



Cruising in environmental planning

Identifying factors, motivations, and barriers that explain intervention in the air pollution of cruise ships in Amsterdam



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Cruising in environmental planning: Identifying factors, motivations, and barriers that explain intervention in the air pollution of cruise ships in Amsterdam.

Key words: Air pollution, tourism, externalities, environmental planning, cruising, Amsterdam, shore power, LNG

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Cover image: Gerritsen, R. (2018)

Abstract

This study aims to portray the subject of air pollution in ports caused by cruise shipping through the perspective of environmental planning. This is done by characterising it as a spatial conflict between the ship and the port, applied to the case of Amsterdam. This in turn uncovers factors that contribute to the current situation, and explains reasons for intervention or a lack thereof through motivations and barriers of both local authorities and the cruising industry. These motivations and barriers are explored through literature review, policy review and the analysis of conducted interviews. The identified barriers are a lack of authority of the port over the cruising industry, cost of potential interventions and investment risk, and the external benefits that cruise ships offer to a port. Motivations are the external costs of air pollution and tourism. These two are subject to discussion, indicating that the impacts of tourism and air pollution are subjective in nature. This is also shown in the other identified motivation, which is public opinion on the matter. As a result, motivations are a matter of subjectivity, whereas barriers are determined by much more rigid investment costs.

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Abbreviations		
ECA	Emission control area	
EEZ	Exclusive economic zone	
IMO	International maritime organization	
LNG	Liquefied natural gas	
MARPOL	International convention for the prevention of pollution from ships	
PTA	Passenger terminal Amsterdam	

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1. Cruising and air pollution

When a cruise ship arrives in a city, it poses a striking image. A ship with the height of several storeys, with thousands of people on board, almost an apartment block by itself, attaches itself to the city, stays for a while, and leaves to its next destination. Cruising is a part of the tourism sector, allowing vacationers to book trips around the world, visiting several destinations over a period of time. At these destinations, cruise ships have a clear impact. Aside from the striking image, its passengers disembark to explore the city, and the ship can cause a certain amount of air pollution. Generally, the damages caused by air pollution are undesirable for the local governments that have jurisdiction over these destinations, but nevertheless, action to reduce or eliminate the air pollution coming from cruise ships is limited, raising the questions of why this is the case, and in turn, what is possible, what is allowed, and what motivates responsible actors. This study specifically concerns the air pollution of ocean going river cruises, not river cruises, which are also common in Amsterdam.

1.1 Emissions into the air

In 2015, the Paris agreement was signed, with ambitious goals for emission reductions worldwide. This is part of a wider trend, in which more attention is paid to the environment. Where the Paris agreement specifically aims to reduce emissions of CO₂, other emissions that lead to air pollution also form a concern. The World Health Organization estimates that annually, 4.2 million people die worldwide as a result of air pollution (WHO, 2021). When categorising the emission of different substances of the transportation, industry and agriculture sectors into the air, there is a difference between air pollution and CO₂ emissions. Air pollution tends to inflict damage on a more local environment, whereas CO₂ leads to climate change through the greenhouse effect. While both cause damages, the main difference between the two is in the scale level. Where CO₂ emissions have global effects that do not directly impact the environment where it is emitted, air pollution largely remains in this environment. Similar to CO₂ emissions, The effects of air pollution are not immediately visible: pollution has a weak profile, and as a result measures against air pollution may not always be a logical outcome, or may even be controversial (Zuidema, 2016). This is because environmental objectives are commonly directly at odds with economic objectives. As a result, air pollution can be a matter of public discourse, and therefore perceived damage, not actual damage (Bickerstaff & Walker, 2003).

Nevertheless, policy on air pollution keeps developing. The European Clean Air Outlook renewed objectives to reduce background concentrations of polluting substances (European Commission, 2021), which signifies a continued effort in Europe to reduce air pollution. In the Netherlands, air pollution has received renewed attention since 2019 because of the nitrogen crisis, where high emissions of nitrogen compounds forced immediate action. Different sectors cause nitrogen emissions, which has forced political choices to limit nitrogen emissions from different sectors. As a result of these choices, this has led to a stop in construction and a lowering of the speed limit on motorways.

Similarly, the municipality of Amsterdam has its own sets of air quality objectives which aim to lower ambient air pollution to the WHO norms (Gemeente Amsterdam, 2019b). However, in the case of international shipping, legislation and regulation is lacking. For example, the Paris agreement does not include objectives for the reduction of CO₂ emissions of international shipping, and the European Commission limits its shipping regulation to setting emission standards (European Commission, 2021), which currently are on par with the international standards for shipping emissions. These standards are limited in ambition, the reasons for which will be discussed in chapter 2.2. The cruising industry also falls within the

category of international shipping, facing the same limited regulations on their emissions. As a result, cruise ships emit significant amounts of polluting substances into the air, while providing less value to the world economy than international cargo shipping. The media and the population are increasingly more aware of this issue. For example, the municipality of Amsterdam has received criticism because it allowed a cruise ship undergoing maintenance to continue emissions (Bianchi, 2021), and a study by Abbasov et al. (2019) that compared cruise emissions to those of personal vehicles has received considerable media attention. The question that is asked in these articles is why this is allowed in the first place, and why nothing is being done about it. This study aims to clarify why this happens by first reviewing scientific literature related to the subject, and then reviewing policy documents and analysing qualitative data in the case of Amsterdam based on the findings of the literature review.

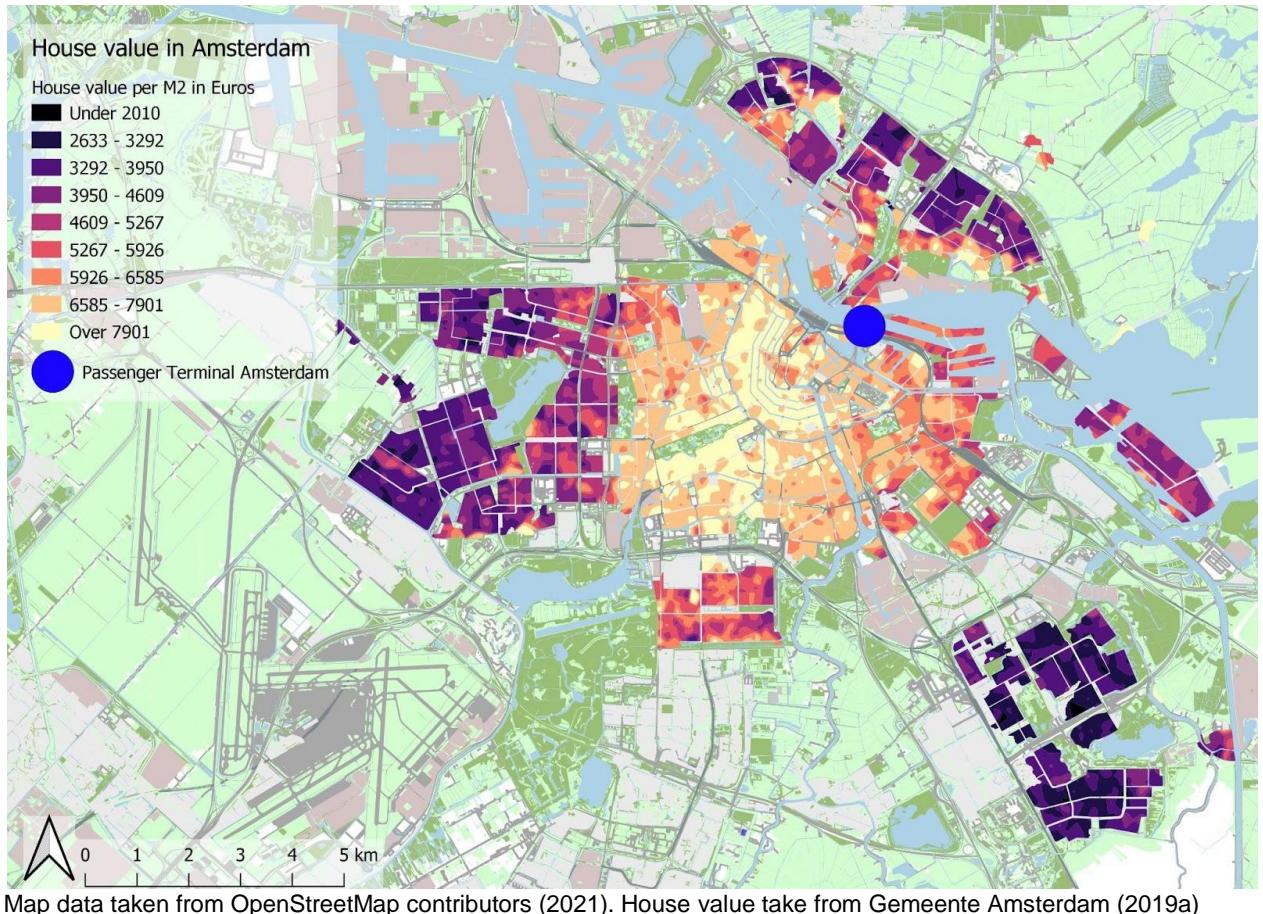
1.2 A spatial conflict

The concerns that recent news articles voice signifies a conflict: the air pollution that is caused by cruise ships does not only impact the ship and its passengers, but also the port city and its inhabitants. When a cruise ship enters a port, it brings tourists to the city. On board, the ship has different kinds of amenities, also known as hotelling services, that consume power. For cruise ships, this power is usually generated by on-board diesel engines. As a result, the amenities that cruise tourists use directly result in air pollution where the ship is berthed. With the limited space of a city, the air cannot be freely used by the ship to emit whatever is convenient, but rather it is shared with other parties who are involved, leading to a spatial conflict. At sea, this is not as much of a problem, as the emissions have enough space to disperse, and the space is shared by fewer parties, avoiding a concentration of polluting substances. As such, the problem is not that ships emit pollution, but rather that this pollution is concentrated in a place where it can cause damage, in the city or otherwise. This concentration in turn inflicts costs on inhabitants, in the form of negative health effects and damage to the environment. As a result, the space is contested between the cruise ships and the other functions of the areas that are visited. This spatial conflict between shipping and urban space is not just limited to cruise ships. It is also one of the reasons that has caused ports to move away from the city (Hoyle, 1989). This development however has not happened in the case of cruising because of the touristic aspect that is part of it. As cruising is part of the tourism sector, cruise lines aim to go to desirable destinations, determined by either cultural or natural value.

At the same time, the value that cruise lines seek, which can either be natural or cultural value, means that there is more damage to be done by pollution caused by the ship. As a result, what is in the interest of the cruising industry might not necessarily be in the interest of the destinations it attends. In the case of Amsterdam, this location is the Passenger Terminal Amsterdam (PTA), located near the central train station in the centre of the city. PTA is an arrangement for cruise ships in Amsterdam, and desirable for its proximity to the city centre and public transport connections. This means that it is well connected to the tourist hotspots, making it a desirable destination for cruises with the city as an attraction. On the other hand, this attraction also means that the pollution that is emitted is concentrated in the city centre of Amsterdam, a place that is more strongly contested. The value of this area, and by extension the degree to which the urban space is contested, is reflected in the house pricing. House pricing in the centre of Amsterdam is among the highest in the world, also in the area around the PTA, as can be seen in figure 1. The exact impact of these emissions however is unknown, as emissions from shipping are not included in pollution calculation models (Rijksoverheid, 2021). With the framing of the question of air pollution caused by cruise ships as a spatial conflict resulting from a combination of environmental impact and contested space, there should be possible interventions to resolve this conflict. The discipline that is concerned with these types of interventions is spatial planning, which is defined by de Roo &

Voogd (2019) as “*the science of purposeful interventions*”. What is different in the case of cruise shipping from standard environmental planning, is that while the damage of emissions is concentrated near the environment where it is emitted, while the source itself, the ship, is not confined to this environment. Cruise ships inherently move around between environments, and because of this, the issue can be described as a local problem with international causes.

Figure 1, House pricing in Amsterdam.



1.3 Research outline

The aim of this study is to find possible interventions to resolve this conflict, whether these interventions are already taking place in the case of Amsterdam, and if not, what the reasons of involved actors are. These reasons can emerge either from a lack of possible interventions, or a lack of interest from involved actors to resolve the conflict. For this, literature on subjects related to cruising, spatial planning and air pollution is examined to identify factors that lead to action and inaction, which will be used construct a conceptual model, which is then applied to the insights of relevant actors. Additionally, policy documents related to cruising and air pollution are reviewed. As can be seen in chapter 2, research on the subject is primarily concerned with the documentation of the current situation. It describes the air pollution that is caused by cruise ships or shipping in general, from a different perspective than environmental planning, and often recommends that policy makers should try to address this specific issue (i.e. Viana et al., 2014; Dragović et al., 2018; Simonsen et al., 2019). However, the question of how this might be accomplished, and why it is not happening already is not asked. Evidently, this is not straightforward, as emissions of air pollution caused by cruise ships are still high in many ports, as can be seen in Abbasov et al. (2019). Therefore this study attempts to answer this so far unanswered question. The

answer to this question may also offer insight into the situation in cities other than Amsterdam, and other subjects where a problem with a global cause is concentrated on a local level. Considering this situation persists, logically there must be reasons why it does. For example, the interests of the location a cruise ship attends might not include cleaner air, or if it does, there might be barriers that prevent it from holding cruise ships accountable. In order to find the different reasons that may help to describe the current situation, and the reasons that may explain its origins, the following research question is asked:

What are the factors that contribute the current situation of air pollution caused by cruise ships in the case of Amsterdam, and what influences intervention?

