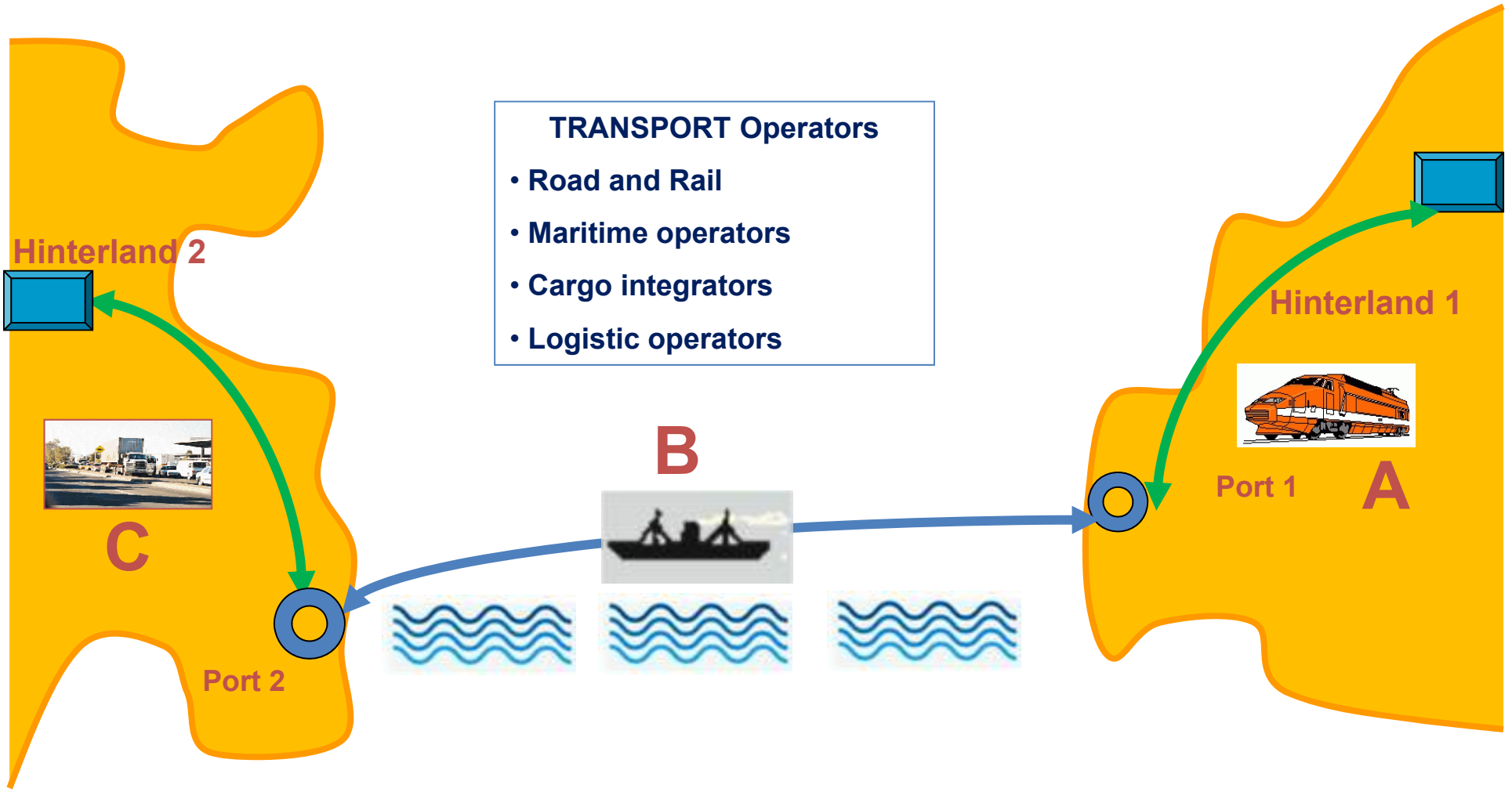
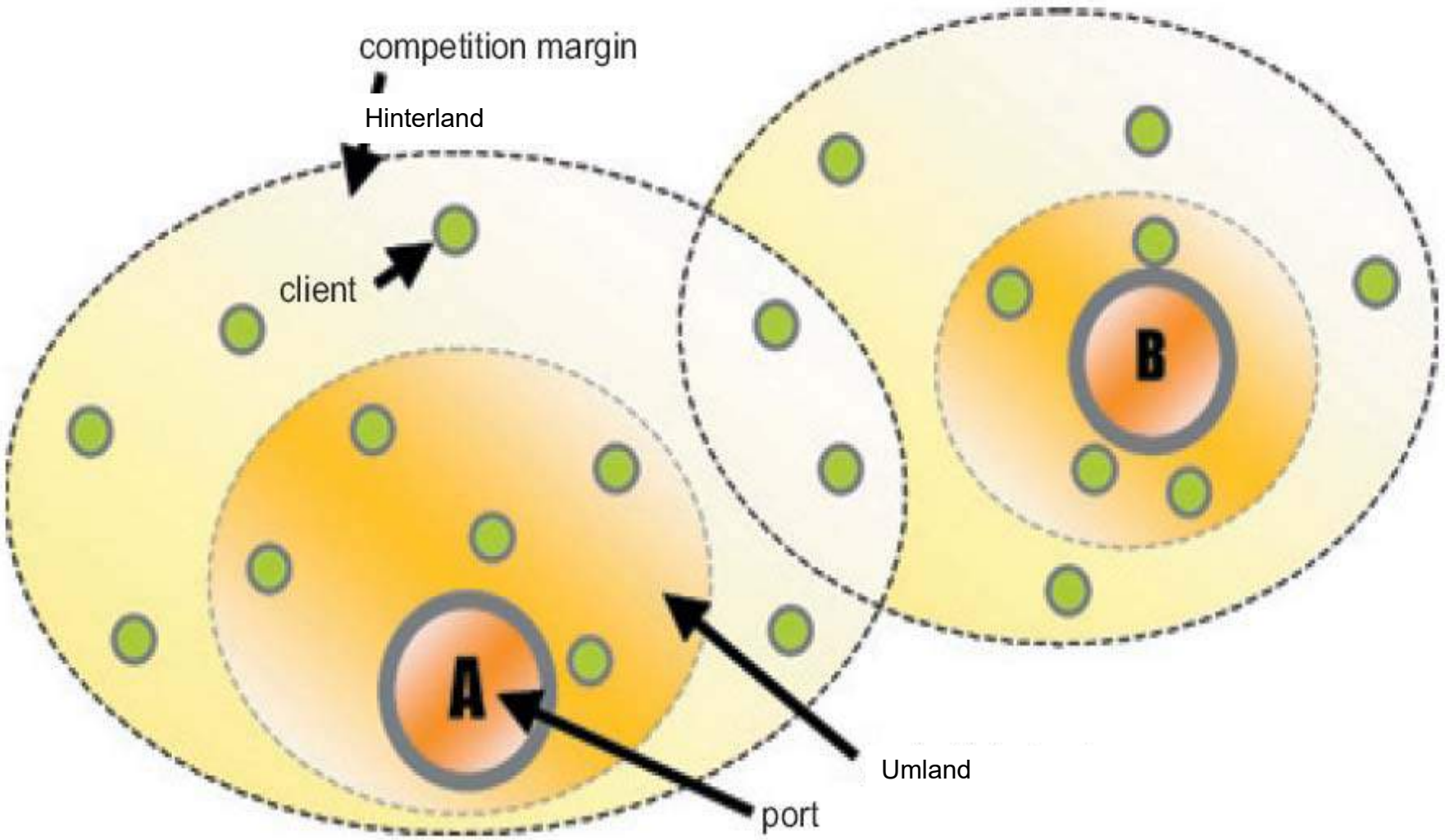
3.9 Multimodal connection between markets

