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Port related transport management and the governance of air pollution:
A comparative study on emission standards between china and Europe and the position of ports

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Abstract

It can be observed that hinterland connections of ports have experienced an unprecedented growth over the last two decades due to the emerging economies in the Asian countries and the related process globalization. At the same time, this development has sincere negative effects on the natural environment, in particular emissions with a regional impact and emission with a global effect, in particular CO_2 emissions. Addressing these issue is becoming more urgent but there are different approached to come to a coherent strategy. Emission standards are a promising tool as they can set specific limits to the amount of pollutants that is emitted into the environment. Therefor standards setting can be considered as an efficient way of direct regulation to realize objectives on the global, national, regional and local level as they do not only set limits (a constraint on behavior), but standards can also function as a positive impetus to stimulate technological development. This paper focus the role of standards from a port and hinterland transport perspective and it describes the various policy initiatives undertaken in China and Europe (who represent the biggest ports in the world) with respect to standard setting in transportation with the aim to improve the air quality in ports and the hinterland connections and the results of these efforts so far. The most striking conclusion is that, despite the sense of urgency, the public concern and the willingness of the government in China to address air pollution, standards are completely lacking. This is in contrast to Europe where clear standards are formulated for vehicle emissions even for the period after 2020.

Keywords: Ports and Port Related Hinterland Transport, Air Pollution, Emission Standards, Comparative Study

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1. Introduction

Transport has many positive characteristics both for the individual user as for society as a whole. This explains why the transport sector, for more then a century now, has experienced an unprecedented growth. We see this pattern in the port development as well, where especially Chinese ports have shown a spectacular growth over the last 2 decades. At the same time, the expansion of port and port-related activities has undesired side effects. The demand for transport leads to congestion and at the same time, besides other aspects, there are other serious concerns related to emissions (at the regional, national and the global level). These concerns are encompassed in the concept of sustainability and the governance towards sustainable ports.

Governments and other stakeholders who work in the domain of port management are generally aware that policy measures are needed to find a balance between accessibility and sustainability. This is an enormous challenge, and the question arises: How can this be materialised?

In this paper the authors make an inventory of the different standards and policy initiatives that are undertaken in China and Europe with respect to air quality in ports and the hinterland connections and the results of these efforts so far.

The structure of the paper is as follows: in Section 2 the need to come to a more sustainable transport sector is described. Special attention is given to the concept of sustainability and the meaning of air pollution. Section 3 deals with the impact of this challenge for port operation and the hinterland connections. In the following Section 4 a comparison is presented between the situation in the Ports of Shanghai and Rotterdam, not only in terms of the specific local situation but also the wider setting in which standard setting takes place. In Section 5 a synthesis of the findings is presented and finally, in Section 6, conclusions are drawn.

2. The demand for Sustainable Transport

The concern for the environmental burden caused by human action has been studied for many years and is reflected in numerous reports and policy documents (see for instance Meadows et al, 1992). The discussion has gained first momentum by the introduction of the concept of sustainable development in the 1980s. One of the first references to the term sustainable development appeared in UNCED's 1980 World Conservation Strategy. Later, in 1987, the World Commission for Environment and Development (WCED, 1987) described the concept of sustainable development more extensively in their report 'Our Common Future' (the Brundtland Report). In this report, sustainable development is defined as: "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It is interpreted by Geerlings at al. (2009) as "a process of change in which the exploitation of resources, the direction of investment, the orientation of technical development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations".

As a result the thinking about sustainable development in relation to technological development also received considerable attention. On the international level, the discussion then received a new impetus from the Rio Summit organized by United Nations Commission for Environment and Development 1992, where the action plan Agenda 21 (United Nations, 1992)

was adopted in which Sustainable Development was chosen as the leading principle for future development.