This question is attempted to be answered in both a theoretical framework based on relevant literature, and through empirical research. To aid in this, sub-questions are asked, aimed at providing the necessary contextual information of the issue, that might offer additional explanations that influence the decision making process of the port and the cruise companies.

What are the costs and benefits of cruise ships to a port?

The extent of the negative impact of the air pollution caused by cruise ships, as well as the potential benefits of tourism, can offer insights into the decision making process. If the damages are lower than initially thought, or if cruise ships offer considerable benefits to the port, this explains why little action is being taken, as the impacts are largely positive.

What is the legal context?

Considering the characteristic of a problem with a global cause being concentrated on a local scale, it is important to know what port authorities and local governments are legally allowed to do in relation to international law. Furthermore, it is also important to know whether the current situation is legal in the first place, and which parties are legally responsible for different aspects of the issue.

What are potential interventions?

For a problem to be solved, interventions need to be available. These can take different forms. Interventions can consist of policy changes, but also technical changes. The availability of these interventions needs to be investigated, as it indicates what options are on the table for both the port and the cruise companies. An absence of viable interventions would offer a potential explanation for the current situation.

First, in chapter 2, relevant literature is collected to gain an understanding of current insights into the specific issue of air pollution caused by cruise ships in ports. This is then used to construct a conceptual model that identifies factors that can explain why the current situation persists, and how they interact with each other. In chapter 3, the methodology of the study is discussed, explaining the data collection process and how this data will be analysed. Ethical and scientific issues are addressed here as well. Then, in chapter 4, the analysis of policy documents is shown. Then, the findings of the qualitative data collection are presented, analysed, and compared to the findings of the literature study in chapter 2. Then finally, the research questions are definitively answered in the conclusion, and possible limitations of the study are discussed. The answered research question also leads to a set of possible interventions that can reduce air pollution from cruise ships, which are also shown in this chapter.

2. Theoretical framework

In order to find an explanation for the barriers between the current situation and one where air pollution from cruise ships is reduced, this chapter aims to connect different domains of research. Existing studies related to shipping pollution focus on taking inventory of the current situation of air pollution originating from cruise ships (e.g. Abbasov et al., 2019; Dragović et al., 2018), shipping as a whole (e.g. Tzannatos, 2010; Viana et al., 2014) emission reducing measures (e.g. Gilbert et al., 2018; Vaishnav et al., 2016) and analyses of international maritime law (e.g. Animah et al., 2018; Kopela, 2017). These often end with the recommendation that policy makers should look at reducing pollution or finding ways to implement measures (i.e. Viana et al., 2014; Dragović et al., 2018; Simonsen et al., 2019), but literature that theorises how this goal might be achieved, and the limitations in achieving it, appears to be absent. In this chapter, scientific literature is analysed by connecting the causes of air pollution to other domains, which results in a conceptual model that explains the current situation. First, the influence of economics through market forces is investigated. This is to explore economic incentives that play a role in the current situation. Then, the influence of laws and regulations that may limit action through emission norms and legal provisions is assessed. To identify potential physical interventions, technologies that reduce the emissions polluting substances are assessed. Finally, spatial planning theory is analysed to connect these areas of research on the port level, offering insight on how these different disciplines manifest themselves on the ground. With the premise that air pollution from cruise ships should be reduced, the chapter is aimed at finding an explanation of why these domains together have not led to intervention by involved actors. This results in a conceptual model that describes how the different identified factors lead to a potential intervention on the subject of air pollution of cruise ships.

2.1 Externalities of cruising

As Zuidema (2016) states, a reason for a lack of intervention on environmental issues can be that economic objectives are at odds with environmental objectives. Economic incentives in the spatial conflict caused by cruise ship emissions can be characterised through externalities. Externalities are a general economic concept, that describes effects of economic decisions that are outside of (external to) the market valuation. Air pollution is usually an externality, where there are no charges for emissions if they are within the legal limit.

Cornes & Sandler (1996) discuss definitions of externalities, where different definitions may be more appropriate for different situations. Of these definitions, the one by Meade (1973) is described as the most broad one: *"An external economy (diseconomy) is an event which confers an appreciable benefit (inflicts an appreciable damage) on some person or persons who were not fully consenting parties in reaching the decision or decisions which led directly or indirectly to the event in question."* To paraphrase, an externality results from a decision that causes costs or benefits for people who were not a part of reaching this decision. This broad definition is useful for defining the issue of pollution from cruise ships, as it is not primarily a question of economics. Additionally, it continues to be cited in more recent work. Other definitions used by Cornes & Sandler (1996) are applicable to more specific economic situations and calculations, whereas this study takes a more generalist approach to the economic side of the issue of pollution.

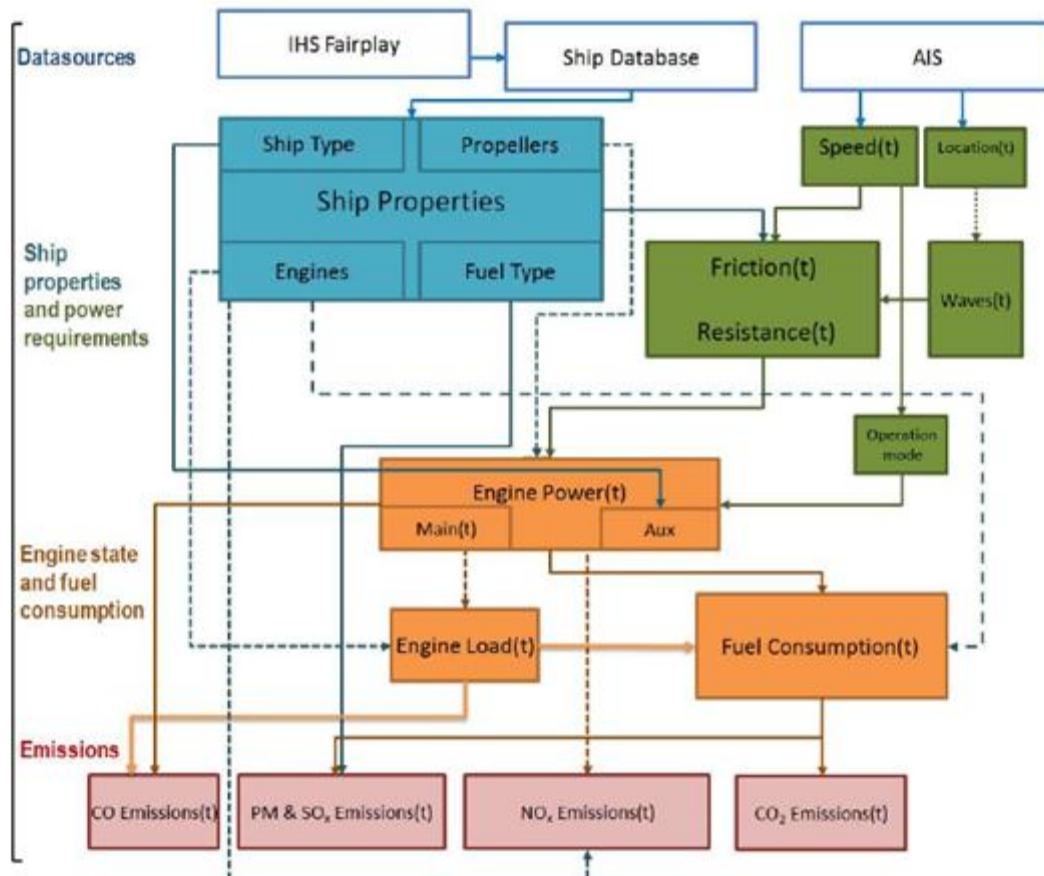
Externalities are not part of the market by definition, and therefore market forces will not account for them. In the case of cruising, both positive and negative externalities result from the agreement that is reached between the port and the ship. In this agreement, the ship pays harbour fees in exchange for the services provided by the port, but there are also

additional economic gains for the port city (Dwyer & Forsyth, 1998). The additional gains are externalities that result from the addition of tourists, but cruise ships also cause air pollution as a negative externality. These consequences of a cruise ship entering a port generate both costs and benefits for the inhabitants of the port who have not participated in this agreement, making them externalities. This perspective offers explanations for why these negative impacts of cruise ships may be allowed to persist: as externalities, air pollution and tourism are not valued by the market and therefore the market does not offer compensation for these costs. In addition to this, the main transaction between the port authority and the cruising company is exclusively positive for the port. Because of the involvement of both positive and negative externalities, it may be the case that the values of these cancel each other out, reducing the willingness of authorities to internalise them. How the willingness of local authorities influences action will be addressed further in chapter 2.4.

2.1.1 Air pollution

The main external cost that is caused by cruise ships in cities is air pollution, which consists of several different substances. The substances that are emitted by any ship can vary based on its properties and its operations. This process is described by the STEAM2 model (Jalkanen et al., 2012), which is intended to calculate shipping exhaust emissions. For this purpose, the model describes how the different characteristics and operations of a ship result in different emissions, and how these characteristics and operations affect each other. The main difference between cruise ships and other ships in this model is the increased demand for auxiliary power, which cruise ships need for hotelling services (Tzannatos, 2010), resulting in an increased demand for engine power. Emissions of SO_x, NO_x and PM are influenced by the type of engine, the amount of fuel that is used and the composition of this fuel. This process can be seen in more detail in figure 2.

Figure 2, STEAM2 model, Jalkanen et al. (2012)



The operations of a ship also affect emissions, as this influences how much power is required from the engine. Dragović et al. (2018) categorise three activity phases that cruise ships go through while in a port, which help to portray how operations affect the emissions of cruise ships, and how spatial characteristics may influence these operations. The activity phases are manoeuvring, anchoring and berth. The emissions during these phases can differ based on the port, depending on its layout and the facilities it offers. Dragović et al. (2018) examine the ports of Dubrovnik and Kotor in the Adriatic sea, each with different attributes. The port of Dubrovnik provides a high number of berthing places, but requires a difficult manoeuvring phase, whereas the port of Kotor has easier manoeuvring but a limited number of berths, requiring ships to anchor for longer until a berthing place is free. Both of these characteristics increase emissions in these ports. Tzannatos (2010) examines the port of Piraeus in a similar fashion for all shipping activity, with similar results: both studies (Tzannatos, 2010; Dragović et al., 2018) find that a large part of pollution caused by cruise ships in a port is emitted at berth (or at anchor) due to the use of auxiliary engines for electricity generation. As a result, a possible method of reducing the exhaust emissions is by reducing the amount of emissions at berth. This is examined further in chapter 2.3.

2.1.2 Emission impacts

The emissions indicated in the STEAM2 model are carbon monoxide (CO), particular matter (PM), sulphur oxides (SO_x), nitrogen oxides (NO_x) and carbon dioxide (CO_2). These emissions all have different impacts, which can be broadly categorised as local and global impacts. The negative effects that are caused by CO, PM, SO_x and NO_x are mostly felt directly around the environment where they are emitted, whereas CO_2 has the global impact of climate change, the effect of which is independent of the area where it is emitted.

PM, mostly measured in $\text{PM}_{2.5}$ and PM_{10} , consists of small solid and liquid particles, ranging from a few nanometres to tens of micrometres. In the case of cruise ships, around 92% of PM emissions are $\text{PM}_{2.5}$ (Abbasov et al., 2019). Long-term exposure to particulate matter can result in a reduction in life expectancy caused by cardio-pulmonary and lung cancer mortality (WHO, 2018).

NO_x is mostly released by combustion of fuels, depending on the air-to fuel ratio. In more oxygen-rich areas, more NO_x is released. High concentrations of NO_x in the atmosphere react with water particles in the air, which leads to acid depositions, also known as acid rain. Acid depositions degrade soil and water, which in turn damages ecosystems and crops. Additionally, NO_x emissions affect the wider nitrogen cycle, leading to additional negative effects (Erisman et al., 2013). One of such effects is eutrophication, which increases the amount of nutrients in the environment, leading to the degradation of ecosystems and a degradation of biodiversity (EEA, 2020).

SO_2 is emitted from combustion of sulphur present in fuels, which can be found in varying amounts in marine fuels. High concentrations in the atmosphere lead to acid depositions. These acid depositions lead to a reduction in soil and water quality, damaging ecosystems and crops (EEA, 2020).

Health effects of CO in high concentrations, for example in apartments, are well known as dangerous because it replaces oxygen in the blood, but in lower concentrations there are inconsistent symptoms and adverse effects. Nevertheless, there are indications that low background concentrations have negative consequences to health (Townsend & Maynard, 2002).

CO_2 emissions of the entire shipping sector contributes to 2.2% of global CO_2 emissions (Johansson et al., 2017). Since CO_2 emissions of cruise ships are an even smaller subdivision of this, adverse effects caused by global warming in ports that can be linked to

cruise emissions in ports are extremely limited, and therefore CO₂ emissions will not be considered in this study.

An additional pollutant that indirectly causes damage is ozone (O₃), as it is not directly emitted. In this context, it is known as tropospheric ozone. Tropospheric ozone is formed by other pollutants, primarily NO_x and SO₂ reacting to light. (Finlayson-Pitts & Pitts Jr, 1993). High concentrations lead to reduced lung function, and can cause lung diseases (WHO, 2018). Additionally, it negatively affects plant growth, leading to reduced biodiversity (EEA, 2020).

