventually the observations of this study could lead to the forming of a theory (McDonough & McDonough, 1997).

Ending with Stake (1995), who is the second person leading in the field of case studies. According to him the case study research method consists of three categories as well, but as mentioned these are different than the ones of Yin (1984). Since, he distinguishes the case studies in intrinsic, instrumental or collective. Whereby the intrinsic case study has the most in common with the exploratory category of Yin (1984). Since, the aim of the researcher is not

about extending of existing literature, but the focus is more on the case itself. This is different when the researcher uses an instrumental case study, hereby the researcher select the case on the basis of theory or to study specific actions. Additionally, conducting various instrumental case studies together form a collective case study. In this category, different sources are taken into account (Mills, et al., 2010; Zainal, 2007).

3.3 The research method

Anyhow, what kind of case study is conducted in this research? When looking at the categories of Yin (1984) the case study which suits this research the best, is the explanatory case study. Since, a phenomenon, in this case the location choice of chemical companies, is studied in a detailed way. In addition, the aim is not to generate a potential new theory or to describe the location choice of chemical companies. The focus of the research is about the potential extending or revising of the existing location choice theory, applied to chemical companies. Moreover, when the study of Stake (1995) is taken into consideration, this research links mostly back to the category of collective case studies. Since, as discussed the final goal is to revise or extend the location choice theory, to be able to do this two specific cases were selected. So, the cases serve the theory. The reason why it is collective and not instrumental is, because two instrumental case studies were conducted which makes it automatically a collective case study.

Additionally, it has previously been mentioned that case studies could generate both qualitative or quantitative data. In this research there is chosen to obtain qualitative data by among others conducting interviews, researching press releases, reports and news articles. This makes it possible to find the underlying reasons for Ineos and Borealis for choosing the port of Antwerp, which is difficult to include in for example a survey. More on this further in this section.

Altogether, in order to give answer on the question whether CO2 reduction policies of countries are location choice factors for chemical companies, two cases are selected. The choice of Borealis to invest in the port of Antwerp is one case, followed by Ineos which decided to do the same. These cases are selected, because of the level of media attention they got. This makes it besides conducting interviews also possible to obtain data from news articles and press releases. In addition, it is important that the conditions of the cases are more or less the same, in order to be able to compare the outcomes of both cases. Both companies are active in the chemical producing industry and stood for the same kind of investment decision in more or less the same period. Moreover, they are going to construct the same type of plants as well.

Furthermore, the goal of the case studies is to find out why Ineos and Borealis decided Antwerp over Rotterdam or other locations, as for instance Moerdijk or Terneuzen. As described, according to among others Hans de Boer Ineos and Borealis are located in Antwerp because of the more ambitious CO2 reduction policy of the Dutch government. However, no coherent vision on the influence of environmental policies on the location choice of companies exists. On the one hand, Brunnermeier & Levinson (2004) and List & Co (2000) concluded a negative correlation between a strict environmental policy and the attractiveness of a country. On the other hand, Kirkpatrick & Shimamoto (2008) showed that Japanese companies are actually more willing to locate in countries which a stricter environmental policy. Consequently, the opinion of among others Hans de Boer leads to the first sub-question of this research, namely

Sub-question 1: ‘’Are Ineos and Borealis located in Antwerp because of the CO2 reduction objective of the Dutch government?’’

However, the overview of the chemical clusters of Antwerp and Rotterdam showed that the characteristics are quite different. The cluster of Antwerp is more focused on advanced chemicals, where the cluster of Rotterdam is more focused on oil, basics chemicals and is one step ahead in the field of bio-based chemicals. The differences in focus are reflected in the various facilities and the type of companies in the clusters as well. As a result, Ineos and Borealis may have based their location decision on these aspects. This leads to the second sub-question, which is

Sub-question 2: ‘’Are Ineos and Borealis a better fit in the port of Antwerp because of industrial-logistics factors?’’

The answer on the first sub-question gives a direct answer on the main research question. Since, if the answer on this sub-question is positive it automatically implies that the CO2 reduction policies of countries are leading in the location choice of chemical companies. In case of the second sub-question it is different. If the answer on the second sub-question is positive, then the answer on the research question is ‘’no’’. The first sub-question is actually a direct consequence of the research question. Whereby the second sub-question is more or less the expectation, when taking the characteristics of the clusters into account. The sub-questions are not direct opposites, but a ‘’yes’’ on both sub-questions is impossible.

In order to be able to provide an answer on the sub-questions, case studies are conducted. As said, data obtained from interviews, news articles, reports and press releases function as sources. Besides, it is important to take characteristics of the companies and the investments

into account as well. Factors as the business organization, the goal of the company or the different affiliates, could all have an influence on the final investment. For example if a company already has affiliates in a country, it might be convenient to invest in that country because of logistics reasons. Nevertheless, the company could also choose for a better representation and decide to locate somewhere else.

Anyway, the aspects which are investigated in both case studies are firstly, the companies. How did Borealis and Ineos evolve over time? Whereby, special interest goes to the first location, the number of employees, the turnover, the number of affiliates, the location of the affiliates, the beginning activities, the products they are producing at this point and the organizational structure. These are all aspects linking back to the context, which is an important factor of case studies.

The second aspect of the case studies focusses on the characteristics of the investments. Starting with, the aim of the investment. For instance the building of a new refinery or a research centre. Since, Suurs & Roelofs (2014) concluded that the value of location factors is not exactly the same for all kind of investment types, as discussed in the literature review. Another interesting part of the investments is the amount of money the companies have spent. In addition, the effects the investments have on the region. Since, the plants need people to keep the business running and add value to the region. Another factor, related to the investments, which is taken into account are the past investments. On the basis of the past investments it might be possible to derive a set of factors which are essential for Ineos and Borealis. For example, if they only choose locations where the level of education is high or the corporate tax is low. Additionally, the investments can also show a certain pattern, which may explain the choice for Antwerp.

3.4 Interviews

This links back to the aim of the third, and last, aspect of the case studies, which is finding out how the location choice process went and which location factors where leading in the choice for Antwerp. That is also the purpose of the other two aspects of the case studies, but more indirectly. Since, a framework is built on the basis of news articles, reports and press releases to make sure that every contextual aspect is included in the case studies. Nevertheless, the goal of this research is to expose the underlying reasons to locate in Antwerp. In addition to news articles, reports and press releases, interviews also play a role. Information about the company or the investments is accessible and mostly objective. However, the opinions about the location factors differ and are subjective. By conducting interviews with players who were involved in the negotiation process and experts of the chemical clusters of Antwerp and

Rotterdam, it is possible to take different sides into consideration. Conclusively, as with the other two aspects of the case studies, this leads to the most objective judgement possible. An example of a location factor which probably will only be revealed by conducting interviews, is the providing of incentives. Governments would like to attract big investments, because they provide among others employment. In order to attract these investments, governments use incentives. However, these are factors which are not always publicly available. Nevertheless, they could still play a role in the location choice of chemical companies. Consequently, the results of the interviews are a well addition to the data obtained from news articles, reports and press releases in order to describe the location choice process and the location choice factors which were relevant for Ineos and Borealis.

In addition, the data obtained from the interviews is also used to describe the role of image in the location choice process and to generate a ranking of the most relevant location choice factors in general, which is provided after the case studies. This ranking is formed on the basis of how many times a factor has been mentioned by the interviewees. Wherein the factors are distinguished into two groups. Firstly, factors which are often mentioned. The benchmark for this is when a certain factor has been mentioned three or more times out of a total of ten interviews. Secondly, the location choice factors that are mentioned less often, namely one or two times. Furthermore, some people refer to the same factor, but in other words. In that case the they are grouped under one factor.

3.4.1 The participants

Anyway, the process of taking interviews consists of two aspects, namely the participants and the questions. Starting with the participants, in the best case scenario either the management of Ineos or the management of Borealis would have liked to conduct an interview. However, as said in the best case scenario, it was actually not possible. This is probably because they are too busy and not willing to reveal their reasons to locate in Antwerp, because of privacy issues. Luckily, there are enough of experts and organizations that know how chemical companies chose their location. The selection of participants is based on a snowball effect. This implies that a couple of persons function as starting point and on their turn recommend other persons to have a conversation with. Consequently, the snowball, the group of participants grows over time. The reason for choosing this selection process is to make sure that the participants have the relevant knowledge to be able to answer the questions. The beginning of the research started with a fellow researcher of Mr. Kuipers at the University of Antwerp and some representatives of authorities in both Antwerp as Rotterdam. This eventually led to ten interviews with ten different organizations spread across Belgium and the Netherlands. These organizations can be divided into four groups, namely authorities,

government agencies, regional development organizations and trade associations. In addition, six out of the ten interviews mainly produced knowledge about Rotterdam and the other four about Antwerp. A complete overview of the dates, a description of the organizations and the participants of the interviews is included in Appendix A.

Since, the investments of Ineos and Borealis in Antwerp are still ongoing cases and confidential information is shared during the conversations. It has therefore been decided to make the names and organizations of all the participants anonymous in order to guarantee their privacy. Therefore, references to the conversations are as follows; a certain group plus a letter. Consequently, the overview included in Appendix A consists of the referenced name in the text as well.

Furthermore, after an interview a report is made, which is sent to the interviewee for verification. After which, the report, whether modified by the interviewee or not, is used as a source for this research. Inspection of these reports is only, limited, possible in consultation with the graduate and / or supervisor. Anyhow, the next section describes the nature of the interview questions.

3.4.2 Interview questions

Ending with the questions, the most important aspect of the questions is to exclude every potential threat of bias. Consequently, there is chosen to use open questions instead of closed questions. By using open questions, the participants are forced to think about an answer and the answer will probably be more complete and extensive. Then the question remains whether the list of location factors from the literature should be provided or not. Lu & Yang (2006) did research on the selection of logistics zones by Taiwanese manufactures and their research method was asking the participants to rank their provided list of location factors. In addition, Lee, et al. (2007) had the same approach in their research about the port selection by liners, shippers and terminal operators. Nevertheless, by asking participants to rank a list of location choice factors, the threat of biasness appears. Since, this would stimulate the participants to keep the real reasons for themselves or to rank a safe traditional factor above potential new location factors such as a CO2 reduction policy. In addition, it might be the case that the participants actually know some more factors which are not involved in the list obtained from the literature. Consequently, it has been decided to ask completely open questions and not to share the list of factors.

In addition, the previously discussed study of Suurs & Roelofs (2014) is discussed will serve as an example. This is actually for several reasons. Firstly, the aim of the research is more or less the same. They researched the most important location factors for bio-based chemical companies. Secondly, they derived a list factors from the literature as well and made interview questions based on the list. The same approach is used in this research. Thirdly, three different kinds of investments are taken into account and the importance of the location factors turned out to be linked with the nature of the investments. That is why in this research this is also taken into account. Fourthly, besides finding the most important location factors, they researched how the Netherlands score on these factors. The same kind of method can be applied for Antwerp and Rotterdam. So, the interview questions of this research are partly built on the questions of Suurs & Roelofs (2004). A complete overview of the questions is included in Appendix B. Additionally, the participants received the same list of interview questions in advance of the interview in order to prepare themselves, to make sure whether they have the right knowledge and to be able to coordinate in advance which aspects cannot be discussed.

Altogether, the results of the case studies show which factors are leading in the location choice of chemical companies, whereby special interest goes to CO2 reduction policies and the associated objectives. On the basis of this the list of currently known location choice factors could be revised or extended. As a result of the statement of Hans de Boer, can be rejected or confirmed. In addition, the revision of the location factors will have positive implications for port authorities as well. Since, they can follow a list that they must meet to attract chemical companies. Starting with the Borealis case study, which is covered in the following section.