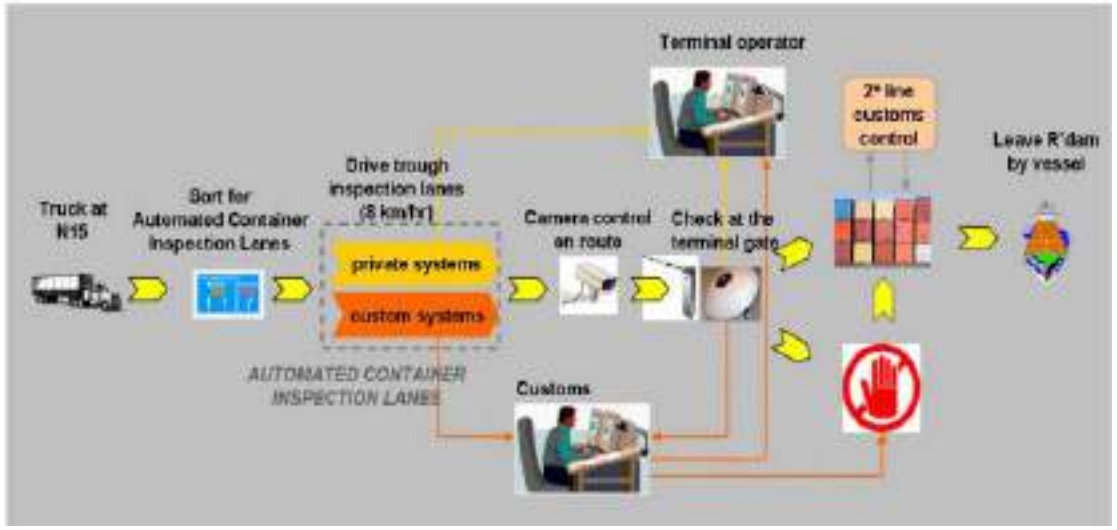


3.10 Port, Hinterland and Umland



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



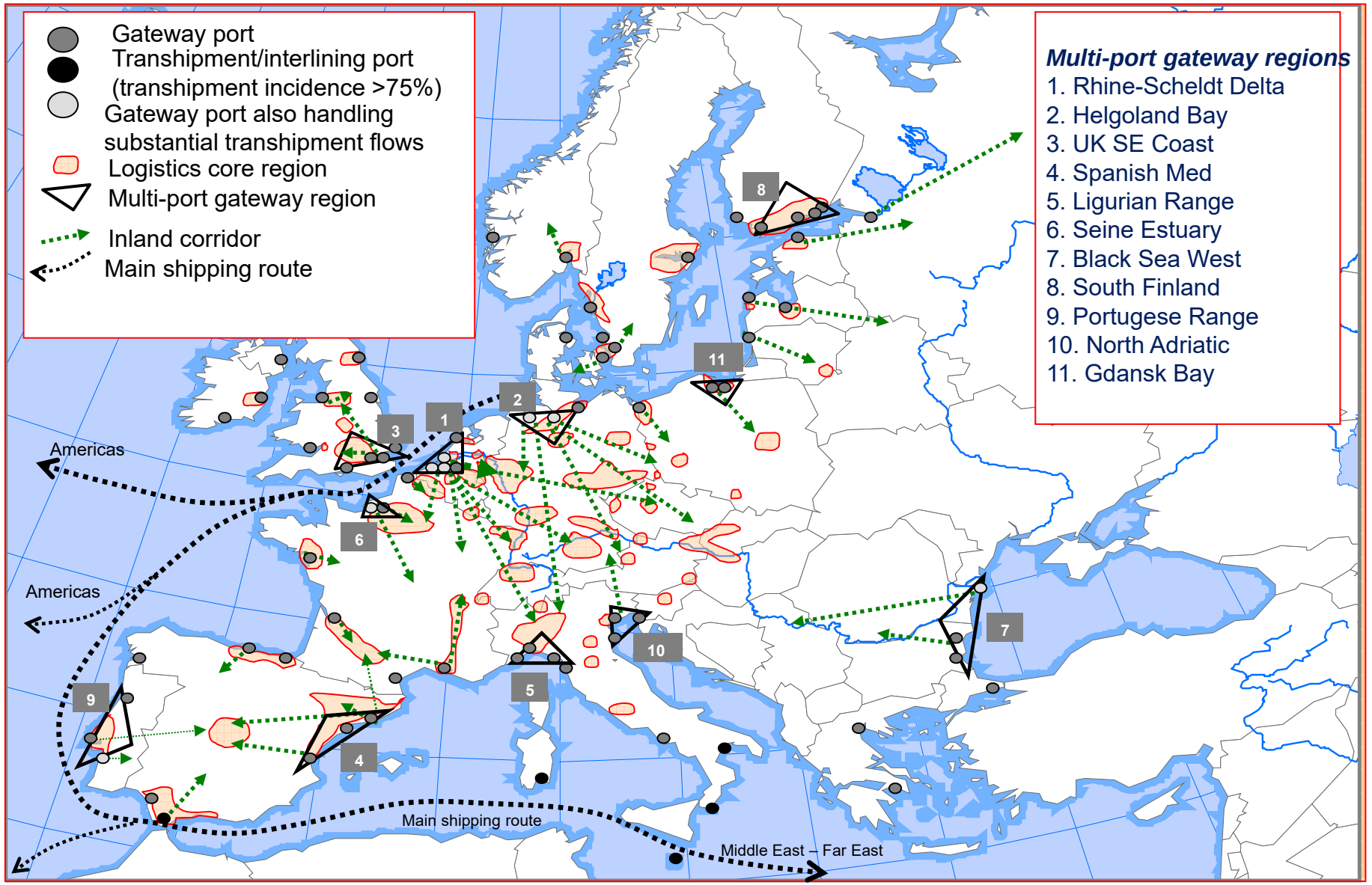
3.12 Conditions of the demand for Port services