Contrary to the emissions of CO₂, the emissions with a mainly local impact are significant on the port level: where there are just over 300 ocean going cruise ships worldwide (Cruise Market Watch, 2021) ports such as Amsterdam can receive up to 200 cruise ships a year. This shows that the emissions of cruise ships concentrate in ports, where a major proportion of the global cruise fleet berths every year. Aside from place, pollution caused by cruise ships is also concentrated in certain periods of time, caused by the tourism season (Tzannatos, 2010; Dragović et al., 2018). This concentration leads to a significant level of pollution on the local scale, while the emissions are negligible on a global scale. Abbasov et al. (2019) estimate the emissions of cruise ships in European ports, and conclude that especially emissions from SO_x and NO_x are high in relation to the emissions of all personal vehicles in the city. It should be noted though that SO_x emissions of personal vehicles in Europe are extremely low because of strict emission standards on cars, which do not apply to cruise ships. The causes for this difference in standards will be examined further in chapter 2.2.

An alternative method for valuing emissions, is to estimate the monetary value of external costs to contextualise the negative externalities of cruising in ports. As an externality, it is difficult to estimate the costs of air pollution. As discussed earlier, externalities are not part of the market, and as such they are not explicitly valued by the market. Putting a monetary value on air quality assumes that people are willing or even able to pay a price for cleaner air, but this may not be the case. On the other hand, this cost estimation may help to internalise them by providing a perspective on the damages caused to policy makers. One method of estimating the severity of air pollution damages by assigning a monetary value is developed by CE Delft (2017), which is applied to cruise ship emissions in Amsterdam in table 1. This method values damages specifically for the Netherlands by their influence on human health, ecosystems, buildings, mineral resources and well-being/nuisance, and is intended for cost benefit analyses. This method can be applied to the estimations of cruise emissions in the port of Amsterdam by Abbasov et al. (2019), who estimate emissions in different European ports based on time spent in the port, assuming emissions are within legal requirements. This provides a rough estimate of the external costs of air pollution caused by cruise ships in Amsterdam.

Table 1, external cost estimation.

	Emissions in kg	Cost per kg	Total cost	Per ship (N=52)
SO _x	6 955	€24,90	€173 179,50	
NO _x	158 953	€34,70	€5 515 669,00	
PM _{2,5}	2 765	€79,50	€219 817,50	
			€5 908 666,00	€113 628,20

Emission data taken from Abbasov et al. (2019). Cost per kg taken from CE Delft (2017).

2.1.3 Tourism impacts

Cruising is mainly part of the tourism industry. Similarly to air pollution, the tourism that is brought by cruise ships is concentrated in the ports it visits, and can be considered an externality. Ships travel to different destinations as a part of a route, where generally passengers leave the boat during the day, to return in the evening when the ship goes to a different destination, although there are also cruises that stay overnight. Most cruises last 4-7 days (CLIA, 2018). Cruising is popular in several areas of the world, of which Northern Europe is a popular destination, receiving 18,8% of total yearly passenger bed days in 2017 (CLIA, 2018). Amsterdam is a common stop for these cruises, and is in some cases a starting and ending point as well, especially as one of the more popular tourist destinations in Europe.

Cruises add to a local economy in two ways, classified by Dwyer & Forsyth (1998) as operator expenditures and passenger expenditures. Operator expenditures are the main exchange between the port authority and the ship, and include charges, taxes, maintenance and use of port services. These in turn result in employment, output, and added value. Passenger expenditures, which can be classified as externalities, include spending on accommodation, food, excursions and shopping (Dwyer & Forsyth, 1998). In general, the money spent by tourists that arrive by cruise ship can be estimated, which is used for an external benefit estimation in table 2. Contrary to the operator expenditures, passenger expenditures are not agreed upon between the two parties, and varies with every cruise ship that arrives, proving that they are positive externalities. In 2018, 426 316 passengers arrived in Amsterdam on 181 ocean cruise ships (Amsterdam Cruise Port, 2019).

An estimate of the average amount of money spent in port by cruise tourists in Europe is provided by Artal-tur et al. (2018), who conclude that the average amount spent is 62 euros, which goes up to 99 euros if guided tours are provided. As table 2 is an estimation of the external benefits, harbour fees are not included.

Table 2, external benefit estimation.

Passengers	Money spent per passenger	Total	Per ship (N=181)
426 316	€62	€26 431 592	€146 030,90

Money spent taken from Artal-tur et al. (2018). Passenger data and ship numbers taken from Amsterdam Cruise Port (2019).

The numbers from tables 1 and 2 suggest a slight external benefit on the side of the port. However, it should be noted that both costs and benefits are not distributed evenly across the city's population: people and businesses closer to the berthing area will receive more costs from the pollution, and only certain sectors profit from the external benefits. For example, in the port of Cartagena, 71% of cruise tourist expenditures were on retail, accommodation and food, and culture and recreation (Artal-tur et al., 2018). Furthermore, these numbers are based on many generalisations that may not be representative of the specific situation of Amsterdam, and therefore should only be interpreted as a very rough estimation. It does show however that the external costs and benefits are at the very least competitive with each other, offering an explanation for why local authorities may not be willing to hold cruising companies accountable for air pollution. This is examined further in chapter 2.4.

2.2 Legislation

Because of the involvement of externalities, the problem is not resolved through the market. When this is the case, a method of preventing damages caused by externalities is by using rules and regulations instead, where legislators may try to internalise the externalities, meaning that attempts are made to include the external cost with pricing mechanisms. Other possibilities to remove these negative externalities are to suspend cruising altogether, or to encourage cleaner shipping indirectly. Within this political realm, the rights and duties of ports on the subject of international shipping are factors that can partially explain the current situation. Legislation can contribute to potential interventions, and international laws could form a barrier to reducing the air pollution of cruise ships. To examine the influence of this, current rules and regulations will be examined.

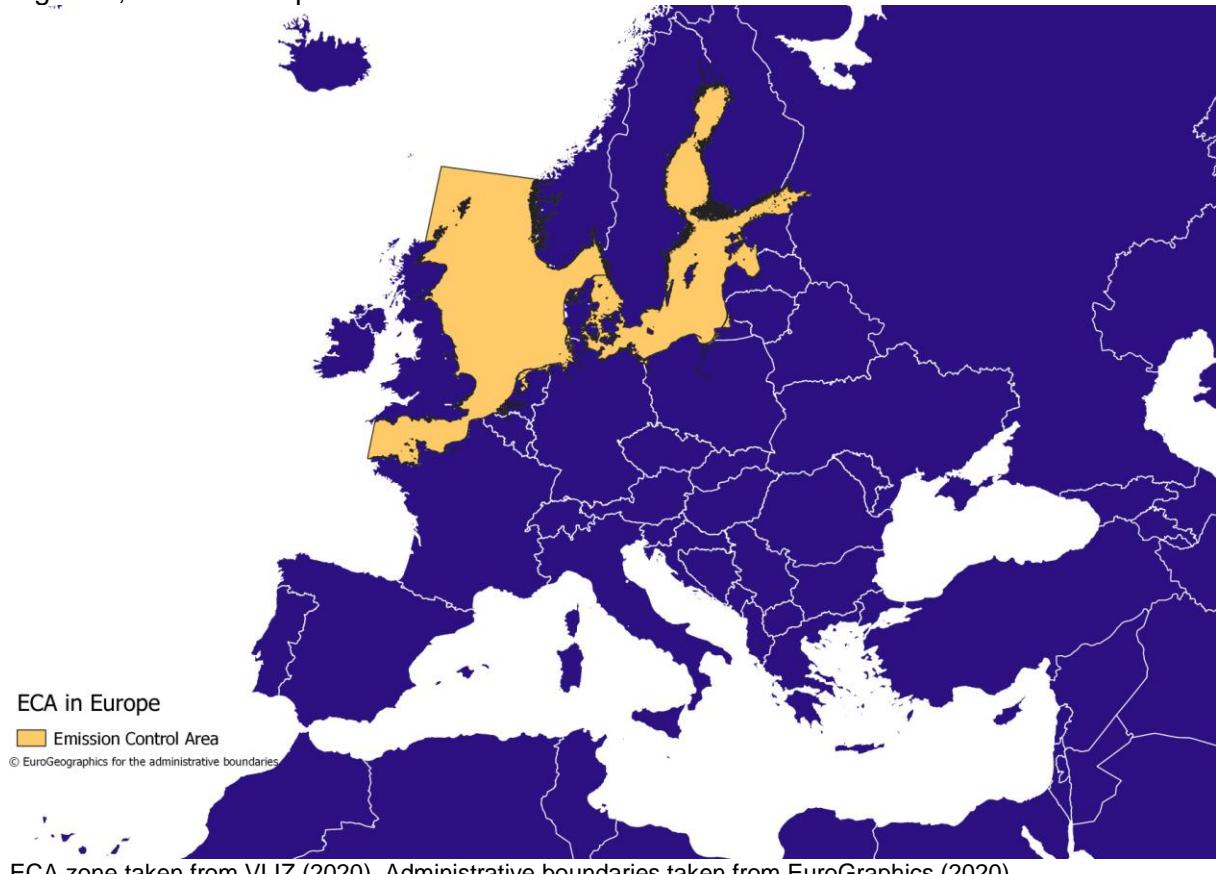
2.2.1 International law

First of all, international shipping is one of the least regulated sources of anthropogenic air pollution (IMO, 2008). The regulations that do exist are largely the result of international agreements, which are only binding to the nations that consent to be bound by them as per the *Vienna Convention on the Law of Treaties* (United Nations, 1969).

Globally, shipping is regulated by the International Maritime Organization, or IMO, which is the maritime branch of the United Nations. Specific legislation for air pollution is MARPOL annex VI, which sets standards for exhaust emissions of seafaring vessels. MARPOL is a convention that provides regulations on different kinds of pollution that all ships registered in the countries that have ratified the convention need to adhere to, and annex VI of this convention concerns emissions into the air. The convention provides progressive standards on different air pollutants, namely NO_x, SO_x, and PM. Stricter standards are possible in *emission control areas* (ECA), which provides the possibility to create stricter standards in areas where air pollution is more of a concern. In Europe, the Baltic sea, the English channel, and the southern part of the North sea are emission control areas, as can be seen in figure 3. An example of a MARPOL annex VI standard is a strict sulphur limit on fuels for seafaring vessels, which is set at 0,5% globally since January 2020, and at 0,1% in the ECA of Europe since 2015. As a result, the 2020 standards do not change rules in the ECA. Additionally, current European standards outside of the ECA are as strict as international ones. As a convention, MARPOL is dependent on its participants, and its contents are the result of negotiations which have led to compromises (Kopela, 2017).

How these standards are enforced is dependent on the law of the sea. This determines what the rights and duties are of nations on the subject of international shipping. The law of the sea differentiates between two different roles of states, namely the flag state and the port state.

Figure 3, ECA in Europe



2.2.2 Flag states

A flag state is the state an international vessel is registered in, and can in many cases be described as open registries that allow for easy registration and low requirements for the vessel (Corres & Pallis, 2008). Flag states determine the laws that ships adhere to. This includes for example taxation laws, but flag states are also responsible for the compliance of their vessels to pollution laws (Corres & Pallis, 2008). In order for port authorities to confirm if a ship complies with regulations, ships of over 400 tonnes are required by the IMO to have an air pollution prevention certificate that validates the ship's conformance to the annex VI pollution regulations. This certificate is provided by the flag state. According to Churchill (2016), these certificates have to be accepted by the port state, "*unless there are clear grounds for believing that the condition of the ship or its equipment does not correspond substantially with the particulars of any of the certificates*". This means that the port authority is required to accept the documents issued by the flag state as correct, unless there is a grounded reason for believing otherwise. It serves as an example of the involvement of the flag state in foreign ports, and how the flag state is responsible for the ship's conformance to its laws. Because of this, when a flag state has ratified the MARPOL convention, it means that a port has to assume that the ship conforms to these norms. Flag states are incentivised to ensure that their vessels conform to local and international laws, to avoid the risk of the flag state becoming blacklisted by the port state if they are found to register too many ships that do not conform to the standards of ports they visit in port state controls (Corres & Pallis, 2008).

Flag states that are commonly used by cruising companies such as the Bahamas (Norwegian Cruises, Royal Caribbean), Bermuda (P&O, Princess, Cunard), Malta (Celebrity cruises), and Panama (Carnival) perform relatively well in port state controls (Corres & Pallis, 2008), meaning that the ships registered in these countries often comply with regulations. As a result, it can be assumed that cruise ships comply with emission norms.

2.2.3 Port states

The port state is the nation in which a ship is located when it is not in international waters. This can be anywhere within the exclusive economic zone (EEZ) of a nation, but the precise location within the EEZ has different implications. In the wider EEZ, ships do not have to strictly adhere to the port state's laws as not to hamper innocent passage (Kopela, 2017), but in a port they do. Port authorities have the ability to prevent ships from entering the port, except for ships that are in distress (Churchill, 2014). Additionally, port states have to enforce laws equally, meaning that MARPOL standards also have to be enforced against ships from states that have not ratified the MARPOL treaty (Churchill, 2016). This means that if a flag state has not ratified MARPOL, it does not offer ships registered in this state exemption from MARPOL standards in other countries, as the ship will still have to conform to the rules of the port state, and by extension, the rules of the port itself.

