Seaport development
1. Ports evolution
2. Port Governance
3. Competitive advantages
4. Present challenges
1.1 Ports and vessels in the history

The navigation is documented in Europe in the Mediterranean since 3000 BC in the East (Egypt) and during 2000 BC in the Aegean (Greece). In Italy the Etruscans sailed 1000 BC

The Romans built their empire sailing to and from the Port of Ostia. Several Ports in Hispania was connected in 50 AD with current Southampton, Cherbourg, La Coruna, Lisbon and Rome Marseille

- The Vikings came to Canada in 1000 AD
- The Chinese arrived in California in 1421
- The Portuguese arrived in Puerto Rico in 1434
- The Spanish arrived in the Caribbean in 1492 .........
1.2 Navigation during S.XVII to S.XIX

- Until the S. XVIII insecurity in shipping, led to a great relationship between the military and civilian aspects. Very often merchant ships carrying guns.

- In the S.XIX, the "iron fleet" takes the place of the "wood fleet" - first the sail was replaced by steam, which is then replaced by the diesel engine propulsion. In the late S.XIX, except for the transatlantic, the length of merchant ships was limited to 100 m and its draft less than 10 m.

- All ports receiving vessels with more or less the same characteristics: the goods the ship was varied, packaged in a way that could be manipulated manually or with the support of the mainstays of the vessel.

Peru Callao port 1655

French frigate Ifigenia S. XVIII

Spanish vessel Numancia S.XIX
1.3 Navigation after WW-II and first container ships

After World War II, the economies of all nations began to open up to other countries - the international exchange of goods grew faster than GDP in most economies of developed countries. These developments, together with the shipbuilding, leading to two phenomena of merchant ships: Size and Cost.

The T2 design was formalized by the United States Maritime Commission as its medium-sized "National Defense tanker," a ship built for merchant service which could be militarized as a fleet auxiliary. Standard T2s were 501 ft (152.9 m) in total length. Rated at 9,900 tons gross (GRT), with 15,850 deadweight tons (DWT), delivered a top speed of 16 knots (30 km/h).

On April 26, 1956, the first of these rebuilt container vessels, the *Ideal X*, left the Port Newark in New Jersey and a new revolution in modern shipping resulted.
The Geneva Convention of December 9, 1923, by granting status to the International Regime of Maritime Ports, ie, "shall be considered as seaports, frequented by ocean vessels serving the foreign trade ports." This definition is very partial, because it removes all river and lake ports.

To facilitate access to foreign ships in 1923 was accepted and Geneva international convention in several states signed undertook to grant full reciprocity with free access and the necessary treatment to foreign vessels.
1.5 Port definition: Robert Rezenthel, France 1989

<< Dictionnaire juridique des ports maritimes et de l'environnement littoral >>
Behçet par JM et R. Rezenthel

In his "Seaports" (1989), Robert Rezenthel recalls that the French Code for seaports does not give a precise definition of Puerto. But there are several definitions individual authors French:

- LE CLERE
- VIGARIE
- LATTY
- GROSDIDIER
- BAUDER
- BAUDELAIRE
## 1.6 Evolving definition of Port

<table>
<thead>
<tr>
<th>Year</th>
<th>Instrument</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1923</td>
<td>Genève Convention</td>
<td>Ports are maritime ports serving oceanic vessels for international trade</td>
</tr>
<tr>
<td>1989</td>
<td>Dictionnaire Juridique des ports maritimes</td>
<td>Ports are natural or artificial instalments to berth vessels</td>
</tr>
<tr>
<td>2001</td>
<td>2nd European Transport White Book Brussels</td>
<td>Ports are nodes to exchange transport mode in logistic supply chains</td>
</tr>
<tr>
<td>2011</td>
<td>3rd European Transport White Book Brussels</td>
<td>Ports are viewed as logistic platforms in relation to Comprehensive and Core networks</td>
</tr>
</tbody>
</table>
We can distinguish between natural and artificial harbors:

A natural port could be sea, river or lake. It could be located in an estuary or upriver. It can be a port with or without tides.

An artificial port can be created inland reaching the depths required by dredging or could gain access to the sea by landfills, piers and other structures. Many ports are mixed, combining these two possibilities.

In the World there are currently 4,570 Ports, from which 2,564 (56%) are built on natural areas: coasts, rivers or bays.

Natural Port at Corfu, Greece

Artificial terminal at Shanghai Port
1.8 Classification by port functions and traffics

• By specific traffics:
  • multipurpose ports
  • specialized ports
  • minerals ports
  • bulk ports
  • oil ports
  • container ports
  • passengers port

• By logistic function:
  • Local port
  • Supply ports
  • Transhipment port
  • Gateway port
  • Hub port
  • Feeder ports
  • Free ports
  • Transit ports
  • industrial ports
1.9 Classification by port trade services

• By trade services
  • International
  • National
  • Regional
  • Local
  • Free Trade
  • Transhipment,
  • Marina
  • Merchandise
  • Cruise
  • Fishing

Cruise Port & Marina

Fishing Port

International Port
From a practical point of view the operations that have recently been developed in the port have contributed to the frequent use of new concepts about the Port, and others like as the Terminal and the Port area.

The concept of the Port area is vital for the smooth operation of cargo handling operations. It is to divide the port on parallel zones to the dock areas. At first is the dock where the cranes and the cargo that can not be stacked are placed. Also the second and third services zones.
1.11 Sea port cross-view: Port & Port Area

<table>
<thead>
<tr>
<th>Maritime Authority</th>
<th>Port Authority</th>
<th>City Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry channel</td>
<td>Dock</td>
<td>Logistic Zone</td>
</tr>
<tr>
<td>Load Unload</td>
<td>Handling</td>
<td>Port Area</td>
</tr>
<tr>
<td>Maritime ops</td>
<td>Storage</td>
<td>Port entry</td>
</tr>
<tr>
<td>Pilots</td>
<td>Port Area</td>
<td>Logistic Zone</td>
</tr>
<tr>
<td>Docking</td>
<td>Service area</td>
<td>Industries</td>
</tr>
<tr>
<td>Towing Berthing</td>
<td>Road and Rail yards</td>
<td></td>
</tr>
<tr>
<td>Crane Wagons Trucks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.12 Spatial organization of Port, Terminals and Port Zone: Zeebrugge

A Port is spatially organized based on specialized Terminals, which handle traffic passing through the port in either direction.