4. Case study Borealis

4.1 Introduction case study Borealis

In this section the previously discussed research method is brought into practise. Among others, the investment of Borealis in Antwerp is studied in-depth, in order to find the reasons why Borealis chose to invest in Antwerp. Before these reasons are discussed, an overview of the company Borealis is given. Examples of aspects which are discussed are the employment, the speciality of Borealis and the organizational structure. Followed by information about the investment in Antwerp. Where after the location choice process of Borealis and the reasons to locate in Antwerp are described in order to see whether Borealis deviates from the standard location choice process, which is described after the two case studies.

4.2 Profile of Borealis

Borealis is originally a Scandinavian company, which was founded in Denmark in 1994. At that time Neste and Statoil held both 50% of the shares. Nevertheless, during the years the ownership did not remain the same, as the rest of this section shows. A year after Borealis became operational, they opened their first Borstar polyethylene plant in Finland. Whereby Borstar refers to the name of Borealis' technology in order to produce polyethylene and polypropylene (''Borstar® Technology'', n.d). The next big step in the history of Borealis is the establishment of a joint venture with ADNOC, called Borouge. Where ADNOC stands for Abu Dhabi National Oil Company. The goal of this cooperation was to build and run a petrochemical cluster in United Arab Emirates, where they have succeeded. Over the years they expanded the complex two times, both in 2010 as in 2014. Consequently, Borouge became the biggest polyolefins complex in the world. After the introduction of Borouge in 1996, Neste sold their shares to OMV and the International Petroleum Investment Company, in 1997. OMV is a company which is active in the oil and gas industry and is located in Vienna. So, this was the first change in the original division of ownership. In this same year Borealis started to buy shares of other companies as well, namely 50% of North Sea Petrochemicals NV. As a result, they obtained the control of a polypropylene plant in the region of Antwerp. This acquisition is followed by the purchase of PCD Polymere, which made Borealis one of the main producers of polyolefins. Additionally, Borealis kept buying other companies over time. Examples are the acquisition of Agrolinz Melamine International GmbH in 2007, the acquisition of DEXPlastomers in 2013 and the acquisition of a significant part of Rosier S.A. in the same year (''History'', n.d.). The purchasing of other companies is an aspect, which got Borealis on the level where it is now. For that reason they still acquire activities of other companies at this stage as well. More on this later on, when the decision of Borealis to invest in Antwerp is discussed more in detail.

Besides the acquisition of companies, Borealis is part of quite some joint ventures as well. Earlier the joint venture with ADNOC, named Borouge, is discussed. Another example of a joint venture is Borealis Brasil S.A., a cooperation with a Brazilian company, named Braskem. This joint venture is responsible for the supply of polyolefins to all the customers in South-America. Another joint venture is the result of a cooperation between DuPont and Borealis. They started to work together by introducing Speciality Polymers Antwerp N.V., in 2000. As mentioned, the ownership of Borealis changed already a bit in 1997 (''History'', n.d.). After the sale of shares by Neste, Borealis had three owners, namely Statoil, OMV and the International Petroleum Investment Company. However, Statoil sold their shares to the other two owners, in 2005. As a result, OMV got 36% of the shares and the International Petroleum Investment Company got the other 64% of the shares (''History'', n.d.). This division has remained unaffected, with the only small change that the International Petroleum Investment Company has been part of a merge, which implies that a company named, Mubadala Investment Company has 64% of the shares of Borealis, at this moment ('Who we are'', n.d.)

Anyhow, the abovementioned is only a small indication of all the developments that have taken place. Since, approximately 6800 people are working for Borealis at this point. Whereby, the majority of the employees is located in Austria and Belgium, namely respectively 1900 and 1100. Interesting to note is that in the Netherlands only 200 people are working for Borealis (Borealis, 2019, February 21). This might be an indication why Borealis decided to place their most recent investment in Antwerp. Considering that Borealis has more industry in Belgium than in the Netherlands . However, this is just an assumption, later in the case study there is elaborated more on this. Furthermore, Borealis has clients spread over more than 100 different countries, which led to a turnover of about 8.3 billion euros and a net profit of 906 million euros (Borealis, 2019, February 21). The remaining of the overview of Borealis dives into the products and the organizational structure in order to show how they are able to generate this turnover.

Starting with the different industry segments they are active in. Firstly a segment which is already mentioned a couple of times, namely polyolefin. Whereby polyethylene and polypropylene are different kinds of polyolefins. The polyolefins manufactured by Borealis are used by the energy, pipe and automotive industry. In addition, the polyolefins are also used in the production of all kinds of consumer goods. To explain one further; the polyolefin plastic of Borealis is an alternative for the use of for instance rubber and metal in the automotive industry, since the use of plastic takes less weight. Another segment that Borealis deals with is base chemicals. The group of base chemicals consists of fertilizers, melamine, hydrocarbons and energy. Whereby the latter is about converting gases like propane and ethane into ethylene or

propylene (''Industry Segments'', n.d.). The new location in Antwerp is meant for this type of activity as well. The production of fertilizers is also mentioned as separate segment. Since, Borealis is leading in this business in Europe. In addition, Borealis has a special division specialised in fertilizers, namely Borealis L.A.T. and they are responsible for the supply of more than five million tonnes of fertilizers (''Industry Segments'', n.d.).

Ending with the organizational structure, as mentioned Borealis currently two owners. Both OMV and Mubadala Investment company have shares in Borealis. Consequently, Borealis has to operate under the control of a supervisory board. In addition, Borealis has an executive board whereby Alfred Stern has the lead as CEO. Alfred Stern became CEO after Mark Garrett in 2018 (Borealis, 2019, February 21). The presence of an executive board and a supervisory board does not sound very odd, considering that Borealis is a major company and in most cases relatively big companies do have an organizational structure like this. Nevertheless, it is relevant to mention, because Ineos does not have such a structure. As a result, the location choice process of Ineos went differently than the process of Borealis. Later in the case study of Ineos, more attention is paid to the different organizational structures and what the different in the location choice process was. The next section dives into the most recent investments of Borealis, including the investment in Antwerp.

4.3 Borealis' recent investments

Before extensively discussing the investment of Borealis in Antwerp, some other recent investments are elaborated on as well in order to indicate a possible pattern in the investments. Such a pattern could possibly explain the choice of Borealis for Antwerp. Furthermore, elaborating on earlier investments also helps to place the investment of interest in perspective. It indicates for instance the size of the investment and the long-term purpose of the investment.

Borealis describes that the period between 2007 and 2010 is characterised by getting through the financial crisis. Borealis decided, among others, to close their polyethylene plant in Beringen, which is a city in Belgium, in 2009. Nevertheless, one year later Borealis announced the completion of Borouge 2, which was the first expansion of Borouge. As a result of the expansion the total production capacity of polyethylene and polypropylene became three times bigger (''History'', n.d.). To make the expansion happen, Borealis signed among others two large contract, including one with Tecnimont. This company was responsible for the construction of different facilities such as laboratory facilities, material handling facilities and the building of three Borstar technology polyolefins units. Moreover, the contract was worth about 1.8 billion dollars (''Borouge awards two major contracts for Borouge 2 expansion project'', 2007, April 12). Important to note is that these developments were not the only ones

in this period, these are just some examples. This also applies to the next period in the history of Borealis, in which both growth as sustainability are important factors. Additionally, this period started in 2010 and is still going on. The following overview of developments during this period, do not consists of any acquisitions despite the fact that they took place quite often. An example is the acquisition of DEXPlastomers in 2013, which is referred to earlier. The focus is on the investments executed by Borealis, otherwise the list of developments would be to comprehensive.

Firstly, the investment in the innovation of the polyethylene plant in Stenungsund in 2010. The total money which has been invested reaches to an amount of 400 million euros in order to fulfil the wishes related to more advanced cable products. The next major investment during this period is the announcement of the third expansion of Borouge, in 2014. Unfortunately, the magnitude of the investment is unknown. Nevertheless, this investments doubled the manufacturing capacity and has ensured that Borouge is the world largest polyolefins complex. So, without knowing the exact amount of money invested in this project, it is probably one of the major investments announced during this period. The third investment is an upgrade of the crackers, worthily 160 million euros, which are part of the plant located in Stenungsund, in 2015. This is the same plant in which has been invested in five years before. The fourth investment which is relatively large as well is the investment in melamine and fertilizer plants in Linz, in 2016. In addition, the costs of this project were about 80 million euros (''History'', n.d.). All the above mentioned investments ultimately lead to an investment of Borealis in Antwerp, which is one of the biggest recent investments of Borealis. The following dives into this investment and describes the characteristics.

4.4 Borealis' investment in Antwerp

Borealis describes that this investment is in line with their strategy to be the leader when it comes to the supply of innovative polypropylene and propylene in Europe. Another aspect which was important in their investment decision is the increasing demand from their European customers (''History'', n.d.). Furthermore, the investment consists of an amount of one billion euros and is meant for the building of a propane dehydrogenation plant. The plant is going to convert propane gas into propylene, which is an essential feedstock the chemical industry especially for the plastic industry. Since, it is such a big investment, it is one of the biggest European investments in recent years (Financieel Dagblad, 2018, October 8). This automatically makes it one of the biggest investments for Borealis in recent years as well, a fact which is also noticeable when taking the aforementioned investments into account. Additionally, the plant will be built on a site where Borealis is already present, namely in Kallo which is a place nearby Antwerp. Moreover, the plant will probably be eventually one of the

biggest in the world. Since, the aim is to produce 750 thousand tonnes per year. Nevertheless, before the construction of the plant is going to start, it takes some time. The intended start date of this project is put on mid-2022 (''Borealis to build new, world-scale 750,000 tonne/year propane dehydrogenation (PDH) plant in Belgium'', 2018, October 6).

Besides generating benefits to Borealis, this investment will bring benefits to the region as well. Firstly, approximately 2000 people are needed to construct the plant. This implies that two thousand people are busy with this project for at least a couple of months. Secondly, if the plant has been build, it is going to operate which means that Borealis needs a hundred extra employers. Thirdly, the attraction effect for other investments. Due to the investment of Borealis, Oiltanking Antwerp Gas Terminal announced an investment as well, namely the building of a new propane storage tank (Financieel Dagblad, 2018, October 8). This is a direct consequence out of the investment decision of Borealis. Since the company will be responsible for the logistical part of the propane and propylene (''Borealis to build new, world-scale 750,000 tonne/year propane dehydrogenation (PDH) plant in Belgium'', 2018, October 6). Moreover, Borealis won, because of this investment, the Foreign Investment of the Year Trophy. This is a price for a noteworthy investment by a foreign company, which is awarded by Flanders Investment and Trade. A Belgian organization which is also involved in the attraction of investments (''Borealis wins the 2019 Foreign Investment of the Year Trophy'', 2019, March 19). The fact that Borealis received this price demonstrates the importance of this investment especially due to the size and the strengthening of the existing cluster.

After discussing the characteristics of the investment in Antwerp by Borealis, the question remains why Borealis decided to locate in Antwerp and how the location choice process has been going. The following dives into these questions.

4.5 The location choice process and the decisive factors of Borealis

Borealis announced the new investment in Antwerp, discussed earlier, in October 2018. The interviewee of Trade association C (Personal interview, 2019, August 30) described that the conversations, which are part of the location choice process, partly went through the welcome team. Where the welcome team is a collaboration between a Belgian trade organization and a Belgian regional development organization with the aim of guiding foreign investments in the chemical industry. Companies can approach this team with questions such as: which locations are still available? and what are the tax benefits that Belgium has to offer? So, this team offers an overview of potential incentives and assists in choosing a production location.