2.2.4 Implications of legislative context

An important takeaway from these laws is that they are aimed at shipping in general, and do not differentiate between different types of ships or purposes. Because of this, compromises are made in MARPOL annex VI resulting from the global economic importance of the cargo shipping industry. For example, in discussions around the stricter sulphur limits to be implemented in 2020, it was argued that stricter standards negatively would affect the living quality of developing countries, and that it would lead to market distortion and an increase in transport costs (Kopela, 2017). These are primarily concerns that are relevant to international cargo shipping, and turns cruising into a niche, where the stringency of legislation cruise ships have to adhere to is limited by the merit of international cargo shipping, and not the merit of cruise shipping. Another takeaway is that states may make legislation concerning emissions from cruise ships and shipping in general as strict as they desire. The fact that this happens little and MARPOL remains the guiding standard, suggests that states simply do not desire to adopt stricter legislation. The reason for this might be related to the situation in international cargo shipping as described by Animah et al. (2018), where stricter rules mean that ships are not able to comply, and therefore will not do so. Reasons why ships potentially cannot comply with stricter fuel standards (which do not require refitting a ship) include increased operational costs, lack of infrastructure, and lack of verification of compliance, which means that ships do not face repercussions for not complying (Animah et al., 2018).

2.3 Physical interventions

Legislation concerning emissions is only effective if there are ways for ships to comply with them. Additionally, ports may also play a role in the implementation of physical interventions, as infrastructure is indicated as a potential reason why ships cannot comply with stricter rules (Animah et al., 2018). Referring back to the STEAM2 model, the most straightforward solution would be a source-oriented one, where the different characteristics of ships that cause pollution would be changed to be cleaner. An example of this is included in MARPOL annex VI, where the new sulphur limits of bunker fuel mean that the SO_x and PM emissions will be reduced. With the three identified causes, namely engine load, operations, and fuel, there are different interventions possible.

2.3.1 Changes to ships

In terms of fuel, Gilbert et al. (2018) examine the emission effects of different alternative maritime fuels. They compare heavy fuel (which does not comply with current sulphur standards set by MARPOL) and marine diesel to liquid hydrogen (LH₂), liquefied natural gas (LNG), vegetable oil and biodiesel among others. They conclude that both biodiesels and vegetable oils are good alternatives to marine diesel in terms of CO₂ emissions as they have none, but have higher NO_x emissions and similar SO_x emissions to marine diesel. LNG has CO₂ emissions similar to that of marine diesel, but emits only a fraction of polluting substances into the air. Liquid hydrogen has no emissions of both CO₂ and polluting

substances, but is potentially more polluting upstream, meaning that the production process can be more polluting, depending on the process that is used. Gilbert et al. (2018) also stress that all of these emissions are dependent on the engine. This is especially true for NO_x, where the emissions depend on the temperature and duration of the combustion process (Jalkanen et al., 2012). Based on these conclusions, the adoption of either hydrogen or LNG as fuels are potential interventions to reduce pollution in ports caused by cruise ships.

2.3.2 Changes to ports

In their study, Gibbs et al. (2014) examine the possibilities ports have in achieving the reduction of ship emissions of CO₂, which can also help in reducing the emissions with local impacts. They name speed reduction, aimed at the engine load of the ship, green ship promotion, aimed at the characteristics of the ship which includes the adoption of alternative fuels, and on-shore power supply, aimed at reducing emissions at berth. As a majority of air pollution of cruise ships is emitted at berth and is caused by the demand for electricity (Tzannatos, 2010), the solution to this problem is to make sure this electricity does not have to be generated on-board through the use of auxiliary engines, but can be provided from the shore. Shore power offers benefits for both the ship and the port, as it saves fuel for the ship and lowers pollution for the city. On the other hand, it also requires investments from both parties: the port needs new infrastructure, and the ship needs retrofitting (Vaishnav et al., 2016). This results in a situation where the benefits might be offset by the cost. For example, the port of Rotterdam found that shore power did not yield enough benefits in air quality to justify the cost (Doves, 2006), which in this case was primarily caused by the distance between the port and the city. This serves as an example of why installing shore power facilities may not be a desirable intervention for ports, but because of its lacking recency, it does not necessarily reflect current considerations.

Table 3, intervention overview

Pollution source	Intervention
Engine load	Speed reduction
Operations	Shore power
Fuel	LNG, LH ₂

The advantage of shore power is that it is a local measure that can be taken regardless of the developments in the cruising industry in terms of emissions, as retrofitting a ship to be able to use shore power is cost effective for cruise companies (Vaishnav et al., 2016). However, cleaner engines and fuels would help reduce pollution across all operations, not just at berth, and would omit the requirement of ports to invest in shore power infrastructure. Interestingly, the majority of costs are distributed differently between the two sides in both technical interventions. For shore power, the majority of the costs are borne by the local government, and for cleaner propulsion the majority of the costs are borne by the cruise company.

2.4 Involved parties

The theoretical framework provides a number of parties that are relevant to the subject, based on the different contexts that are examined. The available solutions describe two primary parties that have influence over a potential intervention that will reduce the air pollution of cruise ships. These are cruising companies and local governments, who can either change the properties of the port or of the ship to reduce emissions of polluting substances. In the legislative context, the parties that can implement legislation to reduce the

emissions from cruise ships are the flag state and the port state, and by extension the port itself. The IMO also plays a role in legislation, though it is still dependent on nations to ratify its treaties.

Other parties that are involved are those affected by the externalities of cruising. In the case of cruising, these can be both positive and negative externalities. Positive externalities are mainly experienced by local businesses that cater to tourists (Artal-tur et al., 2018), whereas negative externalities are experienced by people in the vicinity of the cruise terminal, either through negative health effects or damages to the environment (see chapter 2.1.2). Assuming a democratic process, the interests of these parties are protected by the local government.

In the case of Amsterdam, the port authority is a company, similar to a private business, except the municipality of Amsterdam has ownership over it. As a result, the port also executes public tasks (Port of Amsterdam, 2021). This construction makes the port of Amsterdam a for-profit organisation that pays dividends to the municipality, which totalled €68,5 million in 2019, and €1,5 million was collected from port dues of cruise ships (Port of Amsterdam, 2019). The kinds of involved parties on the local scale are limited. Most of the important parties are the port side, namely the municipality and the port authority. Further removed from the local area is the plurality of cruising companies that visit the port along their routes. However, as the cause of air pollution, they are directly involved.

2.5 Implementation of interventions

With the available interventions, the question becomes why these are not being implemented aside from cost issues. Especially on the local scale, cruising forms a spatial conflict where it causes external costs, meaning that at its core it is a planning issue with the goal of resolving this spatial conflict through purposeful intervention. Local authorities are therefore at least in part responsible for a potential intervention, but it is clear that there are barriers between the current situation and such an intervention. Planning literature describes how these interventions can be realised, which can then be applied to the current situation.

2.5.1 Complexity

De Roo & Voogd (2019) describe approaches suitable for different situations, based on the complexity of the problem. Complexity is determined by a number of factors, but it can be simplified to the degree of certainty over the problem and its solution. Using the premise that the spatial conflict should be resolved, there is a clear single goal: Reduce the amount of pollutants that are emitted by cruise ships. The solution to this problem is slightly more complicated, as there are several interventions that can reduce air pollution, but there is certainty that the available interventions will work once implemented. In this framing, it is a relatively simple issue, which according to de Roo & Voogd (2019), calls for a generic approach.

However, there are indications the issue may be more complex than that. A generic solution already exists in the form of MARPOL annex VI, and again using the premise that the spatial conflict between cruise ships and the port they attend should be resolved, the generic approach is not enough. In this case, as discussed previously, one of the reasons why cruise ship emission standards are not more strict is because the legislation is in fact too generic, as it also covers cargo shipping which has different considerations. In these more complex situations, de Roo & Voogd (2019) propose a specific approach, as opposed to a generic one. In such an approach, more attention is paid to the context, which in the case of cruising would be that it provides less merit than cargo shipping, and therefore requires stricter rules. Additionally, more different parties are included in the process to come to a collective decision. This can also be seen as a method for dealing with the externalities, where the

involvement of more parties in the process means that they become internalised. However, all of the solutions in this perspective are based on the premise that the air pollution caused by cruise ships requires intervention, but especially with air pollution there can be disagreement on this. This introduces the aspect of subjectivity to the equation.

2.5.2 Subjectivity

Bickerstaff & Walker (2003) describe air pollution as a more subjective matter, that individuals may perceive differently. This perspective places the air pollution in the area of public discourse, making it more of a political issue instead of an economic one. This subjective approach therefore means that there can be discussion on if and how pollution should be reduced. In this subjective view, individuals mostly attribute air pollution to industry and traffic (Bickerstaff & Walker, 2003), offering an additional explanation why policy has not been targeting shipping and cruising.

Zuidema (2016) identifies the problem of disagreement over the severity as a weak profile, caused by the external nature of air pollution, and pollution in general: its effects are usually much less visible and quite technical, and conflict with policy ambitions of local governments (Zuidema, 2016). This weak profile in turn results in diminished willingness of local governments to intervene, and as such, an area specific approach will be weakened.

As a solution for this, Zuidema proposes the addition of central guidance. Central guidance helps reduce the distortions of the clashing costs and benefits on the local level by using centralised authority to hold local governments accountable. In the case of cruising however, this is not possible as there is no central body for this purpose with the required authority. The IMO is the regulatory body for international shipping, but its measures are limited to international treaties that are inherently limited in their ambitions. As a result of this, the conclusion can be drawn that a potential intervention is inherently decentralised, which threatens the efficacy of environmental governance due to the weak profile (Zuidema, 2016)

2.5.3 A surrogate for centralised authority

There are alternative sources of the necessary authority that would otherwise be provided by central guidance. According to Hooghe & Marks (2003), multi-level governance is a diffusion of authority, and as such, the authority comes from multiple coordinating sources. International treaties are a type of multi-level governance, as there is no central authority, but instead the authority is divided over the countries that have ratified the treaty. Therefore, a form of multi-level governance already exists, but it is insufficient for reducing air pollution further. However, new agreements can always be set up for more specific rules. Multi-level governance provides a good method of offering flexibility in scale (Hooghe & Marks, 2003), which was identified as a problem in the case of cruise ships, where a problem with a global source is concentrated on a local level.

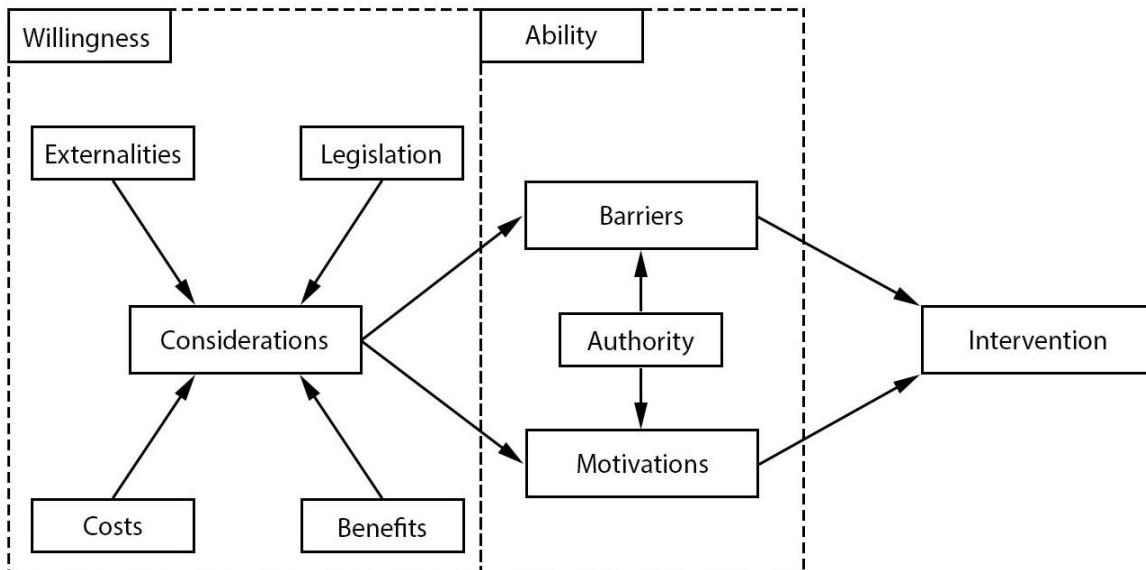
The trade-off of multi-level governance is that it is subject to the transaction cost of coordination caused by a high number of participants (Hooghe & Marks, 2003). This problem can also be seen in MARPOL annex VI, where the number of participating countries has led to compromises to the ambitions of the treaty. The convention was mainly geared towards national interests and the interests of international trade (Kopela, 2017), and more indirectly to cruising and the local interests of ports. If these local and cruising interests are included in multi-level governance structure specifically for cruising emissions, this coordination problem would be exacerbated even further by the addition of more parties. The amount of involved parties can be decreased by reducing the geographical scale, easing the amount of coordination required. This in turn introduces the risk that there might not be the required authority to influence the international cruising industry to accept a stricter global standard for air pollution from cruise ships, which ultimately would be a requirement for the initiative to be effective.