There is, however, as yet no universally accepted definition of sustainability, sustainable development, or sustainable transport. The Brundtland report interprets sustainable development as a process of change in which the exploitation of resources, the direction of investments, the orientation of technical development, and institutional change are all in harmony, and enhance both current and future potential to meet human needs and aspirations. In the WCED report (1987) on sustainable development, three interrelated systems are identified: the ecological system (the exploitation of resources); the economic system (investments and technological development); and the social-cultural system (institutional change). These systems are interrelated and these interrelations can be expressed as functions. Two of these are the production function and the regeneration function. The three interrelated systems are also presented as the triple-P approach, which refers to the balance between planet (the ecological system), profit (the economic system and people (the socio-cultural system). In policy making this is a very often used terminology.

Sustainable development distinguishes several, sometimes seemingly opposing, goals, which hence make it a very difficult task to find synergy between these different goals. Especially in matters where finding the right balance between ecological and economic aspects is concerned, development in harmony with sustainability will be more difficult to put into operation. It is one of those concepts which “inevitably involve endless disputes about their proper uses on the part of their users”, and “to engage in such disputes is itself to engage in politics” (Lukes, 2002, p. 45). In other words, the concept of sustainable development implies that it is a subjective, dynamic concept with different degrees of freedom.

Sustainability is sometimes defined narrowly. Some studies of sustainability focus on long-term resource depletion and air pollution problems, on the grounds that they represent the greatest risk and are prone to being neglected by conventional planning (TRB, 1997). Other studies dealing with sustainable transport, stress the need to find a balance between accessibility and sustainability (Geerlings et al, 2009).

Given the serious impact of transport, there is growing interest in the concepts of sustainability and sustainable transport. Transport systems exist to provide social and economic connections, and people tend to quickly take up the opportunities offered by increased mobility. It is also important to stress that the concept of sustainable mobility is not a static situation that can be described in the sustainability issues as presented above. The concept of sustainability has to be achieved over time, and is part of a process (temporal aspects) which also manifest on a spatial scale (spatial aspects). The concept of sustainability is being translated and applied in many different sectors, such as agriculture, production processes, and energy conservation. It is also being applied in the transport sector. Sustainable transport, according to a report by the Transportation Research Board (TRB, 2008), is a transport system which:

1- allows the basic access and development needs of the people to be met safely and consistent with human and ecosystem health, and promotes equity within and between successive generations;

2 - is affordable, operates fairly and efficiently, offers a choice of transport mode and supports a competitive economy, as well as balanced regional development; and

3- limits emissions and waste, and uses resources at the level of generation or development, while minimizing the impact on the use of land and the generation of noise.

But in the development of the transport sector and all its external effects, this optimum situation rarely occurs (Banister, 2008). This has, for instance, to do with the characteristics of the external effects. In this article we focus on the air quality, as specific external effect. The negative effects of motorized transportation on air quality are quite substantial in significant ways. In terms of timescales, some are instantaneous (e.g. noise), some are pervasive (e.g. hydrocarbons), some are permanent (e.g. visual intrusion), and others are cumulative (e.g. CO_2). Spatially, there is a clear distinction between those adverse effects that have a direct impact at the place where they are generated (e.g. emissions of lead) and those which are transported through the air on a continental or even a global scale (CO_2). Some of the impacts are associated with direct physical effects and can be easily measured (SO_2); others, particularly those affecting public health and the quality of urban life, are more subtle, and less susceptible to objective measurement, etc.

For the transportation sector it is appropriate, according to its type of impacts, to make a distinction between global effects and non-global effects[1]. The global impacts are restricted to emissions into the air and they are directly responsible for causing global warming. The non-global impacts concern emissions that have an effect on water, air and soil quality. These emissions are responsible for acidification and eutrophication on the local, regional and continental scale.

3. Ports and port developments

Free transport of goods is considered an essential element for a modern society. With the integration of the world market, economic growth and higher levels of income, transport has become a major economic sector which is characterised by qualitative as well as qualitative growth. An efficient transport system is in this context a crucial precondition for port development and an asset in local, regional and international mobility. We see that many ports in the world benefited from the increase of international trade and show a spectacular growth over the last decades.