In addition, the interviewee of Authority A (Personal interview, 2019, July 29) described that the location choice process of Borealis was comparable to the general location choice process, which has been outlined earlier. Nevertheless, according to the interviewee, it was quickly clear that the investment was going to take place in Antwerp. There was little competition for Antwerp in attracting the investment, because Borealis is already localised in Antwerp (Government agency A, personal interview, 2019, July 30). This is confirmed by the interviewee of Authority B (Personal interview, 2019, August 15) who described that Borealis would never come to Rotterdam. Since, they have got a big operation in Antwerp and a chemical company will not choose another location when they are already located in a good location, unless they have to expand. Consequently, Borealis decided to invest on the same site where they already have facilities, namely in Kallo. So, the location choice process of Borealis has not really been a location choice process, because probably they have not even considered other locations. Furthermore, not much is known about the actual process, because the discussion did not become public where this was the case with Ineos. Since, the choice of Ineos for Rotterdam was very plausible on a certain moment, but more about this later (Trade association B, personal interview, 2019, August 23).

Anyway, Borealis' choice to invest on the same site already partly reveals why they have chosen Antwerp, but before looking at this, back to the main question of this research; Are CO2 reduction policies, and the associated objectives, of countries leading in the location choice process of chemical companies? As mentioned, according to Hans de Boer, the Netherlands misses out on foreign investments due to the stricter CO2 policy compared to Belgium (Bremmer & Vogels, 2019, January 10). However, in practice this does not seem to be the case and does the location choice of a chemical company not depend on a CO2 reduction policy, which implies that it is not about a difference in the policy objectives either. The interviewee of Authority A (Personal interview, 2019, July 29) described that during the location choice process, the CO2 reduction policy has never been discussed. The interviewee added that it is self-evident for this company to commit to the energy policy agreements. Additionally, the interviewee of Regional development organization B (Personal interview, 2019, August 8), Regional development organization A (Personal interview, 2019, August 7) and Authority B (Personal interview, 2019, August 16) confirm that Borealis did not choose Antwerp, because of the difference in CO2 policy between the Netherlands and Belgium. In addition, the interviewee of Regional development organization C (Personal interview, 2019, August 29) elaborated on the fact that such a difference in CO2 reduction objectives has not been discussed with any other company either. However, companies are looking for certainty, also related to CO2 policies. Consequently, the Dutch or the Belgian policy, depending of the country of interest, is quite often on the table, but again without taking the differences in

objectives into account (Regional development organization C, personal interview, 2019, August 29). That companies are looking for certainty in the area of CO2 comes possibly partly from concerns about the cost price of the CO2 certificates. Since, the price of these certificates in Europe has quadrupled in 1.5 years. However, this applies to both the Netherlands and Belgium, because it is a European measure (Regional development organization A, personal interview, 2019, August 7). In addition, the interviewee of Government agency B (Personal interview, 2019, August 28) described that when conversations about a possible CO2 tax take place in the Netherlands, companies realize that the same conversations will also occur in other countries, because all countries in Europe have signed the Paris Agreements. Nevertheless, these countries have set different targets.

For example, a difference exist in the standard that Belgium and the Netherlands would like to achieve with regard to CO2 emissions. According to the interviewee of Trade association B (Personal interview, 2019, August 23) companies take these, and many factors, differences into account. The investment of Borealis is an investment in the fossil industry and these factories emit CO2. As a result, companies consider where the position in that area is the best. If a strict policy is pursued in the Netherlands and a less strict policy in Belgium, this will result in bonus points for Belgium. So it certainly has influence, but the degree is arbitrary. Furthermore, no silver bullet or a single argument exists, which explains why a certain choice is made. Additionally, a number of different aspects played a role in the location choice process (Trade association B, personal interview, 2019, August 23). Altogether, this interviewee is the only one who confirms that the difference in CO2 reduction objectives has an, whether small or not, influence on the location choice process. Since, the interviewee of Trade association A (Personal interview, 2019, August 7), who mentioned that a CO2 reduction policy is an aspect that weighs heavily in the location choice of a chemical company, indicated that he does not have insight into how the location choice process of Borealis went. *To conclude, I agree with the majority of the opinions that the difference in CO2 reduction objectives has not been a determining aspect in the location choice*. *Since, there is only one person who states that this difference has played a minor role and is not very convincing as well.* Anyway, if it was not about the CO2 reduction policies and the objectives of Belgium and the Netherlands, which aspects ultimately led to Antwerp?

According to the interviewee of Authority A (Personal interview, 2019, July 29) it played a role that Borealis is already represented in Antwerp and is therefore familiar with the quality of the location choice factors in Antwerp. However, this does not seem to have been the only facet in the choice. Among others Baert (2018, October 6) discusses a few other aspects which played a role. Firstly, the investments is going to be executed on the same site where Borealis

has a plant, which implies that the knowledge to produce propylene is already present. Secondly, the favourable location due to the port, which makes it easy to import materials. Thirdly, Antwerp is the second biggest chemical cluster of the world and accommodates all major players. Fourthly, Antwerp is located in the middle of the European pipeline network. This is relevant because in that case the propylene, a building block for the plastic industry, can easily be transported to customers and own plants in Belgium. Fifthly, the support Borealis receives from the Flemish government, in the form of a 6 million euros subsidy intended to train employees and to promote the construction of the plant in such a way that it emits less CO2. Also HLN describes in an article that Borealis chose for Antwerp due to the subsidy, the already existing plant in Kallo and the fact that Antwerp is one of the biggest chemical clusters of the world (HLN, 2018, October 6). Nevertheless, the question is whether Borealis itself has also explained the investment in Antwerp on the basis of these factors.

Borealis has mentioned the following aspects in one of their press releases; Firstly, the good position of Antwerp with regard to logistics. Secondly, the synergies with existing plants of Borealis. Thirdly, the way of producing propylene is known. Fourthly, the strong collaboration with all kind of different actors, such as the governmental authorities, port authority and customers (''Borealis to build new, world-scale 750,000 tonne/year propane dehydrogenation (PDH) plant in Belgium'', 2018, October 6). Altogether, this is more or less the same as what is described by authority A, HLN and Baert, with the exception of the 6 million euros subsidy. *I do believe that Borealis receives this subsidy, but I also understand that Borealis is not releasing this as one of the factors that led to the investment. Nevertheless, I am pretty sure that this plays, whether small or not, a role in a location choice.* Since, the conversation with the interviewee of Government agency A (Personal interview, 2019, July 30) revealed that companies attach great importance to subsidies. Companies see this as a sign of welcome, which is greatly appreciated. To conclude, the location choice of Borealis has not really been a choosing process and the difference in CO2 reduction objectives between the Netherlands and Belgium played no role. The crucial location choice factors were subsidy, logistics and synergy. Additionally, the following section shows whether these factors were also leading for Ineos.

5. Case study Ineos

5.1 Introduction case study Ineos

In this section the second case study is conducted, in which the choice of Ineos for Antwerp is central. Where, just as with the previous case study, the profile of the company is considered first. Aspects as the origin, acquisitions, joint ventures and the organisational structure are reviewed. This is to get an idea of what kind of company Ineos is, which in turn secures that certain choices, such as location choices, are more understandable. After which the recent investments of Ineos are examined, the reason for this is the same as before. When these two aspects of the case study are discussed, it is time to dive into the investment in Antwerp. What kind of plant is Ineos going to place and what is the impact for the region are examples of questions, which are answered. Nevertheless, the focus goes to the factors which were important in the location choice process and the process itself.

5.2 Profile of Ineos

The beginning of Ineos goes back to 1998. In this year Jim Ratcliffe, the founder of Ineos, decided to buy one specific plant of a company named Inspec. The plant where it is about, is the ethylene oxide plant in Antwerp, which used to be property of BP. Interesting to note is that the acquisition resulted from a management buy-out. Where after, a period followed in which Ineos took over many other companies. Examples of acquisitions are both the acquisition of Crosfield as the acquisition of Phenolchemie in 2001. After the acquisitions the company names became respectively Ineos Silicas and Ineos Phenol. Nevertheless, Ineos also owes its growth largely to acquisitions of business units of companies, instead of whole companies. This also characterises Ineos and its history, as this is for example not reflected in the history of Borealis, where mainly entire companies were bought up. In addition, the acquisitions of the business units were not of the small players in the chemical industry. On the contrary, Ineos has purchased business units from among others Dow, BASF and BP. In the case of Dow, Ineos was interested in the acquisition of the global ethanolamine business of Dow Chemical. Consequently, Ineos purchased this business in 2001. However, the purchases of business units consists not only of global businesses. Since, Ineos acquired the polystyrene business of BASF which took place in both Canada as the United States, in 2005 (‘’Our History’’, n.d.). Another example concerns BP, because in addition to the acquisition where it all started in 1998, Ineos acquired a company from BP, namely Innovene. This was a company which was under full control of BP at that time and had the possession of production facilities in seven countries. These facilities together had a total capacity of 18 million tonnes of petrochemicals and the estimated turnover in 2005 was approximately 25 billion dollars. As a result, Ineos had to pay a lot of money, which they did. Since they purchased BP’s Innovene for an amount of

nine billion dollars (''INEOS completes purchase of BP's Innovene business for $9bn'', 2019, December 16).

Another aspect that has made Ineos what it is at this point, is the formation of joint ventures. Two examples of joint ventures which has been formed by among others Ineos, are Styrolution and Petroineos (''Our History'', n.d.). Starting with Styrolution, this joint venture was a manufactural cooperation between Ineos and BASF focused on the production of all kinds of styrene chemicals and started to operate in 2011. Nevertheless, Ineos acquired the other 50% of the shares for an amount of 1.1 billion dollars, in 2014. This implied the end of the relatively short- existing joint venture of Ineos and BASF. Furthermore, Styrolution is at the moment still under full control of Ineos and has 3500 employees worldwide (''INEOS completes the purchase of BASF share of Styrolution'', 2014, November 17). This is just one example of a joint venture between Ineos and a partner that ultimately came into full ownership of Ineos. A joint venture that actually has survived, which is also the only one, is Petroineos. This company, which is started up in 2011, is a joint venture between Ineos and PetroChina International Company Limited. In addition, the company has two refineries in use, namely one in Grangemouth (Scotland) and the other one in Lavera (France). As a result of these two refineries, Petroineos is Europe's independent number one when it comes to the refining of crude oil. Since, both refineries handle over 200.000 barrels a day. Consequently, Petroineos is quite successful, their turnover is estimated at fifteen billion dollars (''Joint ventures'', n.d.).

Anyway, the given overview of Ineos consists only of a small selection of all the developments that have taken place. Since, the total employee base of Ineos consists of 21.000 people at the moment. Furthermore, the sites of Ineos produce approximately 60 million tonnes on a yearly basis. In addition, the total number of sites, namely 168 are spread over 28 different countries of which six sites are located in Antwerp. Interesting is that Ineos does not have any sites in Rotterdam (''Locations'', n.d.) Consequently, the same applies to Ineos as Borealis, the significant representation in Antwerp instead of Rotterdam could be an indication of why they chose to invest in Antwerp. Altogether, these facilities and employees of Ineos generate a yearly turnover of about 60 billion dollars (''INEOS at a glance'', n.d.). This implies that Ineos is measured in terms of number of sites, turnover and number of employees is bigger than Borealis. However, this is not the most interesting difference between these companies. The remaining of this overview dives into the market segments in which Ineos operates and the organizational structure. Whereby special interest goes to the latter, because this is where the biggest difference between the companies arises.