As a result, the inability to rely on multi-level governance can result in a situation where a lack of authority that can provide stricter rules, interventions have to take place extra-legally, initiated by the ports themselves or the cruising industry themselves, with limited coordination. On this local scale, incentives can be too low to properly implement measures because of the weak profile of the problem, and authority is too weak to hold cruise ships accountable.

2.6 Conceptual model

The findings of this chapter are combined into a conceptual model, which describes how the different components interact with each other. This can be seen in figure 4.

Figure 4, conceptual model



This model is an explanation for action and inaction concerning air pollution from cruise ships, which mainly plays for ports, but can also be applied to cruising companies. To which degree they wish to pursue a reduction of air pollution is open for consideration, and there may be disagreements on this (Bickerstaff & Walker, 2003). This consideration encompasses the willingness of the local government to intervene (Zuidema, 2019). Several factors affect this willingness, namely the external nature of air pollution, current legislation, the money it costs to implement solutions, and the benefits that intervention will offer. Together, these considerations can either positively or negatively affect the implementation of an intervention. When it is positive, it is considered as a motivation towards action, and when it is negative, it is considered as a barrier. Independent of this consideration is the degree of authority local governments have: they are limited in authority over cruise ships because of their international origin. Therefore, they may not be able to exercise their authority to impose stricter standards on the ships, regardless of the outcome of the considerations box. However, there may also be ways around this, through for example multi-level governance. As explained by Hooghe & Marks (2003), multi-level governance is a method of applying diffused authority, and therefore might be a way of gathering the required authority to enforce stricter standards. If this is the case, the problem of authority may change into a motivation instead, as it does not form a barrier. This aims to convey the potential limitation of the ability of local governments to address the issue, as Zuidema (2019) identifies as a barrier in environmental governance. Considering cruising companies have full authority over their fleet, this barrier does not apply to the cruising industry. Eventually, barriers and motivations that are caused by willingness and ability are produced, which influence whether action is taken or not. When an actor has motivations to reduce air pollution from cruise ships, and faces few barriers, it leads to intervention. When the actor faces more barriers, intervention will be limited, and when the actor has few motivations, it will lead to no intervention at all.

3. Research design

3.1 Research strategy

As explained in chapter 2, existing research that is specific to air pollution caused by cruise ship in cities is limited. The aim of the study is to identify factors that explain why the spatial conflict that characterises the issue remains unresolved, and therefore it is exploratory in nature. This exploratory nature of the study also results from the lack of theories that can directly be applied to the case, and instead, relevant factors based on relevant literature related to the subject are used instead. These relevant factors are seen in the conceptual model in chapter 2.6. The factors if this conceptual model are then applied to the situation in Amsterdam through interviews by using them as codes. As an exploratory study, data collection is a combination of literature review and qualitative data, allowing for input from experts in the field, as well as an analysis of current policy.

Case studies are a useful method for gaining an in-depth understanding of a single case in a real-world context. This allows for learning about complex situations, with a large number of variables (Yin, 2012). As highlighted in chapter 2, the situation on the local scale is complex, and can be explained by multiple potential variables, leading to motivations and barriers. As the problem emerges on the port level, and this level is primarily responsible for an intervention, the study aims to explain the situation on this scale through asking the following research question:

What are the factors that contribute the current situation of air pollution caused by cruise ships in the case of Amsterdam, and what influences intervention?

This is done through three kinds of data collection, explained in chapter 3.3. First, scientific literature was analysed to identify relevant factors, then policies of the selected case were reviewed, and finally, interviews with relevant parties were conducted. To properly address the complexity of the problem, the aim is to see how the research question can be answered in one particular case, namely Amsterdam. In accordance with the research question, the purpose is to describe the situation in this one particular case. Because the aim is to gain in-depth understanding of the case, and concerns a topic with a high amount of subjectivity it leads to a high number of variables that need to be examined in detail, making quantitative methods unsuitable. Additionally, as this concerns a complex issue, attention needs to be paid to the context. For these purposes, case studies are especially useful (Yin, 2012). As such, case studies can look at the case as a whole, and the surrounding context. As such, a deeper understanding of a phenomenon can be reached with case studies (Rice, 2010). However, a problem with case studies is that results are difficult to generalise: different cases are rarely the same, and the same goes for their context (Yin, 2012). Therefore, findings in the case study are difficult to generalise to other situations. Theory offers help with this generalisation (Yin, 2012). A conceptual model was constructed separately from the case, and then compared to the findings of the case. Because it is constructed separately, the identified factors of this model can also be applied to other cases.

3.2 Case selection

In the selection of cases, the aim was to find ports where the motivations are relatively high and barriers are relatively low. In this situation, ports are more willing to reduce emissions from cruise ships, and as such the case will provide data for both motivations and barriers, as opposed to cases where the impact of cruise ships are seen as exclusively positive. Because of this, only cases in the North Sea area were examined in this study. Here, tourism is a less vital source of revenue compared to the Mediterranean and Caribbean seas. As a

result of this, in cases in the North Sea area the problem of air pollution caused by cruise ships still persists, despite a weaker influence of the positive externalities. This makes the issue more closely contested, and offers more insight into the other identified potential barriers, such as legislation, costs and authority, as ports in this area are more likely to be willing to address this problem, but are still not achieving this goal. Within these parameters, Amsterdam and Bergen were initially selected because of the volume of yearly cruise ships, and availability of contact information of relevant parties, which were then contacted. However, only responses from actors in Amsterdam resulted in interviews, leading to the decision to focus on the case of Amsterdam. Using a single case is also useful for providing the necessary depth that the subject requires, as there is limited existing research, and cruising can be considered as a niche.

Amsterdam is a common tourist destination, making it attractive for cruise ships. Furthermore, within the city, cruise ships are a relatively common type of ship, especially compared to a port such as Rotterdam. Sea cruise ships berth in the city centre at PTA, providing two berths for ships of up to 340 metres (Amsterdam Cruise Port, 2021). The PTA does not provide shore power for ocean going cruise ships, but it does offer other amenities such as waste disposal. It has a sustainability policy, but this is primarily concerned with climate and the terminal itself, not the ships that berth there (Passenger terminal Amsterdam, 2021). Within Amsterdam, the port of Amsterdam is primarily concerned with shipping in the city and neighbouring municipalities, and is a company of which all shares are held by the municipality.

3.3 Data collection

Three kinds of data were collected to answer the research questions. First, relevant scientific literature was analysed in order to construct a conceptual model. Then, policy documents were analysed to assess the policy ambitions of Amsterdam, and finally, qualitative data was collected by conducting interviews where the constructed theory was applied to the real world.

Scientific literature

Scientific literature from several fields that are related to cruising and air pollution was collected to identify relevant theories that may determine the current situation, as well as its context. This was done by identifying possible explanations for the current situation, and then collecting literature on the subject. For example, a possible explanation for the current situation is that the port is not allowed to refuse entry for cruise ships, and as such, the legal context was examined, leading to the finding that ports can in fact refuse entry to ships. These possible explanations resulted in a conceptual model where these factors were related to each other, showing how they together can lead to intervention in the subject of air pollution caused by cruise ships.

Policy documents

To identify the formal objectives that relevant parties have, policy documents published by these parties was examined to review the current ambitions of the municipality of Amsterdam on the subject of air pollution and tourism, as well as the objectives of cruising companies. This provides an overview of the interventions that are currently being made to resolve the spatial conflict, as well as the ambitions related to the subject of this study. The municipality, the port authority, and cruising companies all publish documentation on their objectives, and from these documents, it was examined what was being done and what will be done on to reduce the air pollution of cruise ships.

Interviews

To collect primary qualitative data, semi-structured interviews were conducted with several respondents, who are representative of actors that have the capacity to make possible interventions. An overview of these actors can be seen in table 4. To find these, relevant organisations were contacted. These are port authorities, the cruising industry, the municipality, and citizen representatives. Interviews were scheduled when possible. Interviews were also scheduled based on recommendations of respondents. An overview of the respondents can be seen in table 4. On request of the respondent, the intended questions were submitted before the interview. Primarily as a result of Covid-19 restrictions, Interviews were held in video calls on the platform of choice of the respondent, and recorded with permission and confidentiality. To confirm this, respondents signed informed consent forms, which is attached in appendix II. In these forms, respondents also consented to the use of their names. The interviews were recorded with the permission of the respondent, and transcribed afterwards. Transcripts are attached in appendix III. Participants were sent the transcript of the interview and given the opportunity to change their answers. This is to verify the answers given, and to ensure that the respondents' views on the subject are not misrepresented.

Questions were asked related to the expertise of the respondent, and as a result did not directly correlate to the conceptual model. This is to prevent leading questions. Instead, questions were aimed at the broader goal of identifying motivations and barriers, regardless of their relevance to the conceptual model. The rest of the conceptual model is used to analyse the interviews. In cases when the respondent requested the questions to be sent beforehand, the questions were formally written down. Otherwise, subjects were simply noted down as a guide for the interviewer. These can be seen in appendix IV. The broad questions mean that interviews were semi-structured, which allows the participants to explore issues they feel are important (Longhurst, 2010). This can lead to answers that are unaccounted for by the conceptual model, which means that incorrect and missing parts of the conceptual model can be identified from the interviews, and included in the analysis. The expert status of respondents comes from their firsthand involvement in decision making on subjects related to cruising, shipping, air pollution and tourism. They are also representative of the port and the cruise industry, which are the two main parties that hold responsibility on the subject, and represent most involved parties. As a result of the expert role of respondents, only a limited number interviews were necessary to provide sufficient data, considering the aim was to identify the perspectives of involved stakeholders. To this end, each interview had the goal of identifying the motivations and barriers of different perspectives from the most important actors, which could be gathered directly from interviews.

Table 4, interview overview

Interview	Role	Goal	Date
Sibrand Hassing	Cruising industry- Holland America Group, Carnival Corporation & plc. Director of Fleet Operations HA Group.	Perspective of cruising industry	8-1-2021
Henri van der Weide	Port of Amsterdam, clean shipping programme	Practical implementation of measures	3-12-2020
Zeeger Ernsting	Amsterdam, legislative branch (Municipal council). Transportation and tourism.	Municipality, representative of inhabitants, tourism perspective	11-12-2020
Victor Everhardt	Amsterdam, executive branch (Alderman). Economy and seaport.	Municipality, economic perspective	18-2-2021

3.4 Operationalising the conceptual model

In order to apply the conceptual model to the qualitative data, the interviews need to be interpreted. Interpreting qualitative data can be done through coding (Cope, 2010), which is also done in this study. For this purpose, codes were made based on the conceptual model in order to analyse the transcripts of the conducted interviews, and to identify patterns. Interviews were coded in two steps. First, interviews were coded into motivations and barriers, describing why the actor might want to reduce emissions, and what is keeping them from doing so. The motivations and barriers were then coded into the different considerations identified in the conceptual model, namely externalities, legislation, costs, benefits, as well as *other*, to account for answers outside of the conceptual model. A code was also made for the additional factor of authority, in accordance with the conceptual model. This resulted in a code tree, which can be seen in appendix I. This method of predetermined and systematic coding is known as *selective coding* (Cope, 2010). The factors of authority and externalities were omitted for the cruising sector, as companies have full authority over their fleet, and the study examines the externalities that have impact in the port, not the ship. Every concept of the conceptual model can be interpreted as both a barrier and a motivation, as they can both contribute and detract from intervention against air pollution by being present or absent. Some of these concepts are related, such as costs, benefits and externalities. Additionally, benefits are coded as both motivations and barriers. To solve this problem, the identified motivations and barriers are formulated as arguments below, to consistently separate these related concepts in the transcribed interviews. These arguments are listed in tables 5 and 6.

Table 5, motivation codes as arguments

Code	Argument
Externalities	Desire to internalise externalities/ reasons why externalities from cruising should be addressed
Legislation	The law requires that action is taken
Costs	Intervention does not induce significant costs, directly or indirectly
Benefits	Intervention offers benefits, directly or indirectly
Authority	There is sufficient authority to intervene.
Other	Motivations not represented in the conceptual model

Table 6, barrier codes as arguments

Code	Argument
Externalities	No need to internalise externalities/ Reasons why externalities should not be reduced
Legislation	Current situation is legal/ laws prevent action
Costs	Intervention induces significant costs (space, time, money etc.)
Benefits	Intervention does not provide benefits
Authority	There is insufficient authority to intervene
Other	Barriers not represented in the conceptual model

These codes in turn show which actor is concerned with which types of arguments, and which arguments are dominant within barriers and motivations. It also serves as a method to verify the conceptual model. The codes are also counted, which provides an overview of the most common argument for each participant. This quantitative element is intended to summarise the findings, not as an analysis tool. In accordance with this, arguments are not valued: there is no distinction made between stronger and weaker arguments, as this requires interpretation that is difficult to substantiate.

4. Results

First, policy documents on air quality, shipping and tourism published by the municipality of Amsterdam and the port of Amsterdam are analysed, to show current policy objectives related to shipping, air pollution and tourism. The full results of the coding of interviews are shown in tables in appendix I. These outcomes are then analysed and explained in more detail, and substantiated with quotations in this chapter. The findings are compared to the explanations of the theoretical framework in the synthesis, to find similarities and differences between the motivations and barriers in Amsterdam to those in the theory.

4.1 Policy review

There are different organisations in Amsterdam that deal with cruise shipping, air pollution and tourism. The most important of these are the port authority and the municipality, and cruising companies themselves. Each have policies containing objectives on these topics, which are analysed here.