- 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

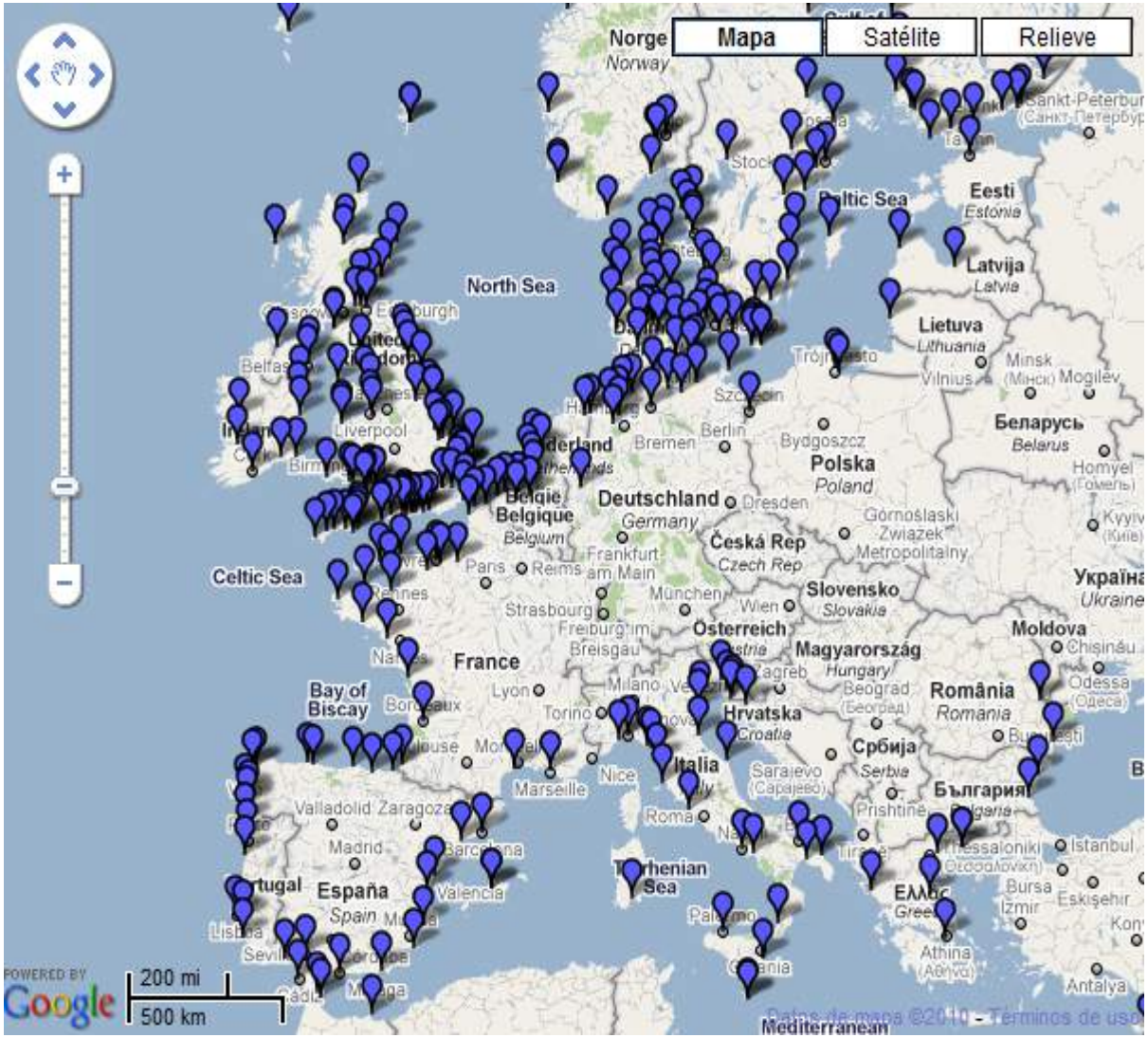
3.13 Inter – Port competition and port development