Starting with the segments in which Ineos is active. Ineos' products are used in a lot of different end markets, namely adhesives, agriculture, automotive, bio fuel, chemicals, coatings, construction, cosmetics, film & sheet, food, home & electronics, manufacture, medical & pharma, packaging, pink & paint, pipes, pulp & paper, rubber & tyre, textiles and wire & cable. Two markets are highlighted, because they are probably not directly linked to the chemical industry, namely the cosmetics and the textiles market. The products which are among others fabricated by Ineos are the building blocks of for example lip sticks and mascara. The companies responsible for the supply to this market include among others Ineos Oligomers and Ineos Oxide. In case of the textiles market, Ineos contributes to the development of high specialised fabrics. Examples of companies which are producing these kind of products are Ineos Olefins and Polymers Europe (INEOS' markets and applications'', n.d.).

Ending with, the organizational structure of Ineos. As mentioned, the organizational structure is quite different than the structure of Borealis. In addition, in case of Ineos, the structure is also very different from what the general picture is. Since, Ineos does not have a supervisory or an executive board. Additionally, Ineos is not a company which is listed. The reasons why Ineos deviates from what is considered normal on these two aspects is, because it is owned by three people. One of them is the founder, biggest shareholder and CEO, Jim Ratcliffe. The other two men are Andy Currie, who is the director of Ineos and John Reece, who is the CFO. Furthermore, John Reece and Andy Currie have approximately the same percentage of shares of the company (''Leadership'', n.d.). Nevertheless, especially the background of Jim Ratcliffe is interesting. Since, he is currently the richest man of the United Kingdom with a fortune of about 21 billion pounds. In addition, he and Ineos are known for their rather eccentric expenditures. An example is Jim Ratcliffe's yacht, which is worth about 77 million pounds (Neate, 2019, February 23). In addition, Ineos is involved in some sport projects as well. In the tour de France of 2019, Ineos had their own team, which is eventually won as well. Furthermore, Ineos acquired a French football club, namely, OGC Nice in the end of August in 2019 (''Congratulations team INEOS'', n.d.). These are some purchases which were very costly as well. Consequently, the wealth of Jim Ratcliffe could be an indication why the investment in Antwerp is one of the biggest in Europe, in the previous years. Additionally, because Ineos is led by only three persons and is not a listed company, decisions are made faster than companies which issue shares according (Government agency A, personal interview, 2019, July 30). The last mentioned information reveals already some information about the investment of Ineos in Antwerp. Nevertheless, the next section elaborates more on this investment after discussing the most recent investments of Ineos in order to see whether there is a certain pattern.

5.3 Ineos' recent investments

As mentioned, before elaborating more on the investment of Ineos in Antwerp, some other recent investments are discussed as well in order to expose whether a certain flow of investments exists. If this is the case, the pattern could be helpful when explain why Ineos chose to locate in Antwerp. Besides, elaborating on other recent investments helps to place the investment of interest in perspective as well. Nevertheless, in case of Ineos there is not such a pattern in the investments, as was the case by Borealis. As mentioned, Ineos formed their own cycle team, in 2018. The amount of money they invested in this team is approximately 110 million pounds. In addition, they acquired a brand, called Belstaff in 2017 (''Our History'', n.d.). These are just some examples of investments Ineos executed in the last years, excluding the acquisitions that have been made.

However, in case of Ineos, a certain development ultimately led more or less directly to the investment in Antwerp, namely the shale gas revolution in 2013 (''Our History'', n.d.). For that reason only this development is elaborated on more in this section. Shale is a type of mineral where there is plentiful of it. Additionally, it is possible to extract gas from shale as well, this gas consists among others of ethane and propane. These gases are already mentioned a couple of times, because these are well known components in the chemical industry. Furthermore, Schinkel (2013, February 1) describes in his article that the business of extracting gas from shale has exploded the last years, especially in the United States. As a result, the United States were, and are, overproducing gas. Consequently, the price of gas is much lower in the United States than in Europe. The reason why this is interesting is, because Ineos has responded well to that by announcing that they will use the cheap available gas from the United States to extend their production of propylene and ethylene in Europe. Furthermore, the increase in the production will arise from investments which will probably take place in Norway, Scotland and Belgium. Where in the case of Norway and Scotland it concerns extensions of existing crackers, namely respectively in Rafnes and Grangemouth (''De visie van INEOS maakt de weg vrij voor nieuwe mogelijkheden in Europa'', 2017). This is not the case with the investment in Belgium, but more about that in the section about Ineos' investment in Antwerp.

Another respond of Ineos to the shale gas revolution which took place, was the ordering of the first ethane ships, in 2013. The purpose of these, by Ineos operated, ships is to transport the cheap ethane gas from the United States to Europe. As a result, the first shipment of ethane from the abovementioned route took place in 2016 (''Our History'', n.d.).Moreover, Ineos would like to have a total fleet size of eight ethane ships, which is referred to as dragon ships as well. The eight ships are part of Ineos' plan to import big amounts of ethane to the crackers in Rafnes and Grangemouth, for which around 2 billion dollars has been set aside (''UK's first US ethane

import arrives at Grangemouth'', 2016, September 29). An investment which has also to do with the import of ethane from the United States, is the investment in Belgium, more specifically Antwerp. The next section dives into this in this investment and describes characteristics as the goal and the number of jobs which will be generated from the investment.

5.4 Ineos' investment in Antwerp

In July 2018,Ineos announced the wish to build two plants somewhere in North West Europe. Wherein one plant is meant for the converting of ethane into ethylene, which is an ethane cracker. The other plant is a propane dehydrogenation (PDH) plant, which converts propane into propylene (Walraven & Joosten, 2019, February 4). This is more or less the same kind of installation which Borealis is going to construct in Antwerp. Furthermore, as mentioned both propylene and ethylene are two of the building blocks of the chemical industry, propylene for the plastic industry in particular (de Roo, 2019, January 14).

Anyhow, after the announcement of Ineos, two chemical clusters were in the running to get these investments. Given the earlier parts of this report, it should not come as a surprise it concerned the chemical clusters of Rotterdam and Antwerp. Nevertheless, more about the location choice process and the location choice factors later in this case study. At the end, Antwerp was the lucky one and attracted the investments. The investments in both projects together amount to approximately three billion euros and the plants is going to be constructed on the same site. This implies that it is the largest investment in the chemical industry in the last 20 years. Roughly 1.7 billion euros of this total investments will be invested in the construction of the ethane cracker (de Roo, 2019, January 14). In addition, this is the first cracker which will be built in Europe in the last 20 years. So, this investment is quite unique in multiple aspects. The cracker is part of the Ineos' plan to extend the ethylene production, discussed in the previous section. Therefore also in case of this plant, besides the plants in Rafnes and Grangemouth, the ethane is imported from the United States and is converted into ethylene.

According to Jim Ratcliffe, the investments in Antwerp will lead to growth of the chemical industry in Europe instead of decline which Europe has been experiencing for some time. Since, the investments will improve Ineos' propylene – and ethylene derivative chains, which contributes to the growth of their customers as well (''INEOS, Europe's largest petrochemicals company, announces Antwerp as the location for its new ground breaking 3 billion Euro petrochemical investment'', 2019, January 14). Furthermore, due to the investment, Ineos needs approximately 500 new employees. Additionally, during the phase in which the installations are built, which is estimated at five years, about 3000 people are needed (The

Brussels Times, 2019, January 5). For among others this reason, the investments are good for the region, Flanders, as well. After discussing the characteristics of the investment in Antwerp by Borealis, remains the question why Ineos decided to invest in Antwerp and how the location choice process has been going. The following dives into these issues.

5.5 The location choice process and the decisive factors of Ineos

Besides the location choice process of Borealis, the process of Ineos corresponds largely to the general process that was outlined before the start as of the case studies as well (Authority A, personal interview, 2019, July 29). However, unlike the location choice of Borealis, the process of choosing a location was in case of Ineos really a process where more than one location could have been eligible for the investment. Despite that, the process of Ineos went faster than the process of Borealis due to the various investment committees that Borealis has (Authority A, personal interview, 2019, July 29). In case of Ineos the employees prepare everything, but Jim Ratcliffe makes the decision. Additionally, private companies generally switch faster, so does Ineos (Government agency A, personal interview, 2019, July 30).

A similarity between the investments of Ineos and Borealis is that Ineos has also been guided by the welcome team, which has already been discussed (Trade association A, personal interview, 2019, August 7). In addition, in order to get this investment to Antwerp, the welcome team received help from a number of cabinets; the cabinets of the Prime Minister of Flanders, the minister of economics, the minister of environment, the minister of mobility and the cabinets of the mayor of Antwerp. (Walraven & Joosten, 2019, February 4). Anyway, the following dives into the specific details of the location choice process.

Ineos wanted to integrate the PDH project with an ethane cracker and that implied a larger project with a larger scope. The project became so sizable that Ineos wanted to know what other locations could possibly offer. The only other option, besides Antwerp, was Rotterdam. Since, other possible locations are not big enough or do not have access to the sea. The latter is important, because Ineos imports among others shale gas. Ineos also wanted more space than the port of Antwerp could offer. Consequently, the port authority took back sites that had already been allocated, in order to facilitate Ineos. When that became clear, Ineos decided that they would carry out the new investments in Antwerp (Authority B, Personal interview, 2019, August 15). The companies that have ceded areas are Gunvor, Monsanto and Solvay (de Roo, 2019, January 14).

Moreover, according to the interviewee of Trade association B (Personal interview, 2019, August 23) Ineos used Rotterdam in a commercial sense. They have announced that they

wanted to execute a major investment in Europe. They have also indicated that it is in line with expectations that Rotterdam would also place a bid, which they have said to Antwerp as well. Ineos has done this to ensure that a sort of competition would arise with who would make the best offer. So, Rotterdam is used to put Antwerp under pressure. Eventually Rotterdam made a good offer. Consequently, Rotterdam has had a serious opportunity to attract the investments, but in the end the position of Antwerp was better in a number of areas (Trade association B, personal interview, 2019, August 23). In addition, according to the interviewee of Authority A (Personal interview, 2019, July 29) there was only a fraction of a difference between the choice for Antwerp or Rotterdam. Furtermore, the fact that there is more to discuss about the process of Ineos compared to Borealis is because the choice of Ineos for Rotterdam was really serious at a certain stage and because the discussion eventually became publicized. Subsequently, an image emerged that this was a missed opportunity (Trade association B, personal interview, 2019, August 23).

Furthermore, the reason why an attempt was made to attract Ineos in times of transition is because, despite the CO2 ambitions, it is important to facilitate these kinds of developments described the interviewee of Authority B (Personal interview, 2019, August 15). Since, otherwise the country will become locked and, instead of going ahead, going backwards. If a country wants to become sustainable then investments must be made. There must be investors who see a future in offering sustainable energy. Nevertheless, an investor makes an investments decision based on a healthy business case and the future of a country. An investor therefore also takes into account whether the country is locked and whether a country is developing further or is stagnating. In the latter case, an investor is faced with a declining market. This is not what an investor is looking for, they are looking for potential and this potential must be offered to them. This implies that new industry needs to be attracted, who will eventually make use of sustainable energy supplies (Authority B, personal interview, 2019, August 15).

Additionally, the port of Rotterdam is a large petrochemical port with large refineries. However, the refining market is a shrinking market. As a result, refineries which are not on a favourable location are for sale, the so-called land lock refineries. Whereby a favourable location is at the sea. So, Rotterdam has a good position in the field of petrochemicals, but would like to grow in terms of the next steps in the chemical chain, such as basic and advanced chemistry. Such an investment by Ineos is therefore desirable in Rotterdam, because this will lead to other investments. What ultimately leads to a certain chain reaction. Attracting investments and switching to other related industries is essential to keep the chemical complex running, but in case of Ineos it did not work out (Trade association B, personal interview, 2019, August 23).