- CARS
- CONTAINERS
- CRUISE / FERRIES
- GENERAL CARGO
- MINERALS
- OIL
- FISHERIES
- CHEMICALS
- GASES
- CEMENT
1.13 Spatial organization of Port, Terminals and Port Zone: Antwerp
1.14 Spatial organization of Port, Terminals and Port Zone: Barcelona

1-Dike 5-Wharfs 9- Duque Wharf 13- Stores 17- Rail terminal 21- Silo
2-Breakwater 6-Pantalan 10- Mouth 14- Sea access 18- Lighthouse
3-Counterdike 7-Dock 11- Warehouses 15- Land access 19- Dry dock
4-Estuary 8-Headboard 12- Wharf cliff 16- Logistic zone 20- Floating dock
1. Specialized coal Terminal (turnover of goods: 5.5 MM/tons per year)

2. Specialized bulk-oil cargos Terminal (turnover of goods: 2.5 MM/tons per year)

3. Specialized containers Terminal (turnover of goods: 17.5 MM/tons per year)

4. General Terminal
1. Ports evolution
2. Port Governance
4. Current challenges
5. Competitive advantages

World Trade Center Rotterdam and Erasmusbrug bridge
2.1 Port Governance : main drivers

**Port Governance**

definition: it can be approached from 2 perspectives:

- At the **Port level**, corporate governance is a system of rules and structures applicable to support the Port’s managerial decisions related to performance.

- At the **Government level**, it is a set of rules and structures imposed on Ports, influencing the scope and the manner of those managerial decisions are taken.
The need for more efficiency, in addition to the shifting and integration of global trade lanes over the past few years, has led ports around the world to review whether their governance structures and operations are optimal in the new global marketplace.

Some have suggested that **publicly-owned ports**, not subject to the full rigor of the market, are unable to effectively adjust to the new competitive pressures of globalization and are targets of city governments that want to “siphon off surplus funds”.

Others in turn have suggested that **private port authorities** are less beneficial to the local economies that surround them as private ports aim at maximizing profits, and may not have any interest in controlling the negative externalities that can be imposed to third parties.
In recent decades, the number of studies dedicated to Port Management and Port Governance has increased (Heaver, 2006). Some of these studies have addressed the ports as **business agglomerations** (clusters, logistics chains and logistics networks). This approach is important because port performance is the result of activities performed by several actors which need to be properly coordinated or governed (De Langen, 2004).

This coordination takes place through a **Port Governance Model**, which should consider the governance structure, the governance actions and the governance elements (Geiger, 2009), as well as the governance outcomes. According to Geiger, any Governance model must answer 3 basic questions: Who governs? What is governed? and How is it governed?. The **ultimate objective** of port governance is to promote port performance through a specific governance model.

<table>
<thead>
<tr>
<th><strong>Who</strong></th>
<th>governance <strong>structure</strong> which refers to the institutional and regulatory framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What</strong></td>
<td>governance <strong>actions</strong> are the mechanisms inducing coordination</td>
</tr>
<tr>
<td><strong>How</strong></td>
<td>governance <strong>elements</strong> are the actors and the associated logistics flows</td>
</tr>
<tr>
<td><strong>Why</strong></td>
<td>governance <strong>outcomes</strong>, associated with the effectiveness and efficiency of the logistics chains where the Port participates</td>
</tr>
</tbody>
</table>
The logic of this model is that the governance outcomes indicate the need for governance actions in order to increase the integration of the port logistics chain and the efficiency of the related flows, which are the governance elements, all driven by the existing governance structure.
## 2.5 Port Governance: main Port factors

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Port Factors</th>
</tr>
</thead>
</table>
| **Structure** | • Existence of a governance structure  
• Effectiveness of the governance structure  
• Improvement of the governance structure over time |
| **Actions** | • Coordination of the actors of different port logistics chains  
• Coordination the cargo & people flows in this different chains  
• Coordination of the information flows from different chains  
• Effectiveness of governance actions  
• Improvement of governance actions over time |
| **Elements** | • Coordination of the actors within the port logistics chains  
• Increasing of coordination over time  
• Efficiency of cargo & people port logistics flows  
• Increasing of cargo & people flows efficiency over time  
• Efficiency of information flow on cargo & people  
• Increasing of information flow efficiency over time |
| **Outcomes** | • Port effectiveness (Technical)  
• Port efficiency (Economy)  
• Competitive costs for both cargo & people flows  
• Adequate Maritime connections (number of liner shipping services)  
• Adequate Frequency of liner shipping services |
2.6 Port Governance: extended interest range

Inspiration from: Dr. Jean-Paul Rodrigue, Dept. of Global Studies & Geography, Hofstra University.
### 2.7 Ports Property Models which determine the Governance Model

<table>
<thead>
<tr>
<th>Public Models</th>
<th>Private Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Port Authority</td>
<td>• Port Company</td>
</tr>
<tr>
<td>• Port Administration</td>
<td>• Port Society</td>
</tr>
<tr>
<td>• National Administration</td>
<td>• PPP – Public Private Partnership</td>
</tr>
<tr>
<td>• Regional Administration</td>
<td>• Joint Venture</td>
</tr>
<tr>
<td>• City Administration</td>
<td>• Corporation</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td><strong>Superstructure</strong></td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td></td>
</tr>
</tbody>
</table>

- **Barcelona Port Authority** (SP)  
- **Leixoes Port Administration** (PT)  
- **Cork Port Company** (IE)  
- **Southampton Port Society** (UK)
## 2.8 Port Business Models

<table>
<thead>
<tr>
<th></th>
<th>EU</th>
<th>EE</th>
<th>US</th>
<th>LA</th>
<th>ASIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Public</td>
<td>10%</td>
<td>50%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>2</td>
<td>Tool</td>
<td>20%</td>
<td>30%</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>3</td>
<td>Landlord</td>
<td>63%</td>
<td>20%</td>
<td>55%</td>
<td>65%</td>
</tr>
<tr>
<td>4</td>
<td>Private</td>
<td>7%</td>
<td>0%</td>
<td>5%</td>
<td>10%</td>
</tr>
</tbody>
</table>

### Model Definition

**Public**

Public or Service ports have a predominantly public character. The number of service ports is declining worldwide.

**Tool**

In the Tool port model, the port entity owns, develops, and maintains the port infrastructure as well as the superstructure.

**Landlord**

The landlord port is characterized by its mixed public-private orientation. Under this model, the port entity acts as regulatory body and services are private.

**Private**

In Private ports, land is privately owned and also services. This requires the transfer of ownership of such land from the public to the private sector.
2.9 Port Business Models

In the World Bank terminology, the Public Port is named as Service Port. These 4 models present a simple approach to classifying port responsibilities, but they fail to provide adequate guidance to a government faced with pressure to devolve port administration as to which approach(es) to take for a given local situation.

These classifications are highly regarded as a 1st step in understanding the allocation of responsibility for capital investment at a port: infrastructure & superstructure, for management and operations at a port from a labor perspective, but fail to fully provide an understanding of the strategic intent of a port, its role in regional economy as seen by Government and the allocation of responsibility for regulatory monitoring in environmental and safety issues.