The benefits of transport, however, come at a high price. No mode of motorised transport is environmentally-friendly. Some modes of transport, notably rail and inland waterways, have lower impacts than others, such as road and air. An analysis of transport developments and their impact on the environment must therefore distinguish between different modes of transport (traffic volume), the substitution effect of a modal shift and individual behaviour.

The negative impacts of transportation on air quality are also a big concern for ports and their development. Ports are important elements in a logistic chain, where goods are transferred from (deep)sea ships, via the port operation activities, to the user/consumer in the hinterland and vice versa. In this paper we focus on port operation and the connection to the hinterland, as the port policies and emission standard for hinterland connections are part of local, regional or national jurisdiction, while the regulation at sea is subject for international regulation (IMO, etc.)

3.1. The growth of ports

Since the 21st century, globalization became increasingly evident which resulted in an increasing volume in global trade (Table 1). Especially because of the growth of China, but also due to other Asian emerging economies, foreign trade volumes came to unprecedented high. And however there

[1] A third category, the quality-of-life aspects, who are restricted to impacts such as noise, visual intrusion, spatial dispersion, etc., are not taken into consideration in this study.

is a small dip to be observed in 2012 as a result of the economic crises in Europe and China, there are indications that the growth of trade volumes will recover.

Table 1 The growth of global trade volume and ocean shipping volume (2010-2013) (%)

	global GDP	trade volume	ocean shipping volume
2010	5.1	12.6	7.0
2011	3.8	5.8	4.0
2012*	3.3	3.2	3.7
2013*	3.6	4.5	5.6

Source: Own elaborations based on databases of IMF and SISI 2012.
Note: Data for 2012 & 2013 is the predicted value.

According to statistics, about 80% of the total global trade volume is currently transported by sea transport, and the ratio in China as exporting country is even as high as 90% (Bajpai, et al.,1997). With this growth of ocean shipping volume, particularly reflected in the number of container transport, required an expansion of the infrastructure to handle the increasing work; therefore the construction of new port infrastructure is more and more popular in most world-class ports like port of Shanghai, Rotterdam, Antwerp and Hamburg (Table 2).

Table 2 2012 world's top five ranked port cargo throughput (million tonnes)

Ranking 2012	name of port	2012	2011	growth rate
1	**Ningbo-Zhoushan**	744.00	694.00	7.2%
2	**Shanghai**	736.00	720.32	2.2%
3	**Singapore**	537.59	531.18	1.2%
4	**Tianjin**	476.00	451.00	5.5%
5	**Port of Rotterdam**	441.53	434.60	1.6%

Source: SISI 2012.

It is clear that there is a direct relationship between ports and the regional economic development. With the increase in the scale of the ports, the interaction becomes even more prominent. On the one hand, when the city economy and external trade improves, the local government will increase relevant investment in fixed assets used for infrastructure, including the port construction; therefore, the port capacity shortage will be eliminated, which will bring the unimpeded cargo handling business and feed back to add the value of GDP. On the other hand, compared to non-port cities, there is also a negative impact of the port economy on GDP loss, for the cost of environmental pollution improvement which caused by port related activities.

3.2. The diversity of hinterland connections

Nowadays, the success of a seaport no longer exclusively depends on its internal weaknesses and strengths. It is more and more determined by the ability of the port community to fully exploit synergies with other transport nodes and other players within the logistics networks of which they

are part (Martinho, 2008). Some governments, such as in the U.K. require that terminal operators firstly must invest in building railways connections between ports and inland infrastructure before getting the license of berths constructions and operations in order to ensure the convenience of hinterland connections (SISI, 2012).