Altogether, this would be the end of the location choice process section. However, the investments of Ineos in Antwerp have also appeared negatively in the news lately. This is the result of a number of aspects. Firstly, forest must be cut down for the construction of the facilities, which creates resistance of a couple environmental associations. Secondly, Ineos has separated the report on the effects of deforestation on the environment from the plans for the construction of the plants. The criticism here is that this is not allowed and in this case it is not possible to verify what the effects of the plants are on the climate. Thirdly, Ineos does not yet have permits for the construction of the plants, which means that deforestation is not necessary at the moment (''Dertig milieuverenigingen tekenen bezwaar aan tegen ontbossingsplannen Ineos'', 2019, August 29). Fourthly, the use of shale gas in the production is also not appreciated by various interest groups, because it would be a highly polluting fuel. Those same groups also suspect that there will be a lawsuit against the current building plans of Ineos (van Gurp, 2019, Augst 29). So, it is yet to be seen whether Ineos can implement the plans as they were made during the location choice process.

Anyhow, what led to the preference for Antwerp and did the difference in C02 reduction objectives between the Netherlands and Belgium play a role in the location choice process? Whereby firstly the main focus is on the latter question. As mentioned, there are a number of parties who say that the difference does have an adverse effects on attracting investments. However, Jim Ratcliff has indicated that the choice for Antwerp is not due to stricter CO2 reduction objectives, as this had other reasons which will be discussed in detail later (Kooiman, 2019, January 21). This does not necessarily mean that this is completely true. Since, the interviewee of Trade association A (Personal interview, 2019, August 7) indicated that other sources described that the Dutch CO2 reduction policy has been decisive. In addition, in the case study of Borealis, the vision of the interviewee of Trade association B (Personal interview, 2019, August 23) on this subject was extensively discussed. In short it said that the difference in CO2 reduction objectives played a role, but perhaps not a major one. Besides, other factors also played a role. This relates to the investment of Ineos as well. Nevertheless, the interviewee of Authority B (Personal interview, 2019, August 15) described that Ineos did not choose Antwerp because of the difference in CO2 policy between the Netherlands and Belgium. According to Ineos, this would eventually end up at the same level, despite the fact that Belgium does not yet display the ambition of the Netherlands. Sooner or later, Belgium is also forced to go that way, but Ineos clearly stated that it would not be coming to Rotterdam if there would be a CO2 tax. Governments have reflected to Ineos that this tax would not come, but eventually have implemented a CO2 tax. This is something this Belgium does not have. However, this wat not yet the case when Ineos had to make a decision about their location

choice (Authority B, personal interview, 2019, August 15). Consequently, this could not have played a role in this process.

This opinion is shared by among others, the interviewee of Authority A (Personal interview, 2019, July 29) and the interviewee of Regional development organization B (Personal interview, 2019, August 8) who describe that the difference in CO2 reduction objectives has not been a factor in the location choice process. In addition, according to the interviewee of Regional development organization C (Personal interview, 2019, August 29) the difference in CO2 reduction objectives has not been discussed with any other company either. This implies that this has not been a factor for Ineos as well. Another vision, which besides Borealis is related to the location choice process of Ineos as well is the one from the interviewee of Government agency B (Personal interview, 2019, August 28). In short, if conversations about a possible CO2 tax take place in the Netherlands, this will happen in other countries too, due to the Paris Agreements. Altogether, also in case of Ineos, the difference in CO2 reduction objectives has not played a role in the choice for Antwerp.

A factor which actually was essential in the choice for Antwerp is the position of Antwerp. Since, Antwerp accommodates a large part of the customers of the new plants (de Roo, 2019, January 14). Another factor that has been decisive in the choice of Ineos for Antwerp is the lack of the right access points in Rotterdam, which were already present in Antwerp. Rotterdam has been able to solve the lack of access points. However, a number of risks were associated with the plans for Ineos. After all, the execution had to be as they were shown. Additionally, distance had to be bridged, because Ineos' business is in Antwerp and is built on pipelines that are available in Antwerp. Bridging distance also entails extra costs. That was ultimately the biggest reason for Ineos to choose Antwerp, after the authorities in Antwerp fixed the spatial concerns. (Authority B, personal interview, 2019, August 15). So, this links back to the first factor as well, because the distance needed to be bridged due to presence of the customers in Antwerp. In addition, the pipeline network of Antwerp made according to the interviewee of Authority A (Personal interview, 2019, July 29) the difference in the location choice. Furthermore, the interviewee described that Ineos already knows the situation in Antwerp, which also ensures that they know that the location factors that are important to them are present in Antwerp. Also the interviewee of Authority B (Personal interview, 2019, August 15) acknowledges the value of the fact that they already have plants in Antwerp. Here is also referred to by the interviewee of Trade association B (Personal interview, 2019, August 23), who described that chemical plants are connected to each other. The end product of one is used as feedstock for the other, the companies are interconnected. If the cross-linking is already present in Antwerp, the only question that remains is whether a company can grow

much larger at that location. Moreover, two interviewees also see the value of the fact that Ineos has started and became great in Antwerp, namely the interviewee of Trade Association A (Personal interview, 2019, August 7) and the interviewee of Government agency A (Personal interview, 2019, July 30). So, it turns out that these kind of sentiments are also important. Additionally the interviewee of Government agency B was also able to tell more information about matters that are less known or less public. Firstly, Ineos has said that if the pollution of the soil were not cleaned up that they would not chose Antwerp. Subsequently, the soil pollution was resolved. Secondly, 'de Vlaamse waarborg regeling', is also an important aspect. This means that a loan is guaranteed, which ensures that a company can agree on a better interest with the bank. The Flemish government was able to do this for 500 million euros. However, it is questionable if this is of great value to a company as large as Ineos. Thirdly, the licensing policy in Antwerp is running more smoothly, also with regard to the work permits for non-European employees. This plays a role when the investment of Ineos will be executed and construction is going on. Fourthly, a person within Ineos indicated that they immediately get a clear answer in Antwerp if there is something and it is resolved immediately (Government agency A, personal interview, 2019, July 30), but the interviewee is not really sure whether the latter is true or just flattery. *Nevertheless, this is an aspect which I heard several times related to other subjects. Consequently, in my opinion Rotterdam and the Netherlands in general need to change something in order to attract more foreign investments, but more on this later on.*

Thus, all the above sources together form the following list of location choice factors that were important for Ineos to choose for Antwerp; the right access points, the pipeline network, familiar with the location choice factors of Antwerp, the presence of their customers in Antwerp, the existing plants in Antwerp, Ineos has grown big in Antwerp, the cleaning of the soil pollution, the licensing policy and the quick responses of Antwerp. Nevertheless, the question is whether Ineos itself has also explained the investment in Antwerp on the basis of these factors. Kooiman (2019, January 21) describes in his article, which incorporates Jim Ratcliffe's vision, that Antwerp is chosen because of firstly, the already existing plants which Ineos has in Antwerp. These will use the ethylene and propylene of the new plants, in their production. Secondly, locating in Rotterdam would imply a long distance between different plants of Ineos. Thirdly, the new plants are a better fit in the chemical cluster of Antwerp compared to Rotterdam, because of the focus. As mentioned in the literature review, Rotterdam is specialised in refinery and Antwerp more on chemistry. Additionally, Verbraeken (2019, January 15) incorporated an interview with Jim Ratcliffe in his article who discussed the following reasons to locate in Antwerp. Firstly, the connection to the pipeline network with in particular both for the plants in Antwerp as the Southern part of Germany. Secondly, if Ineos would have chosen to locate in Rotterdam, 112 kilometre extra pipeline was needed between

Rotterdam and Antwerp. Thirdly, the fact that Ineos is already present in Antwerp and Antwerp is the place where it all started.

Altogether, the location choice factors obtained from the interviews are more or less similar to what Jim Ratcliffe indicated. Both overviews consist of aspects such as the pipeline network of Antwerp, the long distance between Rotterdam and Antwerp, the existing plants in Antwerp, the presence of the customers in Antwerp, the better fit in Antwerp and the fact that Ineos started in Antwerp. Nevertheless, in particular the interviewee of Government agency A (Personal interview, 2019, July 30) shared factors which are not common and do not overlap with the factors of Jim Ratcliffe. This could either mean that these factors are not important or that these factors are not meant for publicity. *Where I suspect that the first mentioned has certainly been an important aspect*. Since it makes sense that a company demands no contaminated soil if they invest over three billion euros. Though, Ineos is currently under pressure from various environmental organizations, so that is probably the reason why this factor is not known to the general public. *The other two factors mentioned by the interviewee of Government Agency A (Personal interview, 2019, July 30) are in my opinion less important for Ineos, namely the smoothness of the licensing policy and the quick responses of Antwerp. These are minor aspects compared to factors like the already presence in Antwerp or the pipeline net, but could still have played a role. In addition, these factors are more generally known as well*. Both refer direct or indirect to potential improvement for the Netherlands when it comes to the attraction of investments, which will be elaborated on in the next section.

To conclude, the location choice process of Ineos was, compared to Borealis, actually a real process in which two locations had good chances to obtain the investments. Whether this process was real or just to get a better offer from Antwerp, only Ineos knows. When the reasons why Antwerp is chosen are taken into account, you wonder why they would come to Rotterdam. Since, the choice for Antwerp sounds in that case quite logical. Aspects such as the existing plants, the pipeline network and the customers which are present in Antwerp appear to me as very important factors. *Nevertheless, for me it is unclear what Rotterdam has offered. Presumable it was a good offer, otherwise there was probably less dismay, which can be read in various Dutch media.* One thing is certain; the choice did not have anything to do with the difference between the Dutch and Belgian CO2 reduction objectives. Since, it has more to do with industrial and logistical aspects. In addition, the next section provides an extension of the case studies in which the general location choice process and a ranking of the most important general location choice factors are discussed.

6. Extension of the case studies

6.1 Introduction section on the extension of the case studies

Besides information about the reasons why Borealis and Ineos have chosen to invest in Antwerp, the interviews provided insights in the general location choice process of a chemical company as well. The same applies for the general location choice factors which chemical companies take into account, when selecting their new location. It is interesting to elaborate on these factors, because it will reveal whether Ineos and Borealis have deviated from the general standard in this area. In order to see whether this is the case, it is necessary to describe the, by the interviewees, mentioned location choice factors. Moreover, the factors are ranked on the basis of how many times a factor has been mentioned by the interviewees. Aside from exposing whether Borealis and Ineos deviate in this aspect, it is meant to show whether the list of location choice factors obtained from the literature is applicable to the real world. In addition, the last aspect to be examined in this section about further information obtained from the case studies is, whether image plays a role in the location choice process as well. Consequently, in this section the general process, the location choice factors and the role of image are discussed.

6.2 The location choice process of chemical companies

Starting with the general location choice process for chemical companies, all interviews, where the location choice process in general was point of discussion, revealed that the search for a new location is the result of market development. For example, it might be the case that a market need arises in a country in which a company is insufficiently represented (Authority A, personal interview, 2019, July 29). Furthermore, it could also be the case that the demand rises in general, which implies that a company needs more production capacity. In both cases, a company will look into whether it is necessary to build a new plant or whether it might be possible to expand and existing production location. Whereby expansion is often preferred, because it involves less in terms of infrastructure and logistics. Examples of factors which play a role when building a new plant are the instalments of pipelines and storage tanks. Consequently, the key aspects in this first phase of a location choice are production capacity, demand expectation and logistics (Trade association A, personal interview, 2019, August 7).