### Table 18.1. Allocation of Responsibilities (World Bank).

<table>
<thead>
<tr>
<th>Responsibilities</th>
<th>Service</th>
<th>Tool</th>
<th>Landlord</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure</td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td>Superstructure</td>
<td>Public</td>
<td>Public</td>
<td>Private</td>
<td>Private</td>
</tr>
<tr>
<td>Port labour</td>
<td>Public</td>
<td>Private</td>
<td>Private</td>
<td>Private</td>
</tr>
<tr>
<td>Other functions</td>
<td>Majority public</td>
<td>Mixed</td>
<td>Mixed</td>
<td>Majority private</td>
</tr>
</tbody>
</table>

In the World Bank terminology, the Public Port is named as Service Port. These 4 models present a simple approach to classifying port responsibilities, but they fail to provide adequate guidance to a government faced with pressure to devolve port administration as to which approach(es) to take for a given local situation.
## 2.10 Port classifications: Land property and Business model

<table>
<thead>
<tr>
<th>New Orleans port</th>
<th>Shanghai port</th>
<th>Durban port</th>
<th>Panama port</th>
<th>New York port</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1-Land Property</strong></td>
<td><strong>2-Business model</strong></td>
<td><strong>3-Cargo weight</strong></td>
<td><strong>4-Influence area</strong></td>
<td><strong>5-Telematic level</strong></td>
</tr>
<tr>
<td>State port</td>
<td>Public port</td>
<td>Very small port</td>
<td>Local port</td>
<td>1st Generation port</td>
</tr>
<tr>
<td>Regional port</td>
<td>Tool port</td>
<td>Small port</td>
<td>Regional port</td>
<td>2nd Generation port</td>
</tr>
<tr>
<td>City port</td>
<td>Landlord port</td>
<td>Medium port</td>
<td>National port</td>
<td>3rd Generation port</td>
</tr>
<tr>
<td>PPP port</td>
<td>Private port</td>
<td>Large port</td>
<td>Continental port</td>
<td>4th Generation port</td>
</tr>
<tr>
<td>Private port</td>
<td></td>
<td>Very large port</td>
<td>Global port</td>
<td>5th Generation port</td>
</tr>
</tbody>
</table>
### 2.11 Port classifications: Other criteria

<table>
<thead>
<tr>
<th>Callao Port</th>
<th>Guangzhou port</th>
<th>Tripoli port</th>
<th>Alaska port</th>
<th>Lockroy port</th>
</tr>
</thead>
<tbody>
<tr>
<td>6- Specialization</td>
<td>7- Geographical</td>
<td>8- Tax policy zone</td>
<td>9- Traffic type</td>
<td>10- Governance</td>
</tr>
<tr>
<td>Passengers port</td>
<td>Coast port</td>
<td>Custom port</td>
<td>Hub port</td>
<td>Conservator port</td>
</tr>
<tr>
<td>Industrial port</td>
<td>Bay port</td>
<td>Duty free port</td>
<td>Gateway port</td>
<td>Facilitator port</td>
</tr>
<tr>
<td>Military port</td>
<td>Estuary port</td>
<td>Free zone port</td>
<td>Terminal port</td>
<td>Entrepreneur port</td>
</tr>
<tr>
<td>Commercial port</td>
<td>River port</td>
<td>Free trade port</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil port</td>
<td>Fjord port</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Container port</td>
<td>Lake port</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General cargo port</td>
<td>Delta port</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 2.12 Port classifications: combined criteria 2-4-10

<table>
<thead>
<tr>
<th>Business model</th>
<th>Profile</th>
<th>Conservator</th>
<th>Facilitator</th>
<th>Entrepreneur</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Public</td>
<td>Land manager</td>
<td>Co-investor broker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- Tool</td>
<td>Rules applicator</td>
<td>Regional Agency</td>
<td>Enforcement of Rules</td>
<td></td>
</tr>
<tr>
<td>3-Landlord</td>
<td>Concessions</td>
<td>PPP service provider</td>
<td>Specific port services</td>
<td></td>
</tr>
<tr>
<td>4- Private</td>
<td>Training, Promotion</td>
<td>Marketing, Lobbying</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Geographical dimension</th>
<th>Local</th>
<th>Regional</th>
<th>Global</th>
</tr>
</thead>
</table>

(source: Adapted from ESPO Port Governance Report, Verhoeven 2010)
2.13 Port Governance: Port – City relationship

2.14 Port Governance: Port – City evolution

Setting

Expansion

Specialization

- Downtown
- Urban expansion
- Terminal facilities
- Port-related activities
- Water depth
- Rail
- Highway
- Reconversion

Year 0 Year +100 Year +200
2.15 Port Governance: Port of Rotterdam evolution case
The port of Rotterdam is the largest logistics and industrial hub in Europe. The port and industrial complex stretches over a length of about 40 kilometers and covers some 12,426 hectares (water and land). From 2012 onwards, Maasvlakte 2 is included in this calculation. The throughput of almost 442 million tonnes in 2012 makes the port of Rotterdam by far the largest seaport in Europe.
The hinterland of the Dutch Port of Rotterdam, reaches until Duisburg, the main fluvial port in Europe, 400 km away on Rhine River, and moving 40 MM ton/year in Barge m Rail and Truck with Rotterdam.
### 2.18 Port Governance: European Models

<table>
<thead>
<tr>
<th>Geography</th>
<th>Industry</th>
<th>History</th>
<th>Demography</th>
<th>Culture</th>
<th>Economy</th>
<th>Environment</th>
<th>Safety &amp; Sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>A</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hanseatic Port</th>
<th>Anglo-Saxon Port</th>
<th>Latin Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltic -North</td>
<td>North Atlantic</td>
<td>Mediterranean</td>
</tr>
<tr>
<td>Municipal</td>
<td>Private</td>
<td>National</td>
</tr>
</tbody>
</table>

Port and City work together to promote local economy growth.

- Fully Private or PPP ownership controls the port management to maximise profits
- Port belongs to National Government with a Central development Plan

*(source: ESPO Port Governance, Verhoeven 2010)*
2.19 Port Governance: Ownership in European Port Entities

(source: ESPO Port Governance, Verhoeven 2010)
## 2.20 Port Governance: Property and Management European Models

<table>
<thead>
<tr>
<th></th>
<th>PROPERTY</th>
<th>MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>National</td>
<td>Regional</td>
</tr>
<tr>
<td>Sweden</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Denmark</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Finland</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Estonia</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Latvia</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Lithuania</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Poland</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Slovenia</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Netherland</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Germany</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Belgium</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Ireland</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>UK</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Portugal</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Spain</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>France</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Italy</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Greece</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cyprus</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Malta</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

(source: ESPO Port Governance, Verhoeven 2010)
PORT COMMUNITY

It is an instrument for the promotion of commercial services provided by the Port and its users.

You may have legal form of foundation, association SA, or be integrated into the local Chamber of Commerce.

It can also be a virtual informal organization around a Portal electronic commerce on the Internet, on a PCS Port Community System.
2.22 Port Governance: Port Community System
1. Ports evolution
2. Port Governance
3. Competitive advantages
4. Present challenges

Donghai bridge, 321 km connecting the Yangshan Deep water port with Shanghai Port.
### 3.1 World ports and coasts

World Port Source provides interactive images, maps and contact information for 4,570 maritime and fluvial ports in 196 countries around the world.

<table>
<thead>
<tr>
<th>Region</th>
<th>Ports</th>
<th>Coasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>1.240</td>
<td>70.000</td>
</tr>
<tr>
<td>America</td>
<td>1.230</td>
<td>305.000</td>
</tr>
<tr>
<td>Asia</td>
<td>1.062</td>
<td>205.000</td>
</tr>
<tr>
<td>Africa + Aus</td>
<td>1.048</td>
<td>91.000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.570</strong></td>
<td><strong>671.000</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>%Coasts</th>
<th>%Ports</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>America</td>
<td>45.5%</td>
<td>26.9%</td>
<td>248km</td>
</tr>
<tr>
<td>Europe</td>
<td>10.5%</td>
<td>27.1%</td>
<td>56km</td>
</tr>
<tr>
<td>Asia</td>
<td>30.5%</td>
<td>23.2%</td>
<td>193km</td>
</tr>
<tr>
<td>Africa + Aus</td>
<td>13.5%</td>
<td>22.9%</td>
<td>86km</td>
</tr>
</tbody>
</table>

- **Maritime**: 3,408 (75%)
- **Fluvial**: 1,162 (25%)
- **Total**: 4,570
## 3.2 World ports: size and geography

<table>
<thead>
<tr>
<th>Type</th>
<th>Large</th>
<th>Medium</th>
<th>Small</th>
<th>Very Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coastal Natural</td>
<td>26</td>
<td>89</td>
<td>474</td>
<td>1596</td>
</tr>
<tr>
<td>2. Coastal Artificial</td>
<td>39</td>
<td>105</td>
<td>281</td>
<td>388</td>
</tr>
<tr>
<td>3. Coastal Tide gates</td>
<td>5</td>
<td>5</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>4. River Natural</td>
<td>25</td>
<td>59</td>
<td>248</td>
<td>518</td>
</tr>
<tr>
<td>5. River Basins</td>
<td>7</td>
<td>20</td>
<td>23</td>
<td>27</td>
</tr>
<tr>
<td>6. River Tide gates</td>
<td>7</td>
<td>14</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>7. Open Bay</td>
<td>18</td>
<td>17</td>
<td>97</td>
<td>450</td>
</tr>
<tr>
<td>8. Lake or Canal</td>
<td>3</td>
<td>6</td>
<td>26</td>
<td>32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4570</td>
<td>131</td>
<td>316</td>
<td>1181</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>2.8%</td>
<td>6.9%</td>
<td>25.9%</td>
</tr>
</tbody>
</table>

Source: adapted from National Geospatial-intelligence Agency (2005) World Port Index
3.3 World ports: density of maritime transport (2014)

Source: Shipping density data adapted from National Center for Ecological Analysis and Synthesis, A Global Map of Human Impacts to Marine Ecosystems.
3.4 Economy development and maritime transport
3.5 Port Positioning Strategy

To compete, a port must be able to rely on some competitive advantages, which are based on both internal and external factors.

Is defined in terms of the Strategy of the Port. In summary are mainly:

- Permanent reduction of costs (to balance inflation)
- Create value, to maintain current customers and attract new customers

3.6 Key Port success factors

1. Near to key global East-West sea routes: the main world route EAST-WEST: Shanghai, Singapore, Colombo, Suez, Malta, Algeciras, Gibraltar, Rotterdam New York, Panama, Los Angeles, Shanghai

2. Next to the main centres of production and consumption: Rotterdam, Tokyo, New York / New Jersey and Mumbai, Hamburg, Shanghai, Los Angeles

3. Physical conditions: right draft, sheltered waters surface, extensive adjoining land available..
## 3.7 Ports, drafts and Terminals

<table>
<thead>
<tr>
<th>Port, Country</th>
<th>Draft (m)</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manzanillo, Panama</td>
<td>13.0</td>
<td>SSA</td>
</tr>
<tr>
<td>MITH, Cagliari</td>
<td>14.0</td>
<td>Contship</td>
</tr>
<tr>
<td>Gioia Tauro, Italy</td>
<td>15.0</td>
<td>Contship + Maersk</td>
</tr>
<tr>
<td>Kitakyushu, Japan</td>
<td>15.0</td>
<td>PSA</td>
</tr>
<tr>
<td>Kwang Yang, S.Korea</td>
<td>15.0</td>
<td>Hanjin/Hyundai</td>
</tr>
<tr>
<td>Malta Freeport</td>
<td>15.5</td>
<td>Grand Alliance hub</td>
</tr>
<tr>
<td>Aden</td>
<td>16.0</td>
<td>PSA terminal</td>
</tr>
<tr>
<td>Algeciras, Spain</td>
<td>16.0</td>
<td>Maersk-Sealand</td>
</tr>
<tr>
<td>Colombo</td>
<td>16.0</td>
<td>P&amp;O Ports</td>
</tr>
<tr>
<td>Freeport, Bahamas</td>
<td>16.0</td>
<td>Hutchison Ports</td>
</tr>
<tr>
<td>Port Said, Egypt</td>
<td>16.0</td>
<td>ECT/Maersk-Sealand</td>
</tr>
<tr>
<td>Salalah, Oman</td>
<td>16.0</td>
<td>Maersk-Sealand</td>
</tr>
<tr>
<td>Tanjung Malaysia</td>
<td>16.0</td>
<td>Maersk-Sealand</td>
</tr>
<tr>
<td>Taranto, Italy</td>
<td>16.0</td>
<td>Evergreen terminal</td>
</tr>
<tr>
<td>Sines, Portugal</td>
<td>17.0</td>
<td>PSA terminal</td>
</tr>
<tr>
<td>Gijón</td>
<td>18.0</td>
<td>TCB (Barcelona)</td>
</tr>
<tr>
<td>Sepetiba, Brasil</td>
<td>18.5</td>
<td>Eurogate</td>
</tr>
</tbody>
</table>
3.8 Hinterland and Multimodal Corridor

Hinterland

City 1

- Inland port
- Multimodal Corridor
- Logistic Activity Zone
- Sea Port

City 2
3.9 Multimodal connection between markets

TRANSPORT Operators
- Road and Rail
- Maritime operators
- Cargo integrators
- Logistic operators
3.10 Port, Hinterland and Umland
3.11 Development factors pf the Ports

- **Globally**: international trade (which, in turn, depends on industrial production and consumption)
- A **waterfront scale**: the hinterland economy (industrial production and consumption)
- At the **port level**: competitiveness in an economy struggling to seize demand
- At the level of the **terminal operators**: efficiency and competitive advantage
- The demand for port services is increasingly influenced by demand conditions by itself and the supply of relevant services
3.12 Conditions of the demand for Port services