The transport activities excluding international shipping and international air transport are accounted for about 60% of CO_2 emissions of total global fuel combustion (TWB, 2012) and contribute significantly to the CO_2 emissions every day. This also explains why so much attention is paid to inland waterway transport and railway transport. These two modes are considered as relatively low carbon-emissions. For ports, which deal with global trade flows, it is quite reasonable to give attention to the modal split and modal shift of hinterland transport

3.3. The role of the government and the meaning of standard setting

An important tool, besides the modal shift policies, is to improve the performance of each modality by itself. Emission standards are requirements that set specific limits to the amount of pollutants that can be released into the environment. Standards setting can therefore be considered as a way of direct regulation to realise targets on the global, national, regional and local level as they can be good reasons to stimulate technological development.

Why is standard setting an important tool? The setting of technical standards can be seen as an aid for the government for the cost-effective development of new technologies. An intensive use of this instrument looks desirable, as long as sustainability is underexposed compared with economic and sociological aspects. For instance, the establishment of fuel efficiency standards and physical compatibility standards for components in vehicle design has an enabling effect.

Secondly, standards act as a constraint on behaviour. Environmental performance standards already cover a wide range of topics. It is likely that these standards will have the incidental effect of creating a commercial inducement to find the most cost-effective means of compliance.

Thirdly, well-defined standards have the advantage that they define the total playing field: all competitors in the market are influenced by the same constraints. In addition, international agreement on standards could be effective, especially in the expanding world market of car manufacturing.

Finally, imposing standards in the total market creates the opportunity for manufacturers to internalise the costs of measures to be taken into the price of the product. In the longer term economies of scale will lead to a reduction of the manufacturing costs of the technologies and create a competitive advantage. One step further is the opportunity for firms to create the profile of a `Green Producer' and to use the `green marketing tool'. So in terms of governance strategy there is a close interaction between modal shift ambitions and standard setting and vice versa: standard setting can be an important stimulus for modal shift policies.

4. Empirical research

Many emissions standards focus on regulating pollutants released by automobiles (motor cars) and other powered vehicles. The United States were ahead compared to the rest of the world by introducing emissions standards. The Air Pollution Control Act of 1955 introduced in the United States was the first legislation ever involving air pollution. This Act provided funds for federal research in air pollution. And it was the Clean Air Act of 1963 that was the first

federal legislation regarding air pollution control. It established a federal program within the U.S. Public Health Service to control air pollution on the basis of emission standards on a national level. The 1970 amendments greatly expanded the federal mandate, requiring comprehensive federal and state regulations for both stationary (industrial) pollution sources and mobile source. The state of California has special vehicle emissions standards, and other states may choose to follow either the national or California standards. California's emissions standards are set by the California Air Resources Board, known locally by its acronym "CARB". Given that California's automotive market is one of the largest in the world, CARB wields enormous influence over the emissions requirements that major automakers must meet if they wish to sell into that market. In addition, several other U.S. states also choose to follow the CARB standards, so their rulemaking has broader implications within the U.S.

In Europe, European emission standards define the acceptable limits for exhaust emissions of new vehicles sold in EU member states. The emission standards are defined in a series of European Union directives staging the progressive introduction of increasingly stringent standards Currently, standards are set for all road vehicles, trains, barges and 'non-road mobile machinery' (such as tractors). The EU planned to introduce in 2008 Euro 4 standards; in 2010 Euro 5 and Euro 6 will become effective on January 1, 2014. These dates have been postponed for two years to give oil refineries the opportunity to modernize their plants. EU Regulation No 443/2009 sets an average CO_2 emissions target for new passenger cars of 130 grams per kilometer. The target is gradually being phased in between 2012 and 2015. A target of 95 grams per kilometer will apply from 2021.

Due to rapidly expanding wealth and prosperity, the number of cars on China's roads is rapidly growing, creating an ongoing pollution problem. China enacted its first emissions controls on automobiles in 2000, equivalent to Euro I standards. China's State Environmental Protection Administration (SEPA) upgraded emission controls again on July 1, 2004 to the Euro II standard. More stringent emission standard, National Standard III, equivalent to Euro III standards, went into effect on July 1, 2007. Plans are for Euro IV standards to take effect in 2010. Beijing introduced the Euro IV standard in advance on January 1, 2008, became the first city in mainland China to adopt this standard. There are no standards for CO_2 emissions of car using in China.