- 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



3.15 European Ports



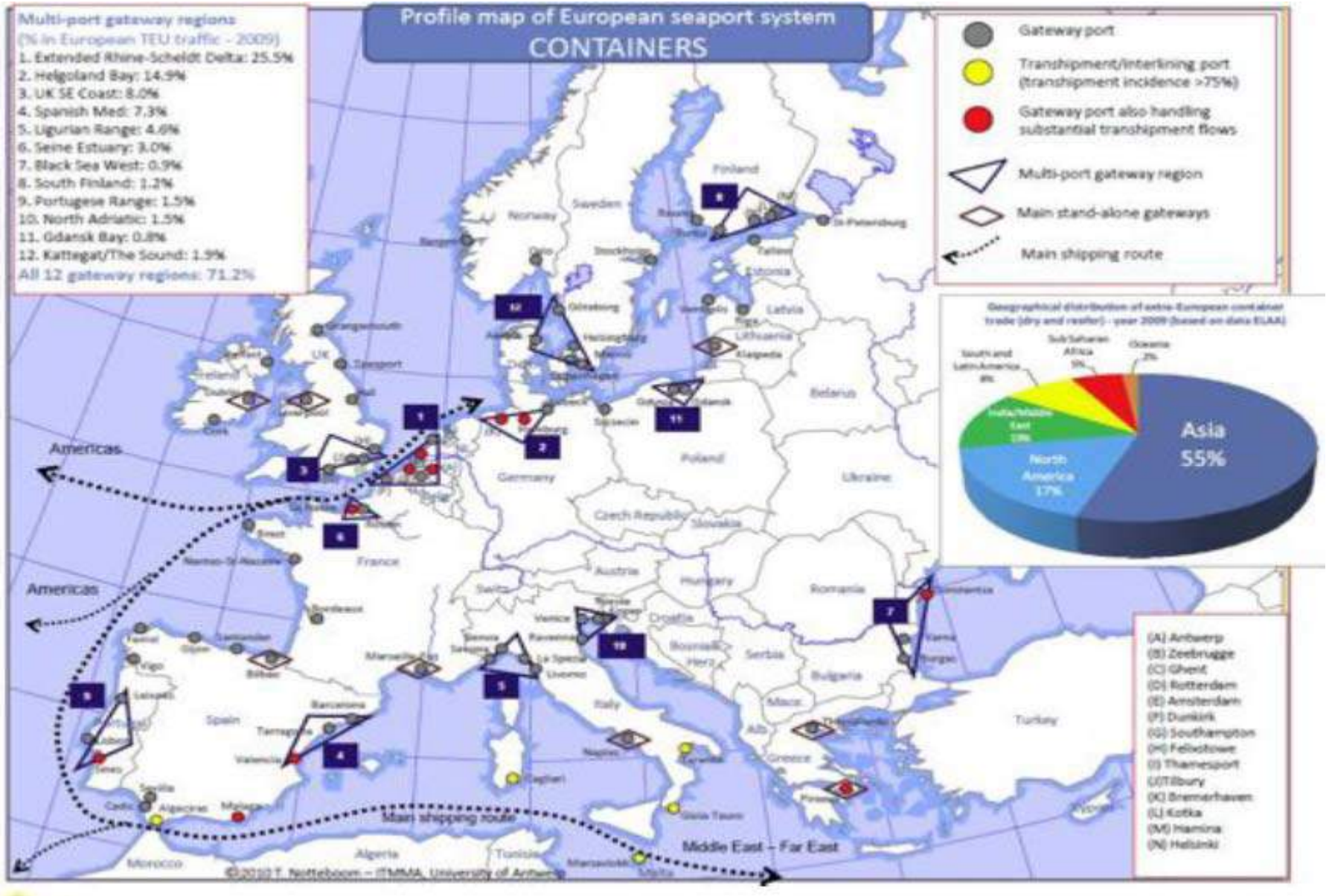
Ports in Europe:

- 1,240 ports
- 4,000 million Ton/year
- 400 million passengers

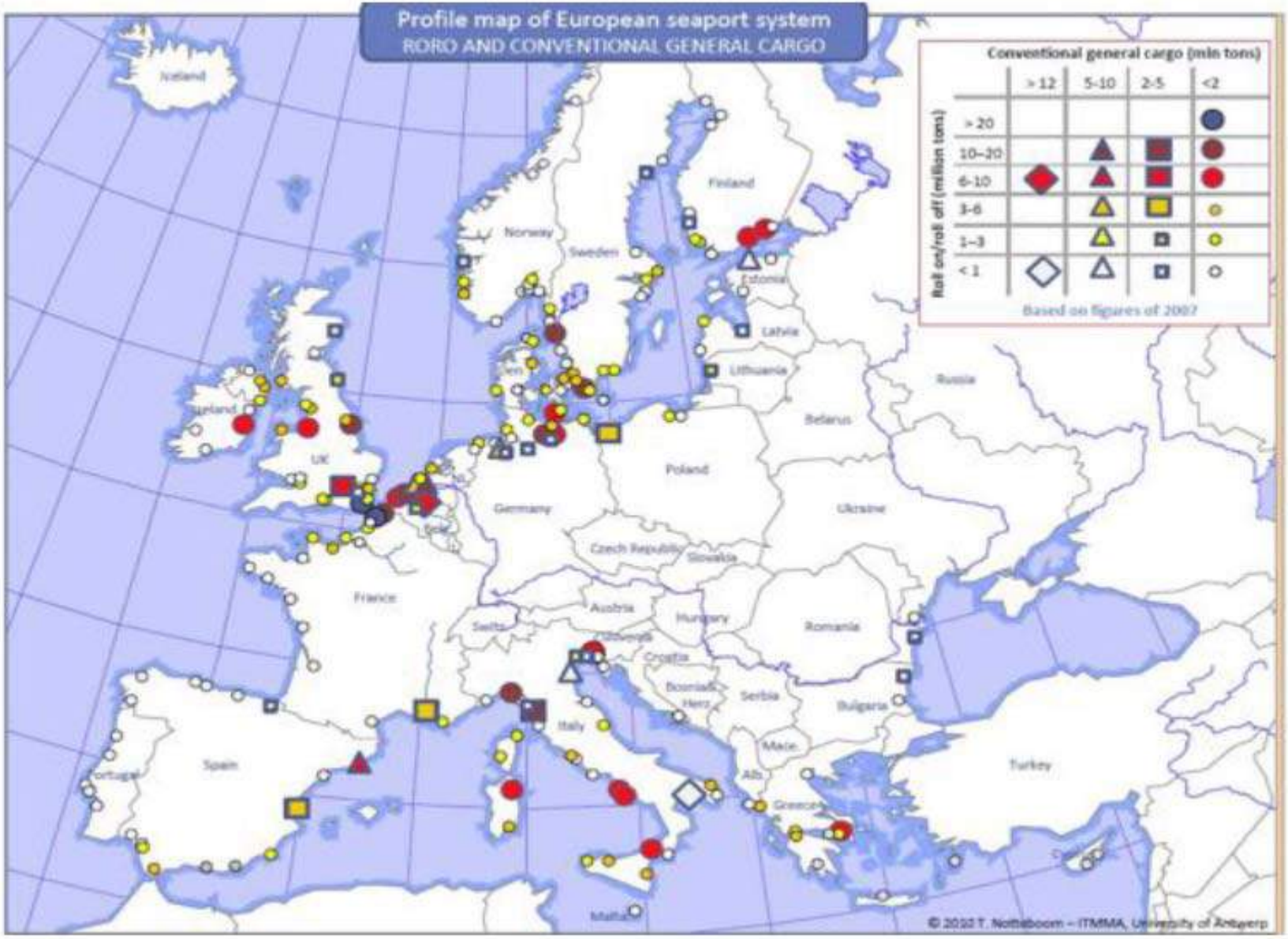
- 50% Small 1-10 MT/y
- 40% Medium 10-50 MT/y
- 10% Large 50+ MT/y