- Globally, demand is rigid and stable in the short term

- A facade port scale, demand is relatively rigid, but more sensitive to competition from other facades or groups of ports of the same hinterland potential suppliers

- At the level of ports and terminals and demand it is elastic and it plays an important role the possible replacement of others to perform services in another port or other terminal operator
2.5  Las Tecnologías de la Información

- Maritime infrastructure
  Access channels, breakwaters, ...
- Land infrastructure
  Piers, docks, ...
- Superstructures
  Facilities and equipment, cranes, ...
- Storage areas and services
  Avoiding bottlenecks
- Structural engineering
  Access roads, railway, ... (increased traffic)
3.14 Location of Port Regions in Europe

Multi-port gateway regions
1. Rhine-Scheldt Delta
2. Helgoland Bay
3. UK SE Coast
4. Spanish Med
5. Ligurian Range
6. Seine Estuary
7. Black Sea West
8. South Finland
9. Portugese Range
10. North Adriatic
11. Gdansk Bay
Ports in Europe:

- 1,240 ports
- 4,000 million Ton/year
- 400 million passengers
- 50% Small 1-10 MT/y
- 40% Medium 10-50 MT/y
- 10% Large 50+ MT/y
- 40% Public – State
- 40% Public – Region & City
- 20% Private or PPP
3.16 European Container Ports
3.17 European RO-RO and General cargo Ports
3.18 European Liquid and dry bulk Ports
## 3.19 European Ports: KPI Key Performance Indicators (2013)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Port, Country</th>
<th>Volume 2010 Million-TONs</th>
<th>Volume 2010 Million-TEUs</th>
<th>Profit Millions €</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rotterdam, Netherlands</td>
<td>429.96</td>
<td>11.14</td>
<td>154.00</td>
</tr>
<tr>
<td>2</td>
<td>Antwerp, Belgium</td>
<td>178.16</td>
<td>8.46</td>
<td>80.10</td>
</tr>
<tr>
<td>3</td>
<td>Hamburg, Germany</td>
<td>121.18</td>
<td>7.89</td>
<td>184.00</td>
</tr>
<tr>
<td>4</td>
<td>Amsterdam, Nederland</td>
<td>90.64</td>
<td>0.20</td>
<td>42.23</td>
</tr>
<tr>
<td>5</td>
<td>Algeciras, Spain</td>
<td>70.28</td>
<td>2.80</td>
<td>15.25</td>
</tr>
<tr>
<td>6</td>
<td>Le Havre, France</td>
<td>70.21</td>
<td>2.12</td>
<td>30.00</td>
</tr>
<tr>
<td>7</td>
<td>Bremen, Germany</td>
<td>68.69</td>
<td>4.88</td>
<td>55.00</td>
</tr>
<tr>
<td>8</td>
<td>Valencia, Spain</td>
<td>64.03</td>
<td>4.20</td>
<td>-6.00</td>
</tr>
<tr>
<td>9</td>
<td>Immingham, UK</td>
<td>54.00</td>
<td>0.11</td>
<td>35.85</td>
</tr>
<tr>
<td>10</td>
<td>Zeebrugge, Belgium</td>
<td>49.60</td>
<td>2.50</td>
<td>15.25</td>
</tr>
</tbody>
</table>
3.20 European Ports: technical and nautical services costs

<table>
<thead>
<tr>
<th></th>
<th>Bremen</th>
<th>Valencia</th>
<th>Amsterdam</th>
<th>Barcelona</th>
<th>Rotterdam</th>
<th>Gijón</th>
<th>Zeebrugge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1-Port dues</strong></td>
<td>3110</td>
<td>5700</td>
<td>3830</td>
<td>5850</td>
<td>3735</td>
<td>3931</td>
<td>880</td>
</tr>
<tr>
<td><strong>2-Pilotage</strong></td>
<td>13440</td>
<td>1620</td>
<td>7720</td>
<td>1790</td>
<td>8780</td>
<td>3214</td>
<td>6020</td>
</tr>
<tr>
<td><strong>3-Towage</strong></td>
<td>15760</td>
<td>17960</td>
<td>11400</td>
<td>15600</td>
<td>8440</td>
<td>11990</td>
<td>5020</td>
</tr>
<tr>
<td><strong>4-Mooring</strong></td>
<td>1080</td>
<td>1250</td>
<td>1720</td>
<td>710</td>
<td>1030</td>
<td>1249</td>
<td>610</td>
</tr>
<tr>
<td><strong>5-VTS</strong></td>
<td>130</td>
<td>480</td>
<td>1170</td>
<td>480</td>
<td>1100</td>
<td>490</td>
<td>420</td>
</tr>
<tr>
<td><strong>TOTAL €</strong></td>
<td>33,520</td>
<td>27,010</td>
<td>25,930</td>
<td>24,430</td>
<td>23,085</td>
<td>20,874</td>
<td>12,950</td>
</tr>
</tbody>
</table>

Port costs ('taxes or rates') comparison for the same vessel:

- Ro-Ro 200m length
- 21,000 dw-ton
- 56,000 gr-ton
- Call: 1 day

Other Port costs in specific ports:
- Security charge
- Waste management charge

Source: Port of Amsterdam – Study Service + Port of Gijon - R&D Dept.
World Port Source provides interactive images, maps and contact information for 4,570 maritime and fluvial ports in 196 countries around the world.

<table>
<thead>
<tr>
<th>Region</th>
<th>Ports</th>
<th>Coasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>1.240</td>
<td>70,000</td>
</tr>
<tr>
<td>America</td>
<td>1.230</td>
<td>305,000</td>
</tr>
<tr>
<td>Asia</td>
<td>1.062</td>
<td>205,000</td>
</tr>
<tr>
<td>Africa + Aus</td>
<td>1.048</td>
<td>91,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.570</strong></td>
<td><strong>671,000</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>%Coasts</th>
<th>%Ports</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>America</td>
<td>45.5%</td>
<td>26.9%</td>
<td>248km</td>
</tr>
<tr>
<td>Europe</td>
<td>10.5%</td>
<td>27.1%</td>
<td>56km</td>
</tr>
<tr>
<td>Asia</td>
<td>30.5%</td>
<td>23.2%</td>
<td>193km</td>
</tr>
<tr>
<td>Africa + Aus</td>
<td>13.5%</td>
<td>22.9%</td>
<td>86km</td>
</tr>
</tbody>
</table>
### 3.22 World Ports: KPI Key Performance Indicators (2013)

<table>
<thead>
<tr>
<th>RANK</th>
<th>PORT</th>
<th>COUNTRY</th>
<th>UNIT</th>
<th>TONS</th>
<th>TEUS</th>
<th>US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shanghai</td>
<td>China</td>
<td>MT</td>
<td>696.985</td>
<td>33.6</td>
<td>1.000</td>
</tr>
<tr>
<td>2</td>
<td>Singapore</td>
<td>Singapore</td>
<td>FT</td>
<td>560.888</td>
<td>32.5</td>
<td>930</td>
</tr>
<tr>
<td>3</td>
<td>Tianjin</td>
<td>China</td>
<td>MT</td>
<td>477.339</td>
<td>12.9</td>
<td>73</td>
</tr>
<tr>
<td>4</td>
<td>Guangzhou</td>
<td>China</td>
<td>MT</td>
<td>472.760</td>
<td>15.3</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>Qingdao</td>
<td>China</td>
<td>MT</td>
<td>450.111</td>
<td>15.5</td>
<td>483</td>
</tr>
<tr>
<td>6</td>
<td>Rotterdam</td>
<td>Netherlands</td>
<td>MT</td>
<td>440.464</td>
<td>11.6</td>
<td>217</td>
</tr>
<tr>
<td>7</td>
<td>Ningbo</td>
<td>China</td>
<td>MT</td>
<td>399.250</td>
<td>17.3</td>
<td>340</td>
</tr>
<tr>
<td>8</td>
<td>Port Hedland</td>
<td>Australia</td>
<td>MT</td>
<td>372.301</td>
<td>0.0</td>
<td>150</td>
</tr>
<tr>
<td>9</td>
<td>Dalian</td>
<td>China</td>
<td>MT</td>
<td>320.843</td>
<td>9.9</td>
<td>95</td>
</tr>
<tr>
<td>10</td>
<td>Busan</td>
<td>South Korea</td>
<td>RT</td>
<td>313.295</td>
<td>17.6</td>
<td>68</td>
</tr>
<tr>
<td>11</td>
<td>Hong Kong</td>
<td>China</td>
<td>MT</td>
<td>276.055</td>
<td>22.3</td>
<td>300</td>
</tr>
<tr>
<td>12</td>
<td>Qinhuangdao</td>
<td>China</td>
<td>MT</td>
<td>253.293</td>
<td>0.0</td>
<td>90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT</th>
<th>Description</th>
<th>US</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT</td>
<td>Metric Ton</td>
<td>US</td>
<td>1.000 kg</td>
</tr>
<tr>
<td>RT</td>
<td>Revenue Ton</td>
<td>UK</td>
<td>1.000 kg x 1 m³</td>
</tr>
<tr>
<td>FT</td>
<td>Freight Ton</td>
<td>US</td>
<td>1.000 kg x 40 ft³</td>
</tr>
</tbody>
</table>
### Economic data

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
<th>Traffics</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>US$ 3,000 m</td>
<td>Traffic total</td>
<td>653 mTon</td>
</tr>
<tr>
<td>Profits</td>
<td>US$ 1,000 m</td>
<td>Containers 31,7 MM-TEU</td>
<td>333.8 mTon</td>
</tr>
<tr>
<td>City</td>
<td>25 MM</td>
<td>Bulk, coal, iron</td>
<td>249.9 mTon</td>
</tr>
<tr>
<td>Density</td>
<td>3630 hab/km2</td>
<td>General Cargo</td>
<td>47.0 mTon</td>
</tr>
<tr>
<td>Hinterland</td>
<td>400 m</td>
<td>Oil, petroleum</td>
<td>25.3 mTon</td>
</tr>
</tbody>
</table>

### Ownership

- SIPG (PPP) 100%
- Municipality 44.23%
- Merchant Holding 26.54%
- Tongsheng Corp. 16.81%

---

#### Shanghai Port: KPI Key Performance Indicators (2012)

- **Passengers**: 10.6 mPax
- **Over the sea**: zanhe
- **Density**: 3630 hab/km²
- **Hinterland**: 1700km
- **Profits**: US$ 1,000 m
- **City**: 25 MM
- **Density**: 3630 hab/km²
- **Hinterland**: 400 m
1. Ports evolution
2. Port Governance
3. Competitive advantages
4. Present challenges
- Smart Port
- Containers Scanning
- Port Energy Management
- Long term Strategic Model
4.1 Smart Port

If SMART CITY is a new, emerging and evolving concept which rose the last years, SMART PORT is even newest, with no international accepted definition and with several parallel initiatives from both main international Ports and Sectoral Associations.

So this is a new land where nobody has the last word, so we will review the main current initiatives regarding Smart Ports and will offer the actual state-of-the-art, as well as some emerging trends which should help to clarify concepts.
## 4.2 UNCTAD Smart Port model

<table>
<thead>
<tr>
<th>1st Generation</th>
<th>2nd Generation</th>
<th>3rd Generation</th>
<th>4th Generation</th>
<th>5th Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanic Port</td>
<td>Container Port</td>
<td>EDI Port</td>
<td>Internet Port</td>
<td>Smart Port</td>
</tr>
<tr>
<td>Mechanical operation</td>
<td>Free Zone</td>
<td>International network</td>
<td>Global Network</td>
<td>ITS port</td>
</tr>
<tr>
<td>Handicraft works</td>
<td>Industrial area</td>
<td>Integrated centre</td>
<td>Port community</td>
<td>Logistic community</td>
</tr>
<tr>
<td></td>
<td>Free tax port</td>
<td>Commercial area</td>
<td>Logistic area</td>
<td>Smart City</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EDI services</td>
<td>Intermodal services</td>
<td>Smart Hinterland</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internet services</td>
<td>Multimodal services</td>
<td>Sustainable port</td>
</tr>
</tbody>
</table>

![Images of ports: 1st, 2nd, 3rd, 4th, 5th generations](image-url)
4.3 IMO Smart Port model

The IMO is another agency of the UN, it has no official definition of Smart Port, but the IMO Convention are in line to define a de-facto Smart Port model that meets their diverse agreements that allow them to send or receive vessels in an regulated framework named e-navigation. Ports that do not meet their standards, will be excluded from the main maritime port traffic circuits. The key ports related Conventions are: MARPOL – ISPS – ISM – PSC – SECA.
The European Union defined in 2014 it means for Smart City and Smart Community. Both definition we saw in the chapter on Smart Cities. As the Ports are considered a special case of a Smart Community, then they have to meet the same requirements that are asked for a Smart City, adapted to the port situation, European Smart Ports should be designed based on the following Regulations on Transport, Energy and ICT:

<table>
<thead>
<tr>
<th>TRANSPORT</th>
<th>ENERGY</th>
<th>ICT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Roadmap to a Single</td>
<td>• Sulphur Emission Control Area</td>
<td>• Intelligent Transport Systems</td>
</tr>
<tr>
<td>Directive 2013/1315</td>
<td>• Clean Power for Transport</td>
<td>• Electronic Single Windows</td>
</tr>
<tr>
<td>Trans European Network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Core Network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Core Network Corridors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Comprehensive Network</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.5 Smart Port mode from Ports

Like cities from the megalopolis to the rural village have embarked on projects called "Smart City" regardless of content or budgets, Ports also follow a similar path, from large international ports to the smallest local port, labeling as "Smart Port" any initiative, project or service that has any content or technological support, if belonging to their normal field of operations.

Many of the Smart Ports (projects) are in port cities, which in turn have a Smart City project that does not have included the port, focusing mostly in urban transport, but both projects should converge and cooperate where appropriate.
### PCS – Port Community System

Port Community System is an electronic trading platform A2A or A2B depending on the type of property and business of the Port Authority. It is a centralized Web services architecture to improve safety and reduce costs.

### PSW – Port Single Window

Port Single Window. There are two definitions and other technical legal. The first refers to a type platform A2B or B2B transactions along the lines of property and business of the Port Authority. The second I defined in European Directive 2010/65

### S&S – Safety and Security Services

Infrastructure safety and security of people are two critical services in transport. IMO regulations as ISM or ISPS apply to maritime transport, or technical standards such as ISO-28000, to improve security in international supply chains. The IMO conventions are mandatory for Ports worldwide.
### 4.7 Smart Port models

We can roughly identify 2 large approach to the Smart Port issue of emerging definition:

- Regulatory
- Technological

The first is based on policies supported by institutions such as IMO and EU, one issuing technical recommendations and the other with mandatory Directives.

The second is used by Ports itself and by the UNCTAD, both of them based on economy aims through the technology implementations.

Surely they will create in the coming years a common area of concepts and definitions of what will be a Smart Port.

<table>
<thead>
<tr>
<th>Top-down Regulatory approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMO Smart port</strong> (standardization)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(services)</th>
<th>(services)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ports</strong> Smart Port</td>
<td><strong>UNCTAD</strong> Smart Port</td>
</tr>
</tbody>
</table>

Technology approach

**Bottom-up**
4.8 Relationship Smart City, Smart Region and Smart Port
4.9 Smart Port projects

**Smart Port AMSTERDAM**

Amsterdam, a port that moves 90 MT/Y presents a model of "Smart Green Port" based on 3 axes: Environment, Intermodal and ICT. Its main business case, is the proximity to the airport Schipool, one of the largest in Europe, selling an interface port-airport, TO customers with mixed Dutch and German logistics services.

**Smart Port HAMBURG**

Hamburg is the 3rd European port for traffics, with 130 MT/Y and has a model of Smart Port-based on logistics services offered to both foreland and hinterland. Its area of influence is beyond Germany and reaches around the Baltic. Hamburg Smart Port 2025 project relies heavily on an intelligent ICT infrastructure and logistic services based on them.

**Smart Port SINGAPUR**

Singapore, a port 550 MT/Y since dropped from No. 1 to No. 3 in the last 10 years, by the thrust of the Chinese ports of Shanghai and Ningbo. PSA have a plan to return to the first place and is called Smart Port Singapore. They know they have no terrestrial hinterland, but one maritime, hence it business case is the development of the Maritime Intelligence & Shipping.
4.10 Smart Port projects

**Smart Port BARCELONA**
Barcelona port has 40 MT/Y, has made a re-interpretation of the services and ICT applications of last 15 years, and now presents them as a new model based on PORTIC, the Barcelona PCS, a A2B service that the Port Authority offers to its Port Community, to facilitate the formalities electronically, and adding any other technology based service.

**Smart Port ROTTERDAM**
Rotterdam is the 1st port by traffics in Europe, more than 400 MT/Y, but the 9th in the World, dominated the ports of China. Erasmus University and the Port of Rotterdam launched in 2010 the Smart Port Rotterdam Project, to connect knowledge management with new logistical services of the Port of Rotterdam. Sinchromodality began adding to port services The project is called "Rotterdam Port Quality 2025"

**Smart Port KANSAS**
KC SmartPort is the authority that manages the logistics services in the 18 counties of the State of Kansas moving 5 MT/Y. KC SmartPort promotes and enhances the status of the Kansas City region as a leading logistics center in USA. Their main argument is that Kansas business is the main logistics hub of Interior (inland port) at the junction of two river systems: Mississippi - Missouri, 4 interstate highways and the main rail hub of the Midwest USA.
### 4.11 Smart Port Platforms

<table>
<thead>
<tr>
<th><strong>ESPO</strong></th>
<th><a href="http://www.espo.be">http://www.espo.be</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>The European Sea Ports Organization was founded in 1993. It represents the port authorities, port associations and port administrations of the seaports of the Member States of the European Union and Norway. Has worked to develop a set of Port KPI in Operations and Environment.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>IPCSA</strong></th>
<th><a href="http://www.epcsa.eu/">http://www.epcsa.eu/</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCSA is the successor to the European Port Community Systems Association (ECPSA) launched in 2011 by 6 European-based Port Community System operators. IPCSA and its members play a vital role in global trade facilitation; the electronic communications platforms provided by Port Community Systems.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>IAPH</strong></th>
<th><a href="http://www.iaphworldports.org/">http://www.iaphworldports.org/</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>The International Association of Ports and Harbors (IAPH) adopted the new IAPH Vision and Mission Statements as well as the Objectives to achieve the Mission. The 2015 Conference held in Hamburg Port was dedicated to develop the Smart Port concept.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>AIVP</strong></th>
<th><a href="http://www.aivp.org">http://www.aivp.org</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>AIVP, the worldwide network of Port-Cities, is the international organization that since 1990 has been bringing together all the public and private development stakeholders in port cities. The Conference 2014 held in South Africa was dedicated to Smart Ports &amp; Smart Cities.</td>
<td></td>
</tr>
</tbody>
</table>
- Smart Port
- Containers Scanning
- Port Energy Management
- Long term Strategic Model
4.12 Containers Scanning: Port Safety and Security

Why High Volume Scanning?

- Mega-volumes demand new inspection concepts.
- Export (Outbound) scanning requires other concepts than Import (Inbound) scanning.
- When integrated in the logistics, high volume scanning can be the most efficient scanning concept.
- Required Technology is available.
Traditionally, Customs administrations inspect cargo once it has arrived at their domestic ports. Today, there must be an ability to inspect and screen a container before it arrives.

The Customs administration should conduct outbound security inspection of high-risk containers at the reasonable request of the importing country.
Advantages High Volume Scanning

- New technology allows for Integration in the Logistics: No extra moves. No delay.
- Data sharing (WCO principle): All possible scanning-picture selections will be available for Customs of exporting AND importing country.
- Second-line inspection (stripping, high energy x-ray) can be more effective (higher hit-rate).
- Opportunities for third parties to add private systems.
Our Vision:
Inspections integrated in Logistics

Rotterdam Automated Container Inspection Lane
Joint project of Customs, Port Authority and Port Business
4.16 Containers Scanning: Automated truck lanes
Flow of export containers
- from hinterland to the sea -

4.17 Containers Scanning: containers flow
4.18 Port of Rotterdam: objective to move 30 MM TEU

2013: Maasvlakte 2
4 new terminals, growing to 30M TEU

Ambition: advanced and efficient inspections
- Smart Port
- Containers Scanning
- Port Energy Management
- Long term Strategic Model
4.19 Port energy efficiency procedure

**Energy efficiency assessment**
- Development of an energy mapping and consumption assessment methodology
- Mapping of port operations and associated processes
- Energy consumption assessment of port activities
- Identification of main energy consumers at each port
- Ports’ needs for energy efficiency
- Identification of SMEs involvement

**Port energy plans**
- Energy management vision, goals and objectives
- Energy policies, standards and regulations
- Summary of the main energy consumption assessment data
- Ports’ energy needs and measures for improvement
- Criteria for selecting energy improving measures
- Measures to be adopted
- Timeline and responsibilities

**Technology validation and transferability**
Description and assessment of measures in each port considering the following technologies:
1. Biomass
2. Marine heat pump
3. Cold ironing
4. Marine currents
5. Wind technology
6. Geothermal heat pump
7. Natural gas
8. Hybrid technologies
9. Hydrogen
10. Tidal technology
11. Photovoltaic solar
12. Solar thermal
13. Wave technology

**Pilot design and implementation**
Pilot projects under implementation focus on the following categories:
- **Port Services (technical – nautical)**
  - Ports of Rijeka and Marseille
- **Cruises and Ferries**
  - Ports of Livorno and Venice
- **Port Equipment**
  - Ports of Valencia and Koper
4.20 Generic energy mapping in Ports from demand side

* According to ISO 50001 & CEN 16258

**LEVEL 1**
(Total Energy Consumption)

- Direct Fuel Consumption

**LEVEL 2**
(Process Blocks)

- Purchased Electricity
  - Technical/Nautical
  - Terminal Oriented
  - General Purpose (e.g., Lighting)

**LEVEL 3**
(Per service/output unit)

- Operations
  - Support/Maintenance functions
    - Ship supplies
    - Ship wastes
    - Equipment/Port fleet maintenance
    - Other

- Buildings
  - Administration (PA, Customs etc)/Client Services
  - Staff
  - Maintenance/Repair
  - Closed storage/warehouses
  - Other

- Pilotage
- Towage
- Mooring
- Seaside (Quay/Loading-Unloading)
- Quay to storage
- Storage
- Receipt/Delivery
- Gate
- Empty storage (in and off terminal)
4.21 Port energy mapping and consumption assessment

Level 2
Port activities

PORT / BERTH GREEN PRACTICES

DISAGREGATE PORT FUNCTIONS

WATERSIDE
(Nautical / Technical)
Infrastructure and equipment for the following processes:
- Vessel Announcement
- Pilotage
- Towage
- Berthing
- Mooring

INTRA-TERMINAL
Infrastructure, equipment, processes for the following types of terminals:
- Container terminal
- General Cargo
- Ro-Ro
- Car terminal
- Dry Bulk
- Liquid Bulk
- Special Cargo

LANDSIDE
Processes for different types of terminals and by mode of transport:
- Truck
- Rail
- Inland Waterways

Energy Consumption

Processes affecting waterside
4.22 Process for developing port energy management plan

- Energy Mapping
- Gap Analysis
- Findings / Preliminary Recommendations
- KPIs / Benchmarking
- Focus Groups
- Energy Management Plans
- Energy Re-engineering
- Calculation
- Reporting
- Management

- Benchmarking KPIs
- Traffic Demand Dependent
- Energy Demand vs Energy Supply (micro grids / Virtual Power Plants)
4.23 Port Energy Management Plan

- Targets set
  - At international, EU, national, regional and port level
  - Per type of energy (fuel, electricity, etc.)
  - Per terminal
  - Focusing on the main port energy consumers

- Energy management vision, goals and objectives
  - Energy policies, regulations and standards
  - Summary of main energy consumption data
  - Energy needs and potential measures for improvement

- Timeline and responsibilities for plan adoption and implementation
  - Selection of measures to be adopted
    - Selection criteria for energy improving measures
      - 1. Timeframe
      - 2. CO2 emissions reduction
      - 3. Total cost
      - 4. Cost effectiveness
      - 5. Technical feasibility
      - 6. Implementability
      - 7. Measurable results
      - 8. Co-benefits
      - 9. Funding opportunities
      - 10. Enforceability
4.24 Technology validation and transferability

Port energy management plan → Identification of promising energy improving measures

Main result

Estimation of:
- Investment costs
- Energy and environmental savings
- Payback period

Criteria:
1. GHG emissions reduction
2. Degree of complexity
3. Availability of resources
4. Needed capacity
5. Economical investment
6. Payback period
7. Barriers for implementation (normative)
8. Barriers for implementation (port organization)

Analysis of relevant available technologies → Technology assessment → Pilot testing of selected technology

Technological fields:
1. Biomass
2. Marine heat pump
3. Cold ironing
4. Marine currents
5. Wind technology
6. Geothermal heat pump
7. Natural gas
8. Hybrid technologies
9. Hydrogen
10. Tidal technology
11. Photovoltaic solar
12. Solar thermal
13. Wave technology

Considering
- Smart Port
- Containers Scanning
- Port Energy Management
- Long term Strategic Model
4.25 Port of Rotterdam: Strategic Model 2030

1_Starting point: The Port in 2011
Analysis of trends & developments
The port operates on an international playing field. It is vital to identify and understand the global developments affecting the port, so that opportunities can be seized and risks dealt with adequately and promptly. The analysis of trends and developments serves as the starting point for the Port Strategic Model.

Forecasting
Based on the analysis of trends and developments, macroeconomic scenarios from the European Commission can be selected. Using the Global Economy, European Trend, High Oil Price and Low Growth scenarios, long-term calculations can be made for the potential size and makeup of freight passing through the port.
4.27 Port of Rotterdam: analysis of the key factors
4.28 Port of Rotterdam: analysis of the key factors
The ambitions presented in the Port Vision are not limited. The Port Vision is part of an orientation in spatial planning and socio-economic development that is widely supported. Further strengthening and innovating Rotterdam Mainport is a widely shared ambition of the European Commission, the Dutch government, regional and local governments, the business community and knowledge institutions. All of these organizations agree that the economic power of the Rotterdam region, and by extension also of the Netherlands, lies in the existence of a world class maritime and logistics network.
Two extreme, idealized future prospects were drawn up for the future port in Rotterdam as a super-efficient logistics hub and Rotterdam as a centre of sustainable industry based on innovation and quality. Both prospects are extreme pictures of a future that probably will never become reality. They show a point ‘behind’ the horizon; an aid in identifying what needs to be done to achieve the thriving port we want for the future.
Seaports development