It is also important to mention that there are no standards (globally or nationally) that apply to seagoing ships or airplanes. The objective of this Section is to provide an overview of the current and future air emissions of different ports[2]. Bellow, the situation for two big port-cities is described, whereby the attention is given to the standard setting and the modal shift policies.

[2] The study contains an overview of emissions factors per tonne-kilometre for the different freight modes in different market segments. For this comparison the emission data, vehicle utilization data and data detouring compared to other modes are important. In many cases, the travel distance by rail and certainly by inland barge is longer than by road.

4.1. Shanghai

4.1.1. Policies on standards

For the Port of Shanghai, there are no other emission standards of air pollutants as the national standards. For the air pollutants (CO, HC, PM10, PM2.5, SO_2, NOx, etc.), the relevant policies and measures for control of the emissions were formulated and implemented by Ministry of Environmental Protection of PRC (MEP) ; and then each local govenment carries out the unified national standards which made by the MEP. In addition to the road transport, the emissions of air pollutants of any other transport modes should be up to “Integrated emission standard of air pollutants (GB 16297)” which was promulgated in 1996 and implemented from 01/01/1997. For road transport, there are several standards which separated by different vehicle models, such as “Limits and measurement methods for exhaust pollutants from diesel engines of urban vehicles(WHTC) (HJ 689)” (promulgated in 2014 and will be implemented from 01/01/2015), “ Limits and measurement method for exhaust pollutants from gasoline engines of heavy-duty vehicles(III,IV) (GB 14762)” (promulgated in 2008 and implemented from 01/07/2009), “Limits and measurement methods for exhaust pollutants from compression ignition and gas fuelled positive ignition engines of vehicles (III,IV,V) (GB 17691)” (promulgated in 2005 and implemented from 01/01/2007), and “Limits and measurement methods for exhaust pollutants from diesel engines of tri-wheel & low-speed goods vehicles (GB 19756)” (promulgated in 2005 and implemented from 01/01/2006).

The air pollutants reduction targets of Shanghai port is totally based on the national requirement. According to "Twelfth Five Year Plan" of Transportation, during the year of 2020, the emissions of CO, HC, SO_2, NOx of transport in Shanghai should be decreased significantly compared to 2015. In 2015, the PM10 emissions of hinterland connections in Shanghai should be respectively decreased by 20% compared to 2010, and the integrated control rate in the port area should be increased to 70%.

Actually, in China, the relevant policies and measures for control of carbon emissions were formulated and implemented by Department of Climate Change, which is attached to the National Development and Reform Commission of PRC (NDRC); meanwhile, the local transport and port authority as well as the local Development and Reform Commission will fully cooperate with the NDRC. At present, although China has no specific laws and regulations of CO_2 emissions, the Chinese government has taken many measures to control CO_2 emissions. According to "Twelfth Five-Year Plan" of Energy Saving of Road and Waterway Transport, during the year of 2015, the CO_2 emissions of road transport and inland waterway transport in China should be respectively decreased by 13% and 15% compared to 2005.

About the CO_2 reduction targets of Shanghai port, in order to match up the national requirement, in December 2011, “The resource-saving and environment-friendly construction guidance of Shanghai port” which issued by Shanghai Municipal Transport and Port Authority, pointed out that by 2015 and 2020, the CO_2 emissions of Shanghai Port should be respectively decreased by 10% and 12% compared to 2005.