Air quality objectives

The municipality of Amsterdam has the ambition to increase air quality, which is recorded in *actieplan schone lucht*, or action plan clean air. In this plan, the aim is to clean up emissions at the source, and in the end conform to the WHO norms of annual average air quality. This is achieved through influencing sources of pollution through communicating, stimulating, facilitating, and regulating (Gemeente Amsterdam, 2019b). Considering Amsterdam has no specific rules for cruise ships in addition to MARPOL annex VI standards, regulating does not happen currently. Additionally, facilitating would encompass constructing shore power, which also is not in place.

International cruising is also mentioned in this plan, but only in the context that shore power is not seen as a viable option for this sector, in contrast to river cruises. This is in line with the aim to limit the plan to sources of air pollution that the municipality can directly influence (Gemeente Amsterdam, 2019b). As a result, the plan mainly targets road traffic, as one of the main polluters and being within the municipality's influence.

Clean shipping

The port of Amsterdam also aims to take measures against different kinds of pollution caused by the shipping sector, including air pollution, which was largely excluded from the municipal plan. These intended measures are documented in *visie schone scheepvaart*, or clean shipping vision. This plan aims to halve the emissions of seafaring cruise ships at berth by 2030. The first steps towards this goal are made through monitoring, and exploring LNG and shore power (Port of Amsterdam, 2017). This plan also states the limited influence over the entirety of the problem, and therefore focuses on what is achievable on the limited scale of the port. The plan also provides a solution for this by proposing to cooperate with and learn from other ports worldwide (Port of Amsterdam, 2017).

Tourism objectives

Tourism has become a controversial topic in Amsterdam. In this light, the programme *Stad in balans* (Gemeente Amsterdam, 2019c) was created, which states the following central ambition:

"Het college wil een nieuw evenwicht vinden tussen bezoekers enerzijds en bewoners anderzijds. Een nieuw evenwicht tussen leefbaarheid en gastvrijheid. De bezoeker is welkom, maar de bewoner staat centraal."¹

This programme describes different plans to reduce the nuisance caused by tourism. Cruise shipping is extensively mentioned in this plan, but is not a major part, whereas for example touringcars and boating are (Gemeente Amsterdam, 2019c). The context in which cruise ships are mentioned is in the objective of moving attractions to calmer areas, in this case by potentially moving the PTA. In the programme, the municipality also wants to address environmental sustainability of different kinds of tourism, where cruising is also mentioned. Here, the desire to increase the sustainability of ocean faring cruise ships is expressed, but does not include specific measures (Gemeente Amsterdam, 2019c). In the light of the discussion surrounding tourism in Amsterdam, legislation to reduce tourism was passed in 2018 as the *dagtoeristenbelasting*². This legislation imposes a tax on tourists that visit the city without staying there for the night (Gemeenteraad Amsterdam, 2018). One of the effects of this tax can be seen in the number of cruise ships that arrived after this tax was introduced, which sharply declined in 2018, and has been recovering since (Cruise Market Watch, 2021).

Cruise companies

Cruise lines generally have a dedicated sustainability vision, expressing their responsibility for the environments that the ships visit. The policies of the two largest cruising companies, namely Royal Caribbean Group and Carnival Corporation & plc, together accounting for 70% of yearly cruise passengers will be analysed here. For Royal Caribbean Group, the sustainability vision includes many different facets of sustainability, such as general consumption of goods, waste streams and wildlife conservation. On the subject of air pollution, 60% of Royal Caribbean's fleet has emission purification systems, and steps towards LNG powered ships are made (Royal Caribbean Group, 2021). For the largest cruising company, Carnival Corporation & plc, 77% of ships are equipped with emission purification systems. Its sustainability goals are not as broad, but focuses more on emissions into the air, also looking into further adoption of LNG power ships, expecting to have eleven LNG powered ships in service by 2025 (Heldewier, 2019). Both sustainability policies specifically mention that they are guided by UN sustainable development goals.

4.2 Interview results

The results are first summarised by the number of arguments mentioned by the port side of the interviews as a simple overview of the results, formatted in table 7. Afterwards, the results are discussed and substantiated with quotations. The full results are shown in appendix I, where the number of times an argument appears is also shown, with a short description of the arguments that are mentioned. These numbers provide a basic indication of the dominant barriers and motivations when it comes to reducing the air pollution of cruise ships. Table 7 summarises the number of arguments mentioned by the port side of the interviews as a simple overview of the results, after which the results are discussed and substantiated with quotations. Considering the difference in incentives for cruise companies, the results are not included in table 7. Rather, they can be seen separately in appendix I.

¹ The college wants to find a new balance between visitors on one side, and inhabitants on the other. A new balance between liveability and hospitality. The visitor is welcome, but the inhabitant is central.

² Day trip tourist tax

Table 7, Summary of port side

	Motivations	Barriers
Externalities	6	7
Legislation	0	2
Costs	3	6
Benefits	1	4
Authority	2	3

4.2.1 Externalities

Externalities are the main topic of discussion for the port side. Some see the external costs as minimal, while there are also common arguments why the supposed external benefits are negative. The impact cruising has on both air pollution and tourism in Amsterdam is open for discussion, and for tourism there even is discussion on whether this externality is positive in the first place. This discussion is also reflected in the division between positive and negative arguments, where the concepts of tourism and air pollution can be seen as both barriers and motivations: tourism is a problem but also a benefit, and air pollution is a problem but the impact is not significant. The fact that the same concept can be considered both positive and negative points towards a debate.

Amsterdam executive representative:

"De cruise is meer een discussie geweest van toerisme, waar willen we als stad naartoe? Wordt het niet te druk? En dan ook een grote boot, dus dan ook qua beeld heel erg zichtbaar. En ten tweede, je hebt ook cruiseschepen die ook nog een keer met hun uitlaat best wel vieze dingen de lucht in sputten. Dat is meer de discussie dan de opbrengsten, want daar zit het hem niet in."³

Additionally, externalities are the main reason to intervene for the port side. This is not surprising, as the costs of cruising are all external. Reducing the air pollution of cruise ships offers no additional benefits to the port city, other than providing a *licence to operate* for the port authority.

4.2.2 Legislation

Legislation is primarily a motivation for the cruising industry, both from the port state and the flag state, whereas other respondents did not see this as such.

Cruising representative:

"Wat wij als beleid hebben is dat wij zo veel mogelijk in lijn proberen te blijven met de laatste wetgeving."⁴

However, on the port side, legislation forms somewhat of a barrier, in that it limits the available tools to deal with the issue: It was expressed that ideally, the municipality would like to differentiate between ships that enter the port, but international law prevents them from doing so. The port authority and cruise sector representatives also mentioned that current

³ Cruising has been more of a discussion of tourism, which direction do we want to go as a city? Is it becoming too crowded? And also a large boat, so it is also quite visible as an image. And second, there are also cruise ships that blow quite dirty stuff into the air with their exhausts. That is more of a discussion than the benefits, because that's not the point.

⁴ What we have as a policy is that we try to stay in line with the most recent legislation as much as possible

initiatives are extralegal. This means that legislation on the subject is behind the curve, as it does not drive current initiatives to reduce air pollution.

4.2.3 Costs

All interventions require an investment, which introduces some form of hesitance in respondents. Therefore, the costs of an intervention are commonly cited as a barrier in reducing exhaust emissions of cruise ships.

For the cruise sector, some interventions are already cost effective, and therefore are already implemented, namely speed reductions and shore power adaptation that is required from the ship side. However, the other interventions that were mentioned, mainly shore power and LNG, had additional costs associated with them for one or both sides of the equation. While shore power, and the required retrofitting is cost effective for cruise ships, this is not the case for the port.

Cruising representative:

*"Wij zijn in ieder geval als Carnival en dan ook HAL in staat om dat soort investeringen uit eigen zak te betalen. Daar zit natuurlijk een business case aan vast, er wordt gekeken van wat is de terugverdientijd, je ziet eigenlijk dat bijvoorbeeld het aanleggen van een walstroominstallatie zichzelf vrij snel terugverdient."*⁵

This investment is also subject to budget constraints of the municipality, where the required money is not available. Therefore the investment would have to come from the port authority, who are already constrained by the dividend requirements, with an investment that is not cost effective for the port side. This barrier is not only relevant to the port authority, but also to the municipality, as a lower dividend pay means a hit to the municipal budget.

Amsterdam executive representative

*"Op dit moment is het een havenbedrijf, maar daar zijn wij 100% eigenaar van. Dus als zij flink moeten investeren zouden ze bijvoorbeeld minder dividend kunnen afdragen, krijgen wij minder in de gemeentebegroting, kunnen wij minder aan armoedebeleid doen. Dat is het complexe systeem waar je daar in zit."*⁶

4.2.4 Benefits

While there are some benefits especially for the private parties, namely the port of Amsterdam and the cruising industry, benefits seem limited for the public ones. The common benefit that was mentioned by both the cruising industry and the port of Amsterdam was a *license to operate*, meaning that a reduction of emissions leads to better public opinion on cruising activity, providing a public support base for their operations.

Port of Amsterdam representative:

*"Je wil laten zien als een haven dat je daar [draagvlak] wel aan werkt, en dat je zorgt voor een veilige en schone leefomgeving. Dus vandaar je license to operate, en een stapje verder nog, een license to grow."*⁷

⁵ As Carnival as well as HAL (Holland America Line), we are able to pay these kinds of investments by ourselves. Of course there is a business case connected to that, we look at when it pays itself back, you can see that for example constructing a shore power installation pays itself back quite quickly.

⁶ At the moment it is a port authority, but we own 100% of that. So if they have to invest a large sum, they would for example be able to pay less dividend, we lose out in the municipal budget, and we can do less poverty policy. That is the complex system that you are a part of.

⁷ You want to show that you work on that [a support base] as a port, and that you take care of a clean and healthy living environment. Hence your licence to operate, and one step further, a licence to grow.

For the public parties however, benefits were not mentioned specifically. For example, the reduction of damages (such as in the calculation in chapter 2) were not cited as a motivation. Instead, it was a broader responsibility for the environment as a whole. Within this context, respondents saw merit in the reduction of pollution from cruise ships specifically, but stated that it only provides a small contribution. Furthermore, the port is disincentivised to take strict measures by the requirement of the municipality to pay out dividends every year, due to the municipality's ownership of the port. This results from a potential decrease of port dues from cruise ships as a result of stricter regulations that cruise ships can not or will not comply with, or losing income from pricing mechanisms.

4.2.5 Authority

Authority over the problem was cited remarkably little as a barrier. It is possible that this is treated as the context in which a solution has to be found given the limited influence over it. However, it also was a motivation. There are indirect methods that can influence the cruise sector to change, which are pricing mechanisms. Especially for the port side, the mechanism that is cited is to offer discounts on port dues to cleaner ships.

Amsterdam executive representative:

*"Wat de kern uiteindelijk is, is dat je uiteindelijk heel schone boten zou moeten gaan krijgen. Uiteindelijk is dat het eindplaatte waar je naartoe zou moeten. En daar kan je een kleine bijdrage aan leveren als stad, dat moet je niet nalaten."*⁸

The authority that the port has over cruising is in this case not seen as the authority to impose stricter emission standards, but rather indirect methods to incentivise cruise companies to adopt cleaner technologies.

4.2.6 Other

According to respondents, one solution to the problem is found in the adoption of new technologies such as shore power and LNG, but there are several new technological standards that can emerge as dominant. In any case, they require investments from both the port and cruising companies, and the uncertainty over the new standard makes these investments risky. This uncertainty raises an additional barrier to reducing emissions in the form of investment risk.

Interviews also show that ambitions to reduce CO₂ emissions, while not directly relevant for local air quality, do contribute to ambitions to reduce the emission of air pollution: Representatives of the cruising industry, the municipality of Amsterdam and the port of Amsterdam all stated that wider sustainability goals were a reason to pursue reductions in air pollution for cruising.

Port authority representative:

*"Het lijkt zo eenvoudig, zorgen dat als een schip klaar is om bijvoorbeeld op methanol te varen, of op LNG, of ammonia of waterstof, noem maar op, dan is dat schip wel klaar, maar als haven moet je ook klaar zijn. Want je moet zorgen dat de infrastructuur er is, en je moet zorgen dat de regelgeving er is dat dat veilig kan gebeuren."*⁹

Another issue that was raised is the problem of policy fields, which is separate from the legislation and authority codes. This study concerns both tourism and air quality, which are

⁸ At the core, you should eventually have to get very clean boats. That is the final picture where you would have to go to as a city. And you can make a small contribution to that as a city, you should not neglect that.

⁹ It seems so simple, making sure that a ship is ready to sail on methanol for example, or LNG, ammonia, hydrogen, you name it. Then the ship is ready, but as a port you need to be ready too. Because you need to make sure that the infrastructure is there, and you have to make sure that there is legislation so it can take place safely.

different fields of policy. In both of these fields, cruising plays a minor role, to the point where intervention is not top priority, reinforcing the niche status of cruising.

Amsterdam legislative representative:

*"Als het puur gaat om luchtkwaliteitsbeleid, staat de effectiviteit denk ik voorop, en waarmee je de grootste impact kan maken. En dat is vooral het rijdende verkeer."*¹⁰

Despite the niche status, many respondents stated that one of the motivations was the visibility of the problem, where large ships visibly cause emissions. This raises concerns with the public, which in turn results in motivations for intervention by relevant actors through for example a *license to operate*.