- 40% Public – State
- 40% Public – Region & City
- 20% Private or PPP

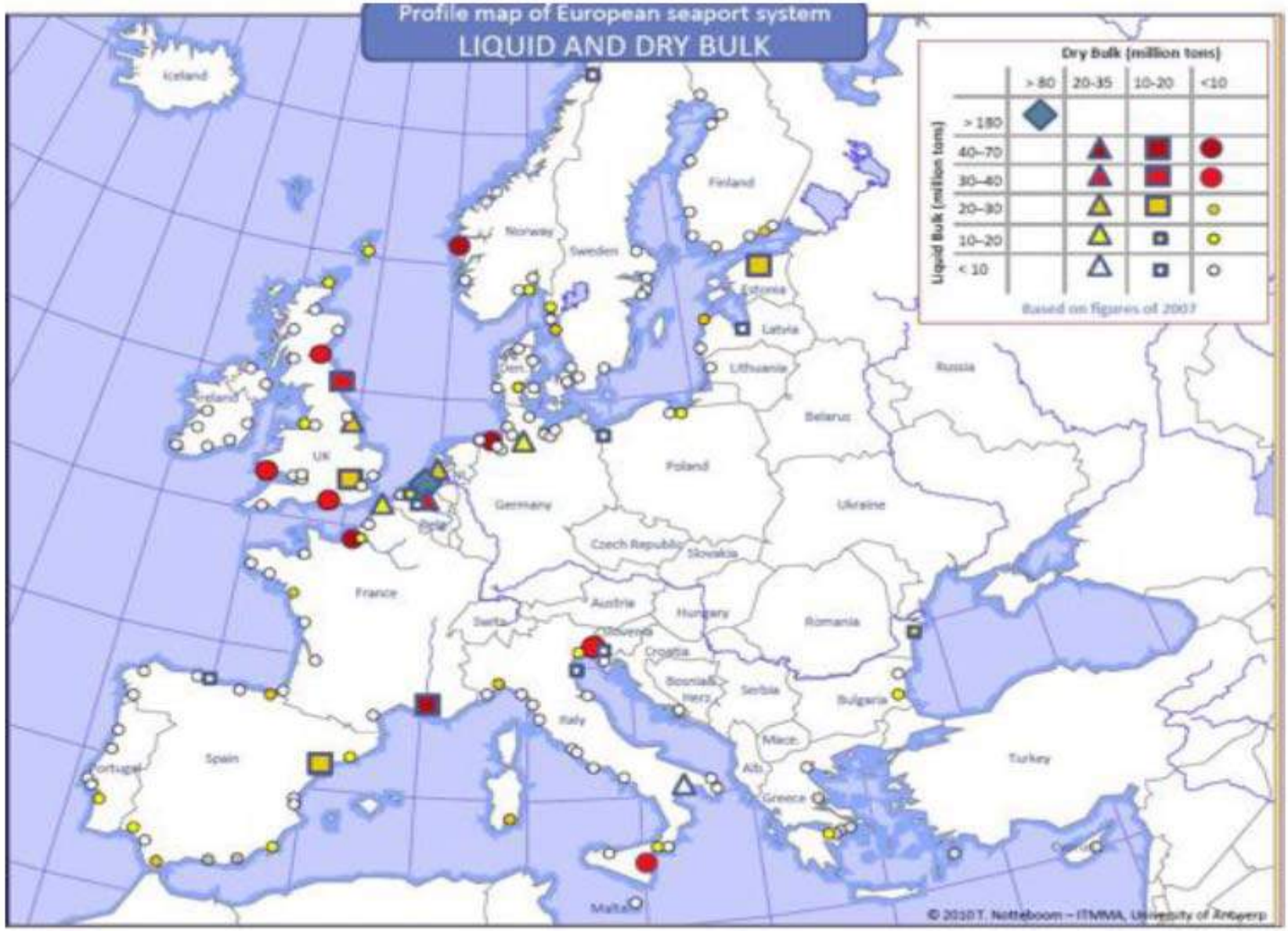
3.16 European Container Ports



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)

Rank	Port, Country	Volume 2010 Million-TONs	Volume 2010 Million-TEUs	Profit Millions €
1	Rotterdam, Netherlands	429.96	11.14	154.00
2	Antwerp, Belgium	178.16	8.46	80.10
3	Hamburg , Germany	121.18	7.89	184.00
4	Amsterdam, Netherland	90.64	0.20	42.23
5	Algeciras , Spain	70.28	2.80	15.25
6	Le Havre, France	70.21	2.12	30,00
7	Bremen , Germany	68.69	4.88	55.00
8	Valencia , Spain	64.03	4,20	-6.00
9	Immingham, UK	54.00	0.11	35.85
10	Zeebrugge , Belgium	49.60	2.50	15.25