4.1.2. Planning of actions in Shanghai

The local government of Shanghai has taken some measures to control air pollutants, especially on CO_2 emissions reduction.

a. To pilot Third-party monitoring of carbon emission and trading surplus of carbon emission

At present, Shanghai has set up the third party professional organizations which could monitor the enterprises' carbon emission volume to monitor and evaluate carbon emission of Shanghai. In addition, Shanghai, as the most important one of cities piloting carbon emission trading system (ETS) in China, has formulated several specific policies of carbon emission trading pilot, such as "Shanghai pilot carbon emission rights trading scheme", "2013-2015 Shanghai carbon emissions quota allocation and management", and "Carbon emissions trading rules of Shanghai Environment and Energy Exchange".

b. To further develop railway-waterway combined transport

At present, the proportion of railway transport in Shanghai is less than 0.5% and there is almost no railway to connect with the port. In order to increase the percent of the relatively low carbon transport such as waterway and railway, the local government of Shanghai is promoting the construction of Pudong railway, which is expected to be completed by 2018. By then, the railway will connect with the rear yard of Shanghai waigaoqiao port area, thus greatly improving the proportion of waterway and railway transport which is good for reducing CO_2 emissions.

c. To promote the application of new energy and alternative energy

Strengthening the application of new energy and alternative energy technologies in Shanghai port infrastructure construction and operation is also a good measure to control the CO_2 emissions. In some port areas which have proper conditions, the local gvernment has gradually promoted the applicable technology of Liquefied Natural Gas (LNG), electric drive, hybrid vehicles, yard pole lamp with intelligent power-saving device, and some new energy application technology such as solar, wind, air heat pump, etc.

4.2. Rotterdam

4.2.1. Policies on standards

Air pollution has been a European political concern since the late 1970s. The European Union policy on air quality aims to develop and implement appropriate instruments to improve air quality. The control of emissions from mobile sources, improving fuel quality and promoting and integrating environmental protection requirements into the transport and energy sector are part of these aims. The air quality in Europe is determined by EU-regulations via so called directives. The most recent directive is Directive 2008/50/EC, adopted on 21 May 2008. This directs which is one of the Directives amending Directive 70/220/EEC. Following the Clean Air for Europe (CAFÉ) program and the resulting Thematic Strategy on air pollution, new Euro 5 and Euro 6 standards have already been agreed by Council and Parliament. Euro 5 en 6 are emission standards dealing with the emission of NOx, SO_2 en PM for motor vehicles.

In December 2013, the European Commission has adopted a Clean Air Policy Package consisting a new Clean Air Program for Europe with new air quality objectives for the period up to 2030, a revised National Emission Ceilings Directive with stricter national emission ceilings for the six main pollutants, and a proposal for a new Directive to reduce pollution from medium-sized combustion installations. The Member States have 2 years to transpose the new Directive, until then the existing legislation applies. Some provisions of the new Directive such as PM2.5 monitoring requirements have to be implemented sooner. It is expected that the provision enabling notifications of postponements or exemptions in respect of the limit values for PM10, NO_2 or benzene will be applied before the end of the 2 year transposition deadline.

Currently, emissions of nitrogen oxides (NOx), total hydrocarbon (THC), non-methane hydrocarbons (NMHC), carbon monoxide (CO) and particulate matter (PM) are regulated for most vehicle types, including cars, lorries, trains and barges, but excluding seagoing ships and aero planes. New standards do not apply to vehicles already on the roads. In this context the port of Rotterdam and the Netherlands, as EU-members, follow the EU requirements.

It can be concluded that within the EU between 2009 and 2020 the well-to-wheel PM10 and NOx emission factors will decrease most for trucks (50-65%), compared to 30% for inland waterway and rail diesel. This trend is the result of the effective European emission standards that apply to truck engines. For the other modes the reduction is smaller because of a slower fleet renewal and in the case of inland barge and marine engines also less stringent emission standards. In 2020 the SO_2 exhaust emissions of short sea transport will be much lower than they are now and by then the sum of the exhaust and upstream emissions.

The CO_2 emissions generated by vehicles are nowadays subject to a voluntary agreement between the EU and the car manufacturers (see ACEA agreement)[3]. The ultimate EU target with voluntary agreements are to contribute, is to reach an average CO_2 emission (as measured according to Commission Directive 93/116/EC of 120 g/km for all new passenger cars by 2012). However, it becomes increasingly clear that the agreement will not deliver much improvement (having achieved only 160 g/km in 2005, from 186 g/km in 1995).