4.3 Synthesis

The findings from interviews can be combined with the relevant theory of chapter 2 and the policy review, to substantiate the results of the different research methods, and to identify where the findings of methods differ. This is done through the concepts that occur in both chapters 2 and 4, namely those from the conceptual model that are used as codes for the interviews. Within these concepts, both the motivations and barriers are discussed.

Externalities

Externalities are found to be quite complex, where intervention is more the outcome of a discussion about their positive and negative impacts than a rigid outcome of a cost benefit analysis. With air pollution, this is in line with Bickerstaff & Walker (2003), who state that air pollution is more of a matter of perception than objective truth. The type of discussion that is produced by the subjective nature of the topic exists for the tourism side as well, where results show that there are different perspectives on its positive and negative impacts. As a result of this, the conclusions of Bickerstaff & Walker (2003) that air pollution is a matter of subjectivity may extend to more externalities, positive and negative, and not just air pollution. This focus on discussion also means that the monetary cost estimations of externalities such as the one developed by CE Delft (2017), that aim to provide objective costs, do not play a leading role in such a subjective topic. However, an alternative explanation for this finding is that the cost-benefit analysis of chapter 2 produced similar costs and benefits. This might be the reason for the discussion that was found to be a part of the subject, where the lack of clear dominance of costs or benefits leaves room for discussion, when this might not be the case when externalities more conclusively lead to positive or negative outcomes.

Legislation

Like in the theoretical framework, international laws and regulations are not much of a barrier for the port side. The port is allowed to make stricter regulations if they so desire, and is allowed to refuse entry to ships that do not comply. However, the IMO laws do set the current standards of international shipping, which results in air pollution in ports caused by cruise ships. While legislation adds few barriers, it also provides little motivation. This can be attributed to a lack of central guidance that provides stricter standards to hold the local governments accountable, as Zuidema (2016) states as a requirement for effective environmental governance on the local level. On the other hand though, contrary to Zuidema's (2016) conclusions that local governments are often limited in willingness to address environmental pollution, the municipality does clearly state that they would like to reduce air pollution from cruise ships in interviews, but are constrained by other factors such as the lack of influence over the cruising industry. These ambitions are also expressed in policy documents, such as for example the commitment of reaching WHO air quality norms (Gemeente Amsterdam, 2019b).

¹⁰ If it is purely about air quality policy, I think effectiveness goes first, and how you can make the biggest impact. And that is mainly road traffic.

Costs

In accordance with Vaishnav's (2016) conclusions, interview results suggest retrofitting a cruise ship for shore power is cost effective, and therefore will also be used. One finding related to costs that does not appear in the theoretical framework is the leading role costs play in barriers, while it is the main barrier in the results. The theoretical framework made clear that investments had to be made, especially on the side of the port. However, the money that is required for such a specific and especially uncertain investment is not readily available for the involved actors.

Benefits

A potential intervention that also did not emerge from the theoretical framework is the availability of subsidies. While this does not appear yet in practice, it was mentioned as a potential source for the required budget. As Zuidema (2016) concludes, local governments have little to gain from stricter environmental regulations, which can also be seen in the results of the interviews. Despite these low gains however, local governments still have ambitions to reduce air pollution in Amsterdam, as stated both in interviews and policy. Further incentive may be provided by public opinion, which was distinctly stated by both the port authority and the cruise industry representatives as a *licence to operate*. However, this specific motivation is not explicitly stated in policy.

Authority

Another problem for local governments other than the limited gains is the barrier of authority. While the willingness to reduce air pollution was expressed, ways of achieving this were limited: representatives concluded that a change in the cruise industry was needed, and the port could only encourage such a change indirectly as the port has no direct authority over the cruising industry. This strategy is also included in *actieplan schone lucht*, through stimulating. The coordination problem of multi-level governance (Hooghe & Marks, 2003) however was not mentioned in either interviews or policy. This is likely because cooperation with other ports and with cruising companies is on a very limited scale, where such a coordination problem would not yet emerge.

Other

The additional findings offer a new case for multi-level governance as described by Hooghe & Marks (2003), for the purpose of coordinating interventions. A solution to the problem is found in a new standard, but there are several new standards that can emerge. In any case, they require investments from both parties, and the uncertainty over the new standard makes these investments risky. Coordination on this subject through multi-level governance may take away this uncertainty, and increase the motivations of actors to make the required investments. Both the interviews and policy review show that the involvement of other ports is seen as part of a solution, where *actieplan schone lucht* names this as communicating, and *visie schone scheepvaart* proposes learning from other ports. Additionally, the finding that CO₂ objectives help in reduction of pollution can be found in Gilbert et al. (2018). Another new insight provided by interviews is the influence of public opinion, which in the case of Amsterdam is a guiding factor for both the cruising industry and the local government. In this way, public opinion functions as an additional motivation for lower emissions. The negative public opinion on tourism is also reflected in the policy of Amsterdam, such as in the *dagtoeristenbelasting*.

The findings of the synthesis can be summarised to a few lessons that describe the most important factors that lead to barriers and motivations.

- In situations where externalities are more strongly positive, intervention might be less likely as the port side seems to be primarily motivated by internalising externalities. When this equation is positive, the port loses economic benefits by internalising these externalities.
- The fact that cruises are a niche in combination with the costs of emission reductions appears to be a bigger barrier than the benefits that cruising offers to a port.
- Motivations are tied to public opinion: Visibility, license to operate, and broader sustainability goals were all commonly named as motivations.
- More attention to financing, for example through government subsidies can play both a role for the port and ship for the cost barrier. However, this might require coordination between different port states and different flag states.
- Amsterdam shows strong willingness to increase air quality in the city, but for cruises the willingness to act is more limited.

5. Conclusions and discussion

The spatial conflict that is caused by cruise ships in Amsterdam can be characterised by different factors, through what motivates relevant actors, and what barriers they face in achieving a reduction in air pollution from cruise ships. Interventions to reduce air pollution from cruise ships remains limited, and possible reasons for this were identified in this study. These are covered by answering the following research question:

What are the factors that contribute to the current situation of air pollution caused by cruise ships in the case of Amsterdam, and what influences intervention?

This research question was answered with the help of different factors taken from relevant literature, which resulted in a conceptual framework, as constructed in chapter 2.5. This conceptual model aims to identify the motivations and barriers of relevant parties in the context of resolving the spatial conflict that is caused by cruise ships in ports.

5.1 Contributing factors

To answer the research question, contextual factors have been identified to determine the circumstances under which the current situation persists, and likewise, the circumstances that determine the viability of possible interventions. These were explored by first characterising the issue through its costs and benefits to the port, and then through setting the legal and technical boundaries of a possible intervention. These answer the secondary research questions intended to explore the context of the situation. The context determines the boundaries that define the current situation, and are the result of analyses of conducted interviews and literature study. Interviews were conducted with representatives of the port authority, the municipality of Amsterdam, and Holland America line. Within the context, factors that determine the current situation of air pollution caused by cruise ships, specifically in the case of Amsterdam have been identified to answer the main research question.

Costs and benefits of cruising

From both the analysis of interviews and literature study, air pollution is identified as the primary cause of costs that cruising causes to a city. This air pollution consists of NO_x, PM_{2.5}, SO_x and CO (Jalkanen et al., 2012), resulting in damage to its environment, as well as negative health impacts to the local population. Cruise ships also emit a significant amount of CO₂, but the impact this has on the local level is negligible. The majority of pollution is emitted at berth (Dragović et al., 2018), the period where the ship is in port, and uses auxiliary engines to generate electricity for the on-board amenities. Empiric findings show that these costs are considered to be limited, but the benefits of cruising are even more limited. The tourism that cruising yields is seen as both positive and negative by the population, meaning that the only clear and undisputed benefit that is provided consists of the port dues that ships have to pay to the port authority.

Legal context

The legal context was primarily examined through literature study, with the following findings. Emission norms for cruise ships are primarily decided through international treaty, specifically MARPOL annex VI. International treaties are agreements between two or more countries, meaning that these standards are not imposed by a global central authority. As a result, these standards apply to all seafaring vessels registered to countries that have ratified the treaty, and to vessels visiting the countries that ratified it. The MARPOL annex VI standards are subject to compromises caused by the importance of international cargo shipping to the global economy (Kopela, 2017), as well as the difficulties of complying with stricter regulations (Animah et al., 2018). Complying with stricter regulations means that some investments need to be made, which many smaller shipping companies cannot afford.

Additionally, these stricter regulations would increase the cost of global shipping, which has undesirable consequences for the world economy.

The port does have the ability to decide its own regulations, but on the condition that these are enforced equally. However, there is an important barrier in doing so, namely the lack of authority local governments have over international cruise ships, which was also found from interview results. Cruise ships primarily have to adhere to global pollution laws of MARPOL annex VI, which are created for shipping in general, and determine the international norms of the technologies that are used on board of ships. This makes cruising a niche in international law, where it has the obligation to adhere to the relatively relaxed norms for shipping, while not providing the merit to warrant these norms, at least in the case of Amsterdam. Because of the difficulties of introducing stricter standards on a local level, the international rules and regulations are used so that cruise ships are able to comply. As a result, the current situation is legal, and potential interventions are all extralegal.

Potential interventions

Despite the limited legal constraints on a local government to adopt stricter rules for cruise ships, results from interview and policy analysis show that the ability to decide regulations does not lead to the actual application of stricter regulations in ports, mainly because ships are not able to comply with them. Complying with stricter regulations often requires different technologies, and the investments that need to be made for this produce its own problems. The main technical interventions are aimed at reducing engine load by offering shore power to cruise ships (Gibbs et al., 2014), and changing propulsion and power generating systems to be able to use alternative fuels such as LNG and liquid hydrogen to limit emissions (Gilbert et al., 2018). These methods of reducing air pollution caused by cruise ships in ports require an investment from either the port or the cruise ship that is not considered to be cost effective. As a result of this, the investments that help to substantially reduce air pollution are not made. Additional to the cost of the different interventions, results show that this investment is also characterised by uncertainty, because the port and the cruising companies are dependent on each other for successfully implementing emission reduction measures. There are several potential interventions that can reduce air pollution, which require different investments from both the port and the ship. Shore power is especially expensive for the port, and alternative fuels are especially expensive for the ship. Additionally, the cruising company relies on multiple ports, not just Amsterdam, to offer the required infrastructure that is needed to use alternative fuels. As a result of this, when a port decides to invest in infrastructure that can help to reduce air pollution, the ships need to make specific investments to utilise the new infrastructure. Likewise, when a cruise company decides to invest, the ports the ship attends all need to provide the required infrastructure for this investment to be effective. This means that in reducing the emissions of cruise ships, the necessary investments are dependent on external parties for them to be effective, making them riskier.

Motivations and barriers

Using the contributing factors, barriers and motivations for intervention were determined for relevant actors in the case of Amsterdam. This leads to an explanation of the current situation based on the decisions made by actors with influence over such an intervention.

The external costs of air pollution, and to a degree of tourism, are seen by the municipality of Amsterdam as undesirable consequences of cruise ships, and therefore it motivates the municipality to reduce these effects. These external costs are subject to public debate, as they are also connected to benefits that are offered by cruise ships, namely the positive aspects that tourism provides.

Public opinion is an important motivation for both the port side as the cruising side. For the cruising side, a positive public opinion results in a license to operate, meaning that taking

social responsibility for its external effects provides support for its operations. On the port side, this public opinion results in a motivation through wider sustainability goals. Sustainability is an important part of the current political agenda, of which cruise ship emissions are a part. If the local government desires to take more responsibility for the environment, taking steps to reduce cruise ship emissions will also be a part of this. Both of these are determined by public discourse, which according to Bickerstaff & Walker (2003) can be a motivation for addressing air pollution, rather than the specific damages it causes. Considering the findings of this study that other externalities, specifically tourism, are also part of a similar public discourse suggests that the role of public discourse is not only an important factor in the case of air pollution, but externalities as a whole.

The most important barrier that was identified was the cost of the potential interventions. Any intervention that can reduce air pollution is associated with some kind of cost, which always produces barriers of some kind. A port does not have the influence to enforce these investments on its own through legislation. Cooperation with other ports offers a potential solution for this, where the diffusion of authority can function as a surrogate for centralised authority that can influence worldwide standards, as a type of multi-level governance as described by Hooghe & Marks (2003). However, to influence international standards, a large number of participants is required, which leads to inefficiencies. In interviews, it was found that initiatives that can be categorised as multi-level governance are being looked at, but on a limited scale, to the point that it will not be able to influence international standards.

Where external costs were identified as the main motivation to reduce the air pollution of cruise ships, external benefits form a barrier. In Amsterdam, the external benefits of cruising consists of tourism exclusively. While external benefits of cruise tourism were found to be limited, they still do play a role in the discussion surrounding the externalities of cruise ships, and the discussion surrounding cruise ships in general. The direct benefits of cruise ships play a bigger role. The port authority needs to pay dividends to the municipality of Amsterdam, and for this is partially reliant on harbour fees paid by cruise ships.

A conclusion that can be drawn from the motivations and barriers is a difference in nature between the two. Where motivations are subjected to subjectivity, specifically the damages of air pollution and the impacts of tourism, barriers are much more rigid. Investing into interventions such as shore power and LNG retrofitting have fixed costs attached to them, and the effectiveness of these investments is subject to uncertainty, making them riskier.