1- Rotterdam Port

3- Antwerp Port

6- Hamburg Port

3.20 European Ports : technical and nautical services costs

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

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.

3.21 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

Maritime	3.408	75%
Fluvial	1.162	25%
Total	**4.570**	

	America	Europe	Asia	Africa + Aus
%Coasts	45.5%	10.5%	30.5%	13.5%
%Ports	26.9%	27.1%	23.2%	22.9%
average	248km	56km	193km	86km

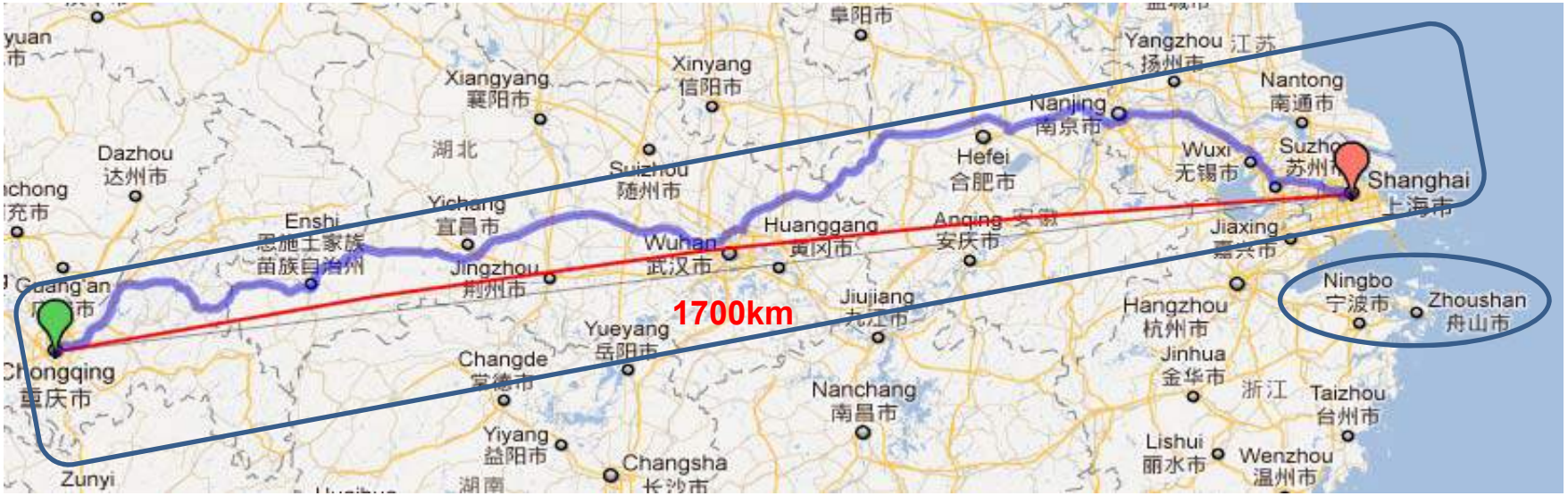
Region	Ports	Coasts
Europe	1.240	70.000
America	1.230	305.000
Asia	1.062	205.000
Africa+ Aus	1.048	91.000
Total	**4.570**	**671.000**

3.22 World Ports : KPI Key Performance Indicators (2013)

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

MT	Metric Ton	US 1.000 kg
RT	Revenue Ton	UK 1.000 kg x 1 m3
FT	Freight Ton	US 1.000 kg x 40 ft3

3.23 Shanghai Port : KPI Key Performance Indicators (2012)

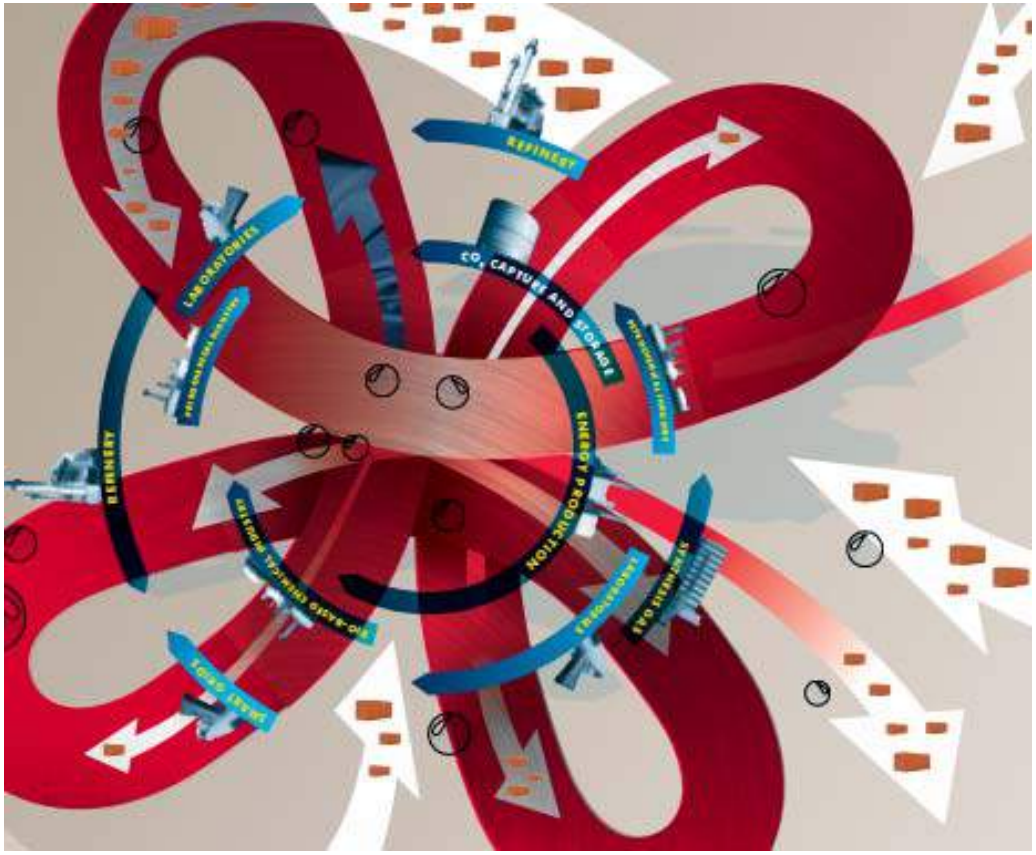


Economic data		Traffics			Ownership	
Income	US$ 3,000 m	Traffic total	653 mTon	100%	SIPG (PPP)	
Profits	US$ 1,000 m	Containers 31,7 MM-TEU	333.8 mTon	51%	Municipality	44.23%
City	25 MM	Bulk , coal, iron	249.9 mTon	38%	Merchant Holding	26.54%
Density	3630 hab/km2	General Cargo	47.0 mTon	7%	Tongsheng Corp.	16.81%
Hinterland	400 m	Oil, petroleum	25.3 mTon	4%		
		Passengers	10.6 mPax			

Shanghai	Over the sea	上海 *zanhe*				

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

1st Generation	2nd Generation	3rd Generation	4th Generation	5th Generation
-----/1940	1960	1980	2000	2020
Mechanic Port	**Container Port**	**EDI Port**	**Internet Port