4.2.2.Planning of actions in Rotterdam

The port of Rotterdam is the main gateway to Europe for containers, fuel, etc. The port is a logistical hub for sea and inland going ships and attracts a lot of road traffic (both freight and private vehicles). With industrial emissions declining, transport (shipping and traffic) is becoming an important source. The absolute amount of traffic emissions went down over the past years (due to technological improvements) despite strongly increasing intensities. Nevertheless, for ambient concentrations, traffic is the main source as it concerns low level emissions and traffic is intimately linked to areas where people dwell. The spatial mix of a relatively high population density with major traffic arteries (for vehicles and ships) and industrial areas causes air quality problems, mainly related to NO_2 and PM.

To improve air quality Rotterdam supports all international efforts to improve shipping fuel (e.g. sulphur reductions) and the region actively advocates stricter Euro limits for (freight) vehicles. Local measures include: the smoothing of traffic flows (speed limits, access control, clever traffic light management), "noise screens" to improve dispersion, improve park and ride facilities, encourage a modal shift (lorries to ships, trains), etc.

This means that for the Port of Rotterdam, the standards of the European Union will be implemented. An important development is the standards on CO_2-emissions for vehicles that will be implemented in 2020. The future CO_2-emissions for passenger cars will become 95 gr/km (or 3.7 liter of fuel in100 km), for vans it will become 147 gr/km (at present 220 gr/km). For heavy duty vehicles Euro 6 will become the standard.

It is clear that this will not be enough to reach the emission ceiling. Therefor stricter requirements are set for companies on the new extension area named Maasvlakte 2 for the reduction of the use of trucks. Only Euro 6 trucks will get access to this new port area. At the

[3] The **ACEA agreement** refers to a voluntary agreement between the European Automobile Manufacturers Association (ACEA) and the European Commission to limit the amount of carbon dioxide (CO_2) emitted by passenger cars sold in Europe. With 18 million cars sold each year, Europe is the last major car market in the world.

same time, the share of the truck in the hinterland transport of containers is At present 50 percent and in 2033 this share should be reduced on Maasvlakte 2 to 35 percent. This is also laid down contractually including penalty provisions.

5. Synthesis

The enforcement of absolute standards is difficult or inefficient in some circumstances. Therefore, the role of the government in transport (and related technology) policy should not be overestimated. At present governments already play a significant role in the economic area (energy prices), environmental policies (emission standards), spatial organisation and (de)regulation of the transport market and the success is not always there.

It seems that in China and Europe, cities and ports follow the regulation initiated by the central government (China) and the EU (The Netherlands). Via a process of subsidiarity the implementation is arranged and managed for the lower levels of government. Especially for the longer term we see that the standards will become much stricter (Table 3).

Table 3 Future emission standards in Shanghai and Rotterdam port-cities

Emission	**Future standards of Shanghai (f.s.) (by 2020)**	**Future standards of Rotterdam (g/km) (by 2020)**
Local impact		
CO	No standards	Present: 1.0 or passenger cars Present: 2.1.5 for large trucks (Euro 3) Future: 1.0 for passenger cars Future: 1.5 for large trucks (Euro 6)
HC	No standards	Present: 0.230 for passenger cars Present: 0.96 for large trucks(Euro 3) Future: 0.170 for passenger cars Future: 0.46 for trucks(Euro 6)
PM10	No standards	Present: 0.1 for passenger cars Present: 0.02 for large trucks(Euro 3) Future: 0.005 for passenger cars Future: 0.01 for large trucks(Euro 6)
PM2.5	No standards	Present: 0.005 for passenger cars Present: 0.01 for large trucks(Euro 3) Future: 0.005 for passenger cars Future: 0.01 for large trucks(Euro 6)
Regional Impacts		
SO_2	No standards very relevant due to fuel quality	Present: not relevant due to fuel quality Present: not relevant due to fuel quality
NOx	No standards	Present: 0.180 for passenger cars Present: 5.0 for large trucks (Euro 3) Future: 0.060 for passenger cars