5.2 Generalisation

The interviews that were conducted and analysed, in combination with the literature review and policy analysis, resulted in relevant factors that contribute to the current air pollution caused by cruise ships. Within these factors, barriers and motivations were identified that are specific to Amsterdam. However, outside of the valuation of these motivations and barriers, they can also be generalised. In other ports, the costs and benefits of cruising may be different, there might be more or fewer budgetary constraints, and public opinion may be different. This means that the identified factors still exist, but they are valued differently, which may lead to different outcomes, but through the same process and the same factors. The situation in other ports may still be described through barriers and motivations that lead to intervention or a lack thereof, and as such, The different valuation of identified considerations to those in the case of Amsterdam explains different outcomes in other. Additionally, the legal context and the potential interventions are the same everywhere. Especially the role of authority is expected to be similar in ports across the world, as in each case there is the situation that ports are attempting to deal with a problem originating from a global scale, but is concentrated in a local environment. Other types of planning issues with

these characteristics can potentially be explained with the same relevant factors that were identified in this study, although the context of these can be expected to be different. Amsterdam does however receive a significant number of cruise ships each year (Cruise Market Watch. 2021), which does make it representative for other major European cruise ports in terms of capacity.

The findings on the cruising side are more difficult to generalise. On one hand, they are representative of Carnival Corporation & plc, which controls the majority of the cruising market: 47,7% of all cruising passengers travel with Carnival or its subsidiaries. On the other hand, the considerations of such a large corporation may be very different from smaller cruising corporations. However, there are other cruising companies that are not a part of Carnival Corporation & plc that are constructing LNG cruise ships, namely Disney Cruise Line, MSC cruises, and Royal Caribbean group (Kosciolek, 2020). This indicates that these companies have incentive to construct LNG propelled vessels, similar to Carnival.

5.3 Relevance to planning

Calling back to the spatial planning definition as a *science of purposeful intervention* (De Roo & Voogd, 2018), this study explains a situation where the intervention is frustrated by multiple factors, specifically those that are indicated as barriers. Other than usual environmental planning issues, the air pollution caused by cruise ships is in its essence not rooted in its environment: cruise ships move around from location to location, meaning that it becomes a local issue with international causes. However, contrary to different international pollution issues such as transboundary air pollution, the local governments do have a degree of control over the air pollution that is emitted by cruise ships. It also describes a situation of a niche, where a lack of attention to the specific subject means that interventions are limited, as portrayed by the role of public opinion identified in the results. The role public opinion plays in air pollution, as well as perhaps externalities as a whole, further establishes the role subjectivity can play as described by Bickerstaff & Walker (2003). This study also expands on the issues of decentralised environmental planning as stated by Zuidema (2016), as the main body that has responsibility for a potential intervention is the local government. Where Zuidema (2016) calls for central guidance as a solution to the lack of authority of local governments, this study describes a situation where this central guidance is not an option, simply because centralised organisations that have global authority do not exist. As the results show, in such a situation the most likely reason for intervention is to increase the willingness of local authorities to undertake action, where constraints of ability cannot be changed. Results and suggested interventions of this study can be applied to other port cities that deal with the spatial conflict that is caused by the externalities of cruising, as well as other situations with similar characteristics such as cargo shipping. For dealing with cargo shipping, local governments have the same constraints in legislation and authority caused by IMO rules. Results of this study can also be applied for other niche situations where laws are too generic, and a potential intervention is extralegal. The combination of a niche problem that manifests on a local scale level, while the cause lies on a global scale level is unique for the case of cruising. With this exploratory study, the subject has been examined from a planning perspective, offering an initial explanation of the current situation, through barriers and motivations that contribute to it.

5.4 Discussion and reflection

Initially, the research question, and by extension the conceptual model was intended to only uncover barriers and not motivations. The research question was broadened to *factors* and motivations were added to the conceptual model after the interviews, where it became clear that more was being done than initially thought, and respondents were inclined to express a

more positive perspective on the situation. Similarly, the potential intervention of refusing entry to the port in the first place was not explored fully, as respondents did not indicate this as a viable intervention, even if it is technically possible. While the study provided an estimation of damages caused by air pollution of cruise ships in Amsterdam, the step between emissions and background concentration is not made. As a result, it does not provide an overview of where this damage is done.

The Covid-19 pandemic also poses a threat to the accuracy of the findings of the study, as the tourism sector has especially been hit hard by it. The pandemic might change the stance of the cruise industry because of the economic damage it has done to tourism, and especially the cruising sector, which was forced to cease operations entirely. As a result, cruising companies may be less willing to invest in interventions, as there is less money available.

Likewise, the pandemic might also affect the willingness of ports to intervene, as a window of opportunity. The new perspectives that the pandemic offers were consciously omitted, as it further complicates an already complex situation, where respondents would not be able to answer based on their own expertise. However, the situation may be different after the covid-19 pandemic. Further study is needed to clarify the effect of the pandemic on the cruising industry, and by extension, the findings of this study. Additionally, as there are no studies the findings can be compared to, further study is needed in different contexts to reliably generalise the findings.

5.5 Suggested interventions

Given that this study has produced motivations and barriers that determine whether interventions are made, reducing the air pollution of cruise ships can potentially be achieved through reducing the influence barriers have, and increasing the influence motivations have. In this, the contextual factors that are found are also taken into account. This way, the results of the study can be turned into advice on how the air pollution caused by cruise ships can be reduced.

Measures targeting barriers

With the cost as a primary barrier, measures aimed at reducing barriers would have to find ways to reduce these costs. For example, money can be provided through subsidies for the port by institutions that have more money to spend on environmental issues than the port does, such as national governments. Contrary to subsidies for cruising, it does not lead to market distortion, and the port was found to have most problems with financing the implementation of interventions. An example of recent developments in this area is the announcement of the Dutch government to investigate shore power as a means of nitrogen emission reduction (NOS, 2021).

The risk of these investments can be reduced through cooperation and coordination between different ports and different cruise companies, so parties can have more certainty that the investments they make to reduce air pollution will actually be functional, and therefore will actually increase air quality. This would be a type of multi-level governance as described by Hooghe & Marks (2003). Multi-level-governance can help the relevant parties coordinate, which can reduce the investment risk. Another possible, but more unlikely implementation of multi-level governance would be the create new international emission standards for the cruising industry through diffused authority, similar to international treaties such as MARPOL, but specific to cruising. In this application, the diffuse authority of different ports or countries can help force cruise companies to reduce emissions by creating stricter legislation. This

however has the same limitations of international treaties as discussed in chapter 2, but it does allow port do exercise more authority than they are able to on their own.

Measures targeting motivations

Considering the impact that public opinion has on the decision making, one potential measure to reduce air pollution from cruise ships is to target public opinion. Public opinion motivates both the local governments and cruising companies to take action. Targeting public opinion also influences the public discourse, which can form both motivations for and barriers against intervention as a determining factor for air quality policy, rather than scientific valuation of air quality. As a result, when the outcome of this debate weighs more towards the external costs of cruise ships than it currently does, both the cruise industry and the port will be motivated to do more to reduce air pollution.

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Appendices

Appendix I

Interview results

Motivations			
	Code		Explanation
Cruising	Externalities	x	
	Legislation	2	Staying in line with current and future legislation, areas with stricter regulations
	Costs	3	Speed is not essential, shore power is viable investment, money available for investments.
	Benefits	4	License to operate, fuel saving, incentive programs, competition
	Authority	x	
Amsterdam port	Other	2	Visibility of problem, part of broader sustainability goals
	Externalities	2	Negative effects of tourism, responsibility for clean environment
	Legislation	0	
	Costs	1	Potential government subsidies
	Benefits	1	License to operate
	Authority	0	
Amsterdam legislative	Other	1	Part of broader sustainability goals
	Externalities	2	Tourism, air pollution
	Legislation	0	
	Costs	1	Low contribution to local economy
	Benefits	0	
	Authority	0	
Amsterdam executive	Other	1	Image of cruising
	Externalities	2	Negative effects of tourism, air pollution
	Legislation	0	
	Costs	1	Low contribution to local economy
	Benefits	0	
	Authority	2	Limiting but not decisive, taxes
	Other	3	Part of broader sustainability goals, visibility of problem, exemplary function

Barriers	Code		Explanation
Cruising	Externalities	x	
	Legislation	1	Flag state primarily concerned with complying with legislation, IMO rules guiding
	Costs	1	Retrofitting is expensive or not possible
	Benefits	2	Alternative fuels limit viable ports, uncertainty over long term
	Authority	x	
	Other	3	No loans for emission reduction, subsidies cause market distortion, Difficulty of adapting new technologies for ships
Amsterdam port			
	Externalities	1	Low contribution to tourism problem
	Legislation	1	Extralegality of measures
	Costs	2	Port has to bear majority of costs, public interest of economic value
	Benefits	2	Uncertainty over long term, dividend obligations
	Authority	1	Limited influence on change in cruising industry
	Other	2	No single solution, cooperation required
Amsterdam legislative	Code		
	Externalities	3	Not a major contribution to air pollution, contribution to employment, low contribution to tourism problem
	Legislation	0	
	Costs	2	Large investment, requires space
	Benefits	1	Not enough benefits for air quality compared to other sources
	Authority	1	Limited authority
	Other	1	Location of PTA
Amsterdam executive			
	code		
	Externalities	3	Shipping is part of the city's identity, tourists pay for cultural institutions, employment
	Legislation	1	Equal treatment requirement
	Costs	2	Infrastructure lifespan, investment required
	Benefits	1	Deterring ships moves problem to different place
	Authority	1	Limited influence on change in cruising industry
	Other	1	Supplying fuels

Appendix II, informed consent form (Dutch)

Formulier geïnformeerde toestemming

De ondertekende stemt toe met deelname aan het onderzoek, en de volgende punten zijn duidelijk gemaakt:

- De deelnemer is niet verplicht om antwoord te geven op vragen
- Deelname is geheel vrijwillig. Het interview kan op elk tijdstip worden stopgezet door de deelnemer, en de gegevens die verkregen zijn uit dit onderzoek kunnen door de deelnemer verwijderd worden.
- De deelnemer kan het transcript inzien en antwoorden wijzigen.
- Het interview wordt opgenomen, en de gegevens die hieruit voort komen worden als vertrouwelijke informatie behandeld. Deze informatie zal alleen inzichtelijk zijn voor de deelnemer, de onderzoeker en zijn begeleider.
- Op verzoek van de deelnemer kan het interview ganonimiseerd worden.

Gegevens onderzoeker:

Ruben Wieringa

r.wieringa.2@student.rug.nl

[Phone number]

[Researcher signature]

deelnemer:

Handtekening:

Appendix III, interview transcripts (Dutch)

Interview transcripts are held by the author, and are not publically available.

Appendix IV, interview questions (Dutch)

Henri van der Weide (*researcher notes*)

Wat waren de redenen om het programma te starten?

Welke voordelen levert het programma op voor de haven en de stad?

Welke oplossingen worden gebruikt?

Ook zicht op cruisevaart?

Grip op internationale scheepvaart? Bereidheid tot meewerken

Zie grafiek reikwijdte

Problemen meten?

Economische impact?

Sibrand Hassing (*researcher notes*)

Waarom lagere uitstoot?

bovenwettelijk

Mogelijkheden tot verlaging uitstoot/welke oplossingen?

Houding tov vervuiling van havens tegenover CO2?

Zijn er acties van regeringen of havens die tot verandering leiden?

Verhoudingen met havens?

Bereidheid tot meewerken?

Verschillende initiatieven, wat leidt tot medewerking?

Speelt concurrentie een rol in de ambities op het gebied van uitstoot?

Bereidheid van passagiers om meer te betalen

Problemen met meten?

Vlagstaat

Victor Everhardt

In hoeverre staat internationale cruisevaart op het agenda in Amsterdam?

Hoe staat de gemeente tegenover het toeristische aspect van cruisevaart?

Hoe verhoudt dit zich met het beleid op massatoerisme?

Vormt internationale cruisevaart een significante inkomstenbron voor de gemeente en de lokale economie?

Hoe staat de gemeente tegenover het luchtvervuilende aspect van cruisevaart?

Wordt de vervuiling van specifiek cruisevaart als een probleem gezien?

Zijn er ingrepen die de gemeente Amsterdam doet of kan doen om de internationale cruisevaart verantwoordelijk te houden voor de vervuiling?

Wat zijn ingrepen die de gemeente Amsterdam lokaal doet of kan doen om de luchtvervuiling te verminderen?

Zeeger Ernsting

Hoe staat de gemeente tegenover het toeristische aspect van cruisevaart?

Hoe verhoudt dit zich met het beleid op massatoerisme?

Hoe staat de gemeente tegenover het luchtvervuilende aspect van cruisevaart?

Wat zijn ingrepen die de gemeente Amsterdam doet of kan doen om grip op internationale cruisevaart te krijgen, en zo de luchtvervuiling die hiervan afkomstig is te verminderen?

Wat zijn ingrepen die de gemeente Amsterdam lokaal doet of kan doen om de luchtvervuiling te verminderen?

Welke voordelen heeft de cruisevaart voor de inwoners van Amsterdam?

Zien de inwoners van Amsterdam luchtvervuiling, en specifiek luchtvervuiling van cruiseschepen als probleem?