After this phase, the concept phase starts. This implies that a company puts a number of locations on a so-called long list, based on a set of factors that are important to them (Regional development organization A, personal interview, 2019, August 7). The factors that companies generally take into account, are discussed later in this section. Anyhow, during the concept phase a company will make a high level rough estimate of what the projects on the possible locations would cost. In this phase, accuracies are maintained between 30% and 60%. As a

result, the decision follows whether they want to investigate a location further (Authority A, personal interview, 2019, July 29). Based on the location choice factors and the rough estimates of the costs of a possible location, the company brings the long list back to a short list of possible locations. After which a business case is developed for the locations on the short list (Regional development organization A, personal interview, 2019, August 7).

The shortlist of possible locations consists usually of 2 or 3 locations. These locations are examined in a more detailed way than the research in the previous phase. For locations on the shortlist, mainly the differences between the locations are examined and they start planning the costs again (Authority A, personal interview, 2019, July 29). This concerns questions regarding important production factors. Such as the costs of personnel, the energy supply, the availability of raw materials, the government policy and what are the costs for the disposal of waste (Trade association A, personal interview, 2019, August 7)? Costly engineering studies and design studies are part of this, for that reason the shortlist only consists of a few locations. The error margin that is used here is approximately 20% (Authority A, personal interview, 2019, July 29).

Another aspect that companies do when they have only a few possible locations is starting a conversation with the port authorities, in order to see whether the investments fits into the cluster in terms of available land and the various flows of materials. Where after, a possible bid or cooperation agreement is put on the table by an interested port authority (Regional development organization B, personal interview, 2019, August 8). Eventually a company chooses their location, after which contracts are signed and permits are obtained. In addition, the assumptions made in the previous phases are checked, at which 5% deviation is taken into account. Consequently, after these location choice phases a company makes their investment decision (Authority A, personal interview, 2019, July 29). Anyway, it was previously mentioned that location choice factors are used to reduce the long list to a short list, but what are these factors? The following dives into the location choice factors which are considered to be important by chemical companies.

6.3 The location choice factors of chemical companies

This section is structured as follows; Firstly, the location choice factors are mentioned which were relatively often discussed during the interviews. As discussed in the methodology, this is the case when a factor has been mentioned three or more times. Secondly, the location choice factors that are mentioned less often, namely one or two times. Thirdly, the overall ranking of the location choice factors. Fourthly, how the degree of importance of the different factors differ per type of investment.

Starting with the factors which are mentioned three or more times, in order of most mentioned. Firstly, the presence of skilled labour, the chemical industry is a very complex industry which needs smart people. According to the interviewee of Trade association C (Personal interview, 2019, August 30), who considers this factor as the most important, they look for 'operational excellents' in the chemical industry. Secondly, access to the customer / proximity of the customer. Since, this forms together with availability of feedstock , the basis of the business case (Regional development organization A, personal interview, 2019, August 7). Thirdly, integration options / being part of a cluster. The possibilities that a cluster has to offer have already been discussed in the literature review. These benefits are also seen by the interviewee from Government agency A (personal interview, 2019, July 30), who describes that the possibility to be part of cluster gives access to customers, skilled labour and other location factors. Fourthly, access to suppliers / availability of feedstock. Numbers five and six are respectively logistics and infrastructure. Where the interviewee of Trade association A (Personal interview, 2019, August 7) gives an example; that when the investment concerns an energy intensive plant, it is important to make sure the infrastructure is sufficient enough to get the energy to the plant. This fits nicely with the seventh factor, which is energy. In addition to the infrastructure, it is also about the availability of energy. Since, this is one of the biggest cost items for a chemical company and therefore also carries a lot of risk (Authority B, personal interview, 2019, August 15). Eighthly, the availability of sites. This factor speaks for itself, apart from the fact that a location meets all the wishes, there must also be space for another investment. A sub factor of the availability of sites is the price of the land, which is considered to be important by the interviewee of Trade association B (Personal interview, 2019, August 23). Ninthly, certainty / political stability, which refers according to the interviewee of Government agency B (personal interview, 2019, August 28) to the number of strikes. The last factor that falls within this group of factors, is the attitude and the willingness of the government. This refers to making companies feel welcome, for example in the field of taxation or innovation aid (Trade association C, personal interview, 2019, August 30).

The factors that are mentioned most frequently of the second group of factors are taxation, subsidies and licensing policy. The latter concerns mainly aspects like the duration and when a revision must be requested (Trade association B, personal interview, 2019, August 23). Another location choice factor which is mentioned twice is the living climate of a location. This falls within the soft factors category, but is certainly seen as important. Aspects like schools and shopping areas play a role in the location choice process according to, among others, the interviewee of Regional development organization C (Personal interview, 2019, August 29). Furthermore, the following factors are only mentioned once; the costs of construction,

innovation and the CO2 reduction policy. To summarize, underneath table 3 is given which consists of the list of location choice factors, ranked on how often mentioned. Moreover, the numbers behind the factors correspond with how often they were mentioned .

Table 3 Ranking of location choice factors based on how often mentioned during the interviews

1. Skilled labour (8)
2. Access to the customer / proximity of the customer (7)
3. Integration options / being part of a cluster (7)
4. Access to suppliers / availability of feedstock (5)
5. Logistics (4)
6. Infrastructure (4)
7. Energy (4)
8. Availability of sites (4)
9. Certainty, political stability (3)
10. The attitude and the willingness of the government (3) (transition to the second group)
11. Taxation (2)
12. Subsidies (2)
13. Licensing policy (2)
14. The living climate (2)
15. Construction costs (1)
16. Innovation (1)
17. CO2 reduction policy (1)

However, this is the ranking of the location choice factors applied to a commercial production plant. Several people indicated that the degree of importance differs per investment. This is line with the research by Suurs & Roelofs (2014), which is discussed more in-depth in the literature review. Since, they concluded that the value of location factors is not the same for all kind of investment types as well. According to the interviewee of Authority A (Personal interview, 2019, July 29) are the integrations options more relevant for small-scale projects, due to the plug- and play concept. The interviewee also indicated that taxation is more important when it comes to a research-related investment, because tax exemptions for certain developments exist. This is confirmed by the interviewee of Regional development organization B (Personal interview, 2019, August 8), who described that in case of an R&D investment, the possibility of getting incentives is more important than if it concerns a commercial investment. Furthermore for pilot projects, it is important that the local government of a location issues the necessary permits (Trade association A, personal interview, 2019, August 7). Anyhow, these are just some examples to show that there is indeed a difference in

the degree of importance for the location factors. Moreover, in the next section the question is answered whether image plays an important role in the location choice process.

6.4 The role of image in the location choice process of chemical companies

As described broadly in the literature review, Pellenbarg (1985) described that Dutch entrepreneurs rank different locations based on the image they have of the locations. Nevertheless, the question was asked whether this also plays a role in the chemical industry. Since, the investments are most of the time relatively costly, compared to other industries. Consequently, the expectation has been expressed that the effect of imago in the location selection process of this industry is not that relevant. This section confirms or refutes this expectation, based on the opinion of the interviewees. Whereby it can already be disclosed that the opinion on this question is not unanimously.

Starting with the group of interviewees who claim that imago plays no role in the location choice process. According to the interviewee of Regional development organization B (Personal interview, 2019, August 8) the majority of the chemical companies is not sensitive to aspects such as image, because it is mainly about the costs. Furthermore, the interviewee argued that a sustainable company might be looking for a cluster with an image of being sustainable. However, this is partially undermined by the interviewee of Authority B (Personal interview, 2019, August 15) who states that sustainable companies do not blame different organizations for attracting investments like those of Ineos, which belongs to the 'traditional' industry. Since, the traditional industry is still needed. In addition, according to the interviewee of Trade organization A (Personal interview, 2019, August 7) image is not an aspect that is taken into account in business to business industries, which the chemical industry is part of. The interviewee added that companies look where professional companies are already present, where the main question is what they need for their production. This is more or less the same vision that the interviewee of Authority B (Personal interview, 2019, August 15) has. Who says that image does not play a role, since aspects as risk and money are more important. Nevertheless, the larger a cluster is, the more attractive, because in that case there are more choices available. Moreover, it also indicates that many companies have already succeeded in that location. (Authority B, personal interview, 2019, August 15).

Ending with the group of interviewees who claim that imago plays a role in the location choice process of chemical companies. For instance, the interviewee of Trade association C (Personal interview, 2019, August 30) who agreed on the question whether imago plays a role and added that Antwerp for example is known as a real chemical cluster. In addition, Rotterdam has a good image when it comes to their port as well. if a maritime company choses for the

Netherlands, they are inclined to go to Rotterdam. Consequently, image plays a role, but to what extent varies (Regional development organization C, personal interview, 2019, August 29). According to the interviewee of Trade association B (Personal interview, 2019, August 23) image plays a role, but not a big one. Whereby image can mainly play a role in the approaching of a new location, because then companies consider the image they have of a location. Consequently, the risk exist that a location will fall behind due to, for example, an image of being not costumer friendly. However, in the end a location choice process is mainly rational and a comparison between the different locations is made to see which location suits the best (Trade association B, personal interview, 2019, August 23). This is more or less confirmed by the interviewee of Government agency B (Personal interview, 2019, August 28) who described that image can play a role when the financial differences between locations are small. When this is the case companies will dive into aspects like where is it hot and happening? In order to make a final investment decision.

To conclude, in my opinion image does play a role in the location choice process of chemical companies. Since, the last two mentioned who discussed that image has no impact on the final investment decision, describe that a larger cluster and a location where professional companies are located, is more attractive for new companies. This vision was respectively given by the interviewee of Authority B (Personal interview, 2019, August 15) and the interviewee of Trade organization A (Personal interview, 2019, August 7*). In my view, in this case the larger cluster and the presence of professional companies refer somewhat to a good image*. Which roughly corresponds to the examples outlined by both the interviewees of Trade association C (Personal interview, 2019, August 30) and Regional development organization C (Personal interview, 2019, August 29). *Nevertheless, I agree with the general view that the role of image in the process is not important and should not be overestimated*. It may give a location just a little head start or may lead to a final breakthrough when locations are financially close to each other. Since, at the end it is about costs. Anyhow, in the following section an further analysis on the conducted interviews is provided.

7. Analysis of the interviews

7.1 Introduction on the analysis of the interviews

After presenting the two case studies and sketching an indication of a general location choice process and the location choice factors for a chemical company, the results of the previous parts are partly analysed in this section. Since, in this section there is exclusively elaborated on the interviews, with a particular interest in aspects such as differences between the visions of the interviewees located in Belgium and the Netherlands. In addition, these differences could also be found between the different organization types. For example, it is likely that the interviewees working for a government agency will share less information than the other interviewees due to certain restrictions. However, these are just assumptions. Therefore, this section indicates whether there are indeed differences noticeable between visions of different organizations or between the Netherlands and Belgium. Nevertheless, no doubt exists whether the interviewees were able to share all their knowledge. Since, this is clearly not the case, some interviewees mentioned that they were not able to answer on specific questions. Additionally, some interviewees wanted to extract certain parts of the interview report, because the information mentioned turned out to be too sensitive. Consequently, the second part of this section elaborates on the aspects to which this is related.

7.2 Patterns in the views of the interviewees

As outlined above, it could have been the case that a certain pattern in the views of the interviewees existed. For example the interviewees living in Belgium could have had a general vision on the most important location choice factors, which is different from the vision of the interviewees living in the Netherlands. However, practice shows that there is no particular pattern in the ranking of these factors between the interviewees in the Netherlands and Belgium. This also applies when the different types of organizations are examined. So, the representatives of the government agencies both did not mention a certain factor, which the representatives of the authorities did not mention. As a result, based on the interviews, can be stated that it is not the case that the interviewees valued certain location choice factors above others factors due to their position or their country of residence. This implies that the interviewees, which are experts in the investments climate of chemical companies, have more or less the same knowledge regarding the location choice factors. If it would have been the case that a group of interviewees had more knowledge about certain factors, then the ranking of the most common factors would not have been a good indication of the reality with the result that the number of people interviewed per type of organization had to be taken into account. Consequently, the ranking of factors is most likely a good indication of the most common and important location choice factors.

Additionally, what is mentioned above also applies to the role of image in the location choice process. The opinions about this seem to be random and not linked to neither a particular type nor a country of residence. Furthermore, there was also an almost unanimous opinion of what led to Ineos and Borealis choosing to invest in Antwerp and in particular, which factor actually played no role in the location choice processes. More about this in the next chapter in which specifically the results of the case studies are further examined.

Nevertheless, there was especially one aspect that not all parties agreed on, namely the Dutch government's weaknesses in attracting investments. Where a number of interviewees did not agree with the idea that there might be points for improvement in this area. *However, in my opinion it is indeed the case that the Dutch government needs to step up their game on certain aspects, but a further elaboration on these improvements follows in the next section of the analysis of the case studies as well*. Though, in this section attention is paid to which parties did not agree with this opinion and how they refuted this opinion. Firstly, the interviewee of Regional development organization C (Personal interview, 2019, August 29) who responded that, despite the fact that this information is obtained from prior interviews, it is not sure that Belgium is currently better at attracting investments due to their different attitude and their willingness to provide incentives. According to the interviewee this is a feeling and an emotion, which means that it is not a certainty. Moreover, the interviewee also added that the Netherlands also has well-known tax incentives, such as the 'Energie-investeringsaftrek' (EIA) and the 'Stimulering Duurzame Energieproductie' (SDE+). To what extent these incentives differ from the incentives offered in Belgium, the interviewee did not know exactly.

Secondly, the interviewee of Government agency B (Personal interview, 2019, August 28), who indicated that he / she does not know whether any differences between the Netherlands and Belgium in the area of local taxes exist. Additionally, according to the interviewee, it also depends on the project to what extent these aspects matter. Logistics are for example important for every project. Furthermore, this interviewee also indicated, just like the previous discussed interviewee, not to know whether the signals that, Belgium currently has a different attitude than the Netherlands when it comes to the attraction of foreign companies, are right. Besides, the interviewee indicated that if it is the case that Belgium would be more able to stretch its tax incentives. The question remains whether this is what you want as a country. Since, if the social sentiment about foreign companies and the tax discussions are taken into account, it might be better to not attract a company, when a certain incentive is needed. Anyway, the interviewee repeated that he does not know whether there is indeed a difference between the Netherlands and Belgium in this area.

Altogether, in my opinion both discussed opinions are a bit ambiguous. It seems to me that both parties do not want to agree with the information obtained from previous interviews, even though they are familiar with it. Since, both parties did not agree with the statements, regarding this subject, provided in the interviews. Nevertheless, both parties felt the need to provide further explanation. The first interviewee mentioned that the Netherlands offers tax incentives as well and the second interviewee provides actually a reason why the Netherlands is not so keen to offer tax incentives. In addition during the interview, the interviewee of Government agency A (Personal interview, 2019, August 28) repeated a couple times not to know whether there is indeed a difference between the Netherlands and Belgium with respect to offering tax incentives. *This and the fact that, in my opinion, the interviewees were not fully open, is mainly due to the confidentiality of the information.*

7.3 Confidential information

Regardless of the attitudes of the interviewees in question described above, the general impression was that the participants of the interviews could not share all their knowledge about certain matters. For example the interviewee of Regional development organization A (Personal interview, 2019, August 7) and the interviewee of Government agency B (Personal interview, 2019, August 28) already mentioned before the actual interview that they cannot comment on still going cases, which also includes Ineos and Borealis. As a result, it was necessary to transform the intended questions into more general questions in order to be able to take an interview with them. The other participants of the interviews did agree with the questionnaire sent in advance. Nevertheless, also during some of these interviews, we came across a number of questions which could not be answered. For instance, both the interviewee from Authority B (Personal interview, 2019, August 15) as the interviewee from Regional development organization B (Personal interview, 2019, August 8) did not want to discuss what Ineos was offered in the negotiating process. The third aspect, which exposed the confidentiality of the information, is the fact that the interview with Government agency B (Personal interview, 2019, August 28) took place with both an expert as a spokesmen. *The presence of the spokesperson was, in my opinion, to be able to nuance certain aspects and to guarantee the confidentiality of information regarding specific companies.* Since, as mentioned, the representatives of this organization only wanted to answer general questions.

The above relates to the interviews themselves, but also with the respect to the reports of the interviews it was noticeable that people were hesitant about sharing information. For example, there was hardly any positive response on the question whether the interview reports could be attached in this research with both the name of the participant as the organization they are working for. That is why it was finally decided to refer to all names anonymously and to not

include the interview reports. In addition, it also happened that some aspects of the interview report were eventually somewhat nuanced by the participants or they requested to scratch certain parts. This was primarily about removing specific company names, both Ineos and Borealis as any other company, for organizations that indicated that they wanted to keep the conversation general. Secondly, among interviewees who indicated that they could talk about Ineos and Borealis, some probably thought that they had shared too much about the location choice process, with the result that it had to be scrapped. To conclude, overall it was hard to get a clear picture of how the location choice process of Ineos and Borealis actually went. Nevertheless, this succeeded based on the fragmented information provided. The result can be read in the following section in which the case studies are analysed and an advice regarding the attraction of investments is given to the Dutch government and the organisations involved.

8. Analysis of the case studies

8.1 Introduction of the analysis of the case studies

After two extensive case studies, the sub research questions can be answered, which is attention paid to in the first part of this section. Secondly, the list of location choice factors obtained from the interviews is compared to the list of factors obtained from the literature in order to see whether there are any significant differences. Followed by the last part, which consists of an advice for the Dutch organizations / government involved in attracting investments. Since, the conversations with the players in the field showed that the Netherlands / Rotterdam is doing less well in a number of areas compared to Belgium / Antwerp.

8.2 Sub-questions

Starting with the first sub-question, namely: ‘’Are Ineos and Borealis located in Antwerp, because of the CO2 reduction objective of the Dutch government?’’ It can be said that it is true that companies are looking for certainty in the field of the future climate policy, this is brought up in several interviews. For example the interviewee of Regional development organization C (Personal interview, 2019, August 29) mentioned that the Dutch CO2 policies are often the subject of the conversation, because companies would like to know what awaits them in the future. Nevertheless, the interviewee added that the difference in CO2 reduction objectives between the Netherlands and Belgium, in turn, plays no role during these conversations with companies. Furthermore, all the interviews reveal that this did not play a role, or at least not a decisive one, in the location choice process of either Borealis or Ineos as well. As a result, the answer on the first sub-question is ‘’no’’. This implies that Ineos and Borealis are not located in Antwerp, because of the CO2 reduction objective of the Dutch government.

An addition to this is that the differences in the objectives may not be as great as they are outlined. The interviewee of Trade association C (Personal interview, 2019, August 30) described that in Europe, the goal is to reduce CO2 emissions by 40% by 2030 compared to the reference year 1990. That is also the 40% that Hans de Boer refers to. This European objective is divided between two other objectives, namely for the ETS sectors and the non-ETS sectors. In the non-ETS sectors, a reduction of -30% is expected for 2030, compared to 2005. In the ETS sectors (the entire industrial sector, including the chemical industry), the objective is -43% for 2030 compared to 2005. These two objectives together lead to a target of -40% compared to 1990. Furthermore, the -43% is a European target that is imposed across all Member States, regardless of the country in which the production cycles are located. For the non-ETs sectors, the European target is -30%, but there is effort burden sharing taken into account. This implies that every Member state has different objectives, which jointly form the

common Europe objective. For Belgium this is -35% and for the Netherlands -36%. So, the Netherlands has registered its own objective of -49%, which is an overarching objective for both the non-ETS sectors and the ETS sectors. That makes it difficult to determine how much the Netherlands would like to reduce specifically in the chemical industry. According to the interviewee, the expectation is that the objective specially for this industry will be lower than 49%. However, this is a speculation, because this depends on among other the efforts made in the past. Consequently, if Europe wants to reach the target of 43% and the Dutch target is somewhat lower than 49%, then the targets are not that far apart. So, the differences in the CO2 reduction objectives for the chemical industry are less significant than outlined, due to the European framework (Trade association C, personal interview, 2019, August 30). Anyhow, if Ineos and Borealis have not chosen Antwerp because of the CO2 reduction objective of the Netherlands, which factor has made them decide for Antwerp? Consequently, the following section provides an answer on the second question, which reads as follows; ‘’Are Ineos and Borealis a better fit in the port of Antwerp, because of industrial-logistics factors?’’

When both the set of Ineos’ and Borealis’ location factors that led to the choice of Antwerp are examined, then it exposes a number of similarities. Firstly, for both companies it was relevant that they already have plants in Antwerp, in order to obtain synergy advantages or just to keep everything close to each other. So as not to incur any additional costs. Secondly, both companies see the value of locating in the centre of the pipeline network. Thirdly, both Ineos as Borealis are going to produce substances used as building blocks for the rest of the chemical industry. So, it is important to be close to their customers, which are present in the number two chemical cluster of the world. The fourth similarity links back to the third, namely Antwerp is a chemical cluster and Rotterdam is more focused on refinery. As a result, Ineos and Borealis suit better in the chemical cluster of Antwerp, because as mentioned they are responsible for the supply of goods for the rest of the chemical industry and not the refining industry. Altogether, these aspects can be combined under the overarching definition of industrial-logistics factors. To conclude, the answer on the second sub-question is ‘’yes’’, which implies that Ineos and Borealis are a better fit in the port of Antwerp, because of industrial-logistics factors.

8.3 Comparison between data obtained from interviews and literature

The list of location choice factors obtained from the interviews (Table 3) is compared with the list of factors obtained from the literature (Table 1), in order to see whether the literature can be applied to reality. As a result, all factors that emerged from the literature study were also brought up during the interviews. With the exception of all the advantages that being part of a cluster has to offer, based on the literature. Nevertheless, the cluster itself also emerged as an

important location choice factor in the interviews, but during the interviews a few factors were brought up which were not obtained from the literature. These factors are innovation, construction costs, the living climate, licensing policy, CO2 reduction policy and subsidies. The fact is that these factors are not high on the ranking, which implies that these are probably less relevant than the factors which are higher rated. This could therefore also be the reason why these factors were not obtained from the literature study, because they are less straightforward. Though, in order to provide a complete overview of the location choice factors, which play a role in the actual location choice process of chemical companies, these factors should be included as well. Except for the CO2 reduction policy, because this study showed that this factor turned out to be irrelevant compared to others factors and is therefore probably completely at the bottom of the ranking as well. To summarize, overall both rankings are more or less the same. Moreover, the factors which are high-ranked in the ranking obtained from the interview, were also obtained via the literature study. Furthermore, this research shows that image plays a role in the location choice process. However, as already outlined in the literature study, the influence of image in the chemical industry is not substantial. Since, chemical companies pay more attention to the location choice factors given in the ranking. It is also interesting that both Ineos as Borealis more or less based their choice for Antwerp on the higher-ranked factors in the given ranking. Nevertheless, there are a number of points for improvement for the Dutch government / Dutch organisations involved in attracting investments. Consequently, the following section picks up on this.

8.4 Advice for Rotterdam / the Dutch government

The results show that the difference in CO2 reduction objectives between the Netherlands and Belgium do not play a role in the location choice process of chemical companies, which are doubting between these countries. Nevertheless, from a number of interviews it emerges that the Netherlands / Rotterdam will have to implement improvements in a number of areas regarding the acquisition of investments, if they would like to be a serious competitor for Belgium / Antwerp. Additionally, this goes beyond the research question of this study. However, if the Netherlands / Rotterdam wants to attract investments, it is important to work on the following aspects in addition to ensuring that the highest ranked location choice factors are present. It has therefore been decided to devote a short section to this as well.

Firstly, investors receive a warmer welcome in Antwerp, they are rolling out the red carpet for a potential investor. Where the Netherlands is a bit more sober. Based on stories, the interviewee of Trade association B (Personal interview, 2019, August 23) knows that the commercial warmth and the eagerness to score is stronger in Antwerp compared to Rotterdam. Moreover, the welcome feeling and the feeling of doing it together must be strengthened

(Regional development organization B, 2019, August 8). Additionally according to the interviewee of Authority A (Personal interview, 2019, July 29) the difference is that objectives are imposed in the Netherlands and Antwerp on their turn does it from bottom up on a voluntary basis. The community aspect is important in Antwerp, since Antwerp takes up the project and looks for a ‘’us’’ instead of a ‘’us vs them’’ situation. In Rotterdam companies experience this less and they just have to agree with for instance the port authority.

This is also reflected in the fact that the Netherlands does not have a welcome team which they have in Belgium. Such a team can ensure that action can be taken quickly when questions come in from the investor. Consequently, the interviewee of Government agency A (Personal interview, 2019, August 30) described that a person within Ineos indicated that they immediately receive a clear answer on their questions, in Antwerp. In addition, it can be difficult for an investor which organization to turn to. Partly because various parties are involved in attracting investments (Regional development organization B, 2019, August 8). When there is a welcome team, this problem would probably not exists.

Also the interviewee of Authority B (Personal interview, 2019, August 15) recognizes a difference in this area between the Netherlands and Belgium, because according to the interviewee the Flemish government is more focused on the attraction of activity and the Netherlands is somewhat indifferent. Another example of this given by the interviewee of Authority B is the property tax, which is the second aspects where the Netherlands should work on. In Belgium, the companies just have to pay a fraction of the costs that companies in the Netherlands have to pay to property tax, namely 25%. This is due to the incentives issued by the Flemish government. In the Netherlands, the local government insists on a permanent property tax and would like to collect the full amount. With such a policy the Dutch government do not contribute in the attraction of new investors, where the Flemish government does (Authority B, personal interview, 2019, August 15). Also the interviewee of Trade association B (Personal interview, 2019, August 23) notices that the Netherlands is under pressure when it comes to local taxes, such as property tax. Since, the Netherlands is starting to become expensive. On this aspect too much is being held to rules, where Belgium is a bit looser and occasionally indicates that certain taxes do not have to be paid.

This is related to the cost side, but the Dutch government can also improve something related to the benefits side of companies. Since, subsidies actually play no role in attracting investments in the Netherlands. Subsidies are available in the Netherlands, when, in addition to producing with the best available technology, a company is also involved in research into sustainability. This is mainly focused on innovation projects and this is has nothing to do with

the traditional industry and the removal of differences between regions. Therefore, new companies do not receive subsidies (Authority B, personal interview, 2019, August 15). Also the interviewee of Regional development organization B (Personal interview, 2019, August 8) describes that the Netherlands is a bit more conservative, compared to Belgium, in making funds available for companies that want to establish themselves in the Netherlands. Yet, as mentioned, the interviewee of Government agency A (Personal interview, 2019, July 30) described that this is seen as a sign of welcome, which is greatly appreciated.

To summarize, if the Netherlands / Rotterdam wants to attract investments, it is important to work on the following aspects; emit a welcome feeling, be less strict on the collection of local taxes and provide subsidies for new investments. However, both the interviewee of Government agency B (Personal interview, 2019, August 28) and the interviewee of Regional development organization C (Personal interview, 2019, August 29) indicate that they do not know whether there are differences in these areas between the Netherlands and Belgium. *Nevertheless, the larger part does recognize this and that is the deciding factor for me. No doubt a number of parties are not keen on confirming this, which in my opinion has to do with politics and the confidentiality of some information.*

9. Conclusion and limitations

9.1 Conclusion and discussion

The reason behind this research was the article written by Bremmer & Vogels (2019, January 10), in which among others Hans de Boer criticizes the difference in CO2 reduction objectives between the Netherlands and Europe. According to him, the Netherlands lose foreign investments, whereby this article specifically addresses the chemical industry, due to this difference of 9%. However, does this outweigh location factors such as the presence of talent and the opportunities for collaboration with companies? Virtually no research has been done into whether such a difference in CO2 policy objectives plays a role in the location choice process of chemical companies. Consequently, an attempt has been made through this research.

Two case studies were conducted for this study, where the investment decisions of Ineos and Borealis to invest in Antwerp were examined. Whereby the characteristics of the company, other recent investments, characteristics of the planned investment in Antwerp, the location choice process and the location choice factors were taken into account. Articles and press releases were used to provide an indication for the first three aspects. Additionally, for the latter two aspects were interviews executed as well. Moreover, the data obtained from the interviews is also used to describe how a general location choice process of a chemical company goes, whether image plays a role and to indicate which location choice factors are the most important for chemical companies. Thus it was possible to indicate whether Ineos or Borealis deviated from this is in some areas and to generate a ranking of the essential location choice factors.

Ultimately image seems to play a role in the location choice process, but this role should not be overestimated. Since, at the end factors such as the presence of skilled labour, access to the customer, integration options, access to suppliers and logistics are of higher value for chemical companies. Interestingly, the CO2 reduction policy was only mentioned once as an important location factor. Additionally, the difference in CO2 reduction objectives played no role in the location choice of Borealis and Ineos between Rotterdam and Antwerp either. Where the process of Borealis was not really a process, the choice for Antwerp was quite evident. In the end, aspects such as the existing plants in Antwerp, the pipeline network, the wish to be close to the customers and the fact that Antwerp is more focused on chemicals than is the case in Rotterdam were important in the location choice process for both companies. This implies that both companies invest in Antwerp, because of industrial-logistics factors.

As a result the answer on the research question: ‘’Are the CO2 reduction policies, and the associated objectives, of countries leading location choice factors for chemical companies?’’

is that neither the objectives nor the differences in these objectives between countries play a role in the location choice process of chemical companies. Consequently, the vision of among others Hans de Boer in the article of Bremmer & Vogels (2019, January 10) can be rejected. Additionally the literature about the location choice factors of chemical companies has been revised. From ten interviews with people working in or involved with the chemical industry, more or less the same list of factors emerged as obtained from the literature. The only difference lies in the less frequently mentioned factors such as subsidy and the licensing policy, which can be added to the literature. This does not apply to the CO2 reduction policy. Altogether, if the Dutch government / Rotterdam wants to compete with the Flemish government / Antwerp on equal terms in the attraction of foreign investments, they should besides ensuring that they have all the main factors of the location choice factors ranking, work on the following aspects; emit a welcome feeling, be less strict on the collection of local taxes and provide subsidies for new investments.

To conclude, the analysis used in this research is far from perfect. Since, it is difficult to get a correct picture of all the different visions of the interviewees and due to the confidentiality of the information. Nevertheless, this is one of the first studies where research has been done into whether different CO2 reduction objectives have an influence on the location choice of a chemical company. This in turn offers a basis for future research.

9.2 Limitations and suggestions for further research

Although, this research is executed to the best of my knowledge, there are some points of improvement. In this section there is elaborated on the limitations of this research. Furthermore, suggestions for future research are given.

Starting with the number of case studies. Since, two may be a too small amount to generalise the location choice process and the essential location choice factors of chemical companies. The same applies to the number of interviews. The more the better, since every interview yielded new knowledge. As the interviews followed, it was possible to ask more critical questions. Perhaps that with a higher number of interviews and / or case studies a better analysis could have been performed. The third limitation of this research is that of all interviews there is no interview conducted with neither a representative of Ineos nor Borealis. This is unfortunate, because this study is about these companies and they can therefore also provide the best answers to the questions. In case of further research, a conversation with these companies should be implemented. As a student it turned out to be hard to accomplish this, for that reason the research should be in cooperation with an influential organization.

However, it is only to be wondered if they would answer the questions honestly, which links to the fourth limitation. Almost all the interviewees indicated that they could not provide all the information requested. This is because it concerns still ongoing cases, which makes it impossible for them to share all the information from either a business, political or confidential point of view. As a result, the executed analysis in this research does not consists of all the information or even wrong information. Nevertheless, this is expected to be largely filtered out by taking different opinions into account. Besides, the conclusions of this research are formed by my opinion and are not backed by for example fixed numbers or a regression, which is the fifth limitation. A suggestion for further research would therefore be to code the answers of the interviews. This makes it possible to bring order to the large amount of data obtained from the interviews. Lastly, as indicated, the literature study did not make exclusive use of studies that only looked at the chemical industry. Therefore the location choice factors from the literature cannot be compared one on one with the location choice factors obtained from the interviews.

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Appendix A

Table 1 An overview of the interviewees

Date of the interview	*Position of the interviewee*	*Type of organization*	*Main knowledge about Antwerp (Belgium) or Rotterdam (the Netherlands)*	*The referenced name in the text*
29 – 07 – 2019	Advisor business development oil and chemical	An authority that manages and further develops the port of Antwerp	Antwerp	Authority A
30 – 07 – 2019	Head of the acquisition department	A Flemish government organization that offers support for Flemish entrepreneurs	Antwerp	Government agency A
07 – 08 – 2019	Head of the department invest	An organization that deals with international business in Flanders. For example by assisting foreign companies in their investment projects in Flanders.	Antwerp	Regional development organization A
07 – 08 – 2019	Team manager physical environment, environment and energy	A Dutch employers' organization	Rotterdam	Trade association A
08 – 08 – 2019	Account manager cleantech	A regional development organization with the aim of strengthening the regional economy in the province South-Holland	Rotterdam	Regional development organization B
15 - 08 – 2019	Business manager chemical and bio-based industry	An authority that manages and further develops the port of Rotterdam	Rotterdam	Authority B
23 - 08 – 2019	Director	An organization that represents the interests of industrial and logistics companies in Rotterdam	Rotterdam	Trade association B
28 – 08 – 2019	Interviewee 1: sector specialist chemical industry and interviewee 2: spokesman	A Dutch government organization, which deals with attracting foreign companies	Rotterdam	Government agency B
29 – 08 – 2019	Business manager energy and maritime	An investment and promotion organization of the city of Rotterdam	Rotterdam	Regional development organization C
30 – 08 – 2019	Head of communication	A Belgian trade association for the chemical industry and life sciences	Antwerp	Trade association C

Sources: the interviews and the websites of the organizations involved

Appendix B

Interview questions:

- What does the process of choosing a location for a chemical company look like?
- Does the image of a cluster also play a role in this process?
- How did the location choice process of Ineos and Borealis go?
- What is your role, as a company, in the investment choice of chemical companies?
- What do you think are the most important location factors?
- Does this ranking of factors apply to each type of investment and were these factors also important for Ineos and Borealis or did they attach more value to other factors?
- How does the chemical cluster of Antwerp score on the location factors you mentioned?
- How does the chemical cluster of Rotterdam score on the location factors you mentioned?
- What characterizes the Antwerp cluster compared to the chemical cluster in Rotterdam?
- Which factor eventually ensured that Ineos and Borealis chose Antwerp?
- Has the difference in CO2 reduction policy between the Netherlands and Belgium played a dominant role in this?
- What have other organizations and local authorities done to attract the investments of Ineos and Borealis?
- Do you think that a certain factor, in addition to CO2 policy, can also become an important location factor in the long term? If yes which one?