		Future: 2.0 for large trucks(Euro 6)
Global impact		
CO_2	No standards	Present: 130 for passenger cars Present: for large trucks no standards Future: 95 for passenger cars from 2021 onwards Future: 175 in 2017, 147 in 2020

For rail, the emission standards (gr/km) are significant higher CO: 3,5; HC: 0,5; NOx: 6,0 and PM 0.2. For inland waterway vessels the standards (gr kW/h) are: CO: 5.0; NOx: 11.0 and PM: 0.5. There are no plans to come up with standards on greenhouse gases for these 2 modalities.

This means that there is an important role for standard setting, but there is also an important role for modal shift policies. In there too there are sincere differences between the ports of Rotterdam and SH, however the gap seems to be bridged. In terms of future ambitions it seems that for Rotterdam the ambitions are more explicit as Shanghai (Table 4).

Table 4 Development modal split in port of Shanghai and Rotterdam (%)

port	Year	Road	Waterway	Railway
Shanghai port	2005	84.10%	15.56%	0.34%
	2010	74.1%	25.7%	0.2%
	2012	56.87%	42.8%	0.33%
Port of Rotterdam	2005	59%	11%	30%
	2010	57%	33%	10%
	2012	60%	30%	10%

Source: SISI, Port of Rotterdam Authority (2012)

6. Conclusions

At present we seem to be in a period of intensified interest for environmental problems, especially in port and port areas. One explanation for this increase attention is the awareness about the seriousness and size of known problems on the local level caused by ports and port activities, such as the NOx, CH and PM that appeared to be much larger than was assumed with a direct and harmful effect on public health and the ecosystem.

At the same time we see that there is no political support to combat the emissions with a global impact, such as CO_2 emissions. This is an important observation as shipping is an activity that forms a chain in a global network. The 10 biggest ports of the world are located in China and Europe and they keep close trade connections with each other.

An effective tool to combat these negative impacts is by setting emissions standards. Emission standards were first introduced in the US, but at the moment also applied in Europe and China. Standards can be considered as constraint on behaviour and are applied to motorised vehicles. There are good reasons to consider standards as an important tool. Therefore we see that each port favours a modal shift policy to stimulate cleaner modes of transport, mostly in favour of inland shipping and rail transport. Sharp modal split standards was even a precondition for approval of the extensions of the Rotterdam port.

In Europe there is a big attempt to come up with strict emission standards for emissions with a local and regional impact, even for the period after 2020. These standards are related to the an emission ceiling, which means that is a maximum of activities set. The ceiling is takes into consideration a mix of activities such as industries, energy production agriculture, transport, etc. At the same time we see that in China that, despite the sense of urgency to improve the address the alarming levels of emissions and the impact on human health, the huge public concern and the willingness of the government in China to address air pollution, standards are completely lacking.

We observe that in ports and port cities, also in the 10 biggest ports of the world, that there is no space to come up with local standards. In China in this context the standards are determined by initiative of the central government and in Europe the E.U. is the most important actor.

When we look more closely to the standards applied in Shanghai (one of the biggest ports in China) and Rotterdam (the biggest port in Europe), we see that the standards in Europe create a level playing field between ports in Europe. Due to the lack of standards in Shanghai, no actor feels responsible, with many negative consequences as a result. This might be the reason why the People's Congress nominated in 2014 environmental quality as a top priority for coming 5 year plan. This does not mean that there is no prospect. In both ports we see that the share on inland shipping in the total transport volume is high and still increasing. The current performance of inland waterway transport is insufficient. Because of the great strategic and economic importance of a properly functioning shipping sector, there is a need for a widely shared and broadly supported vision how the shipping industry can become the greenest mode of transport.

A separate point of concern will remain the global challenge of CO_2 emissions that lead to climate change. It is beyond the scope of this article but for ports and port cities it is difficult to take it responsibility. At the same time we see that this is one of the biggest challenges for the international shipping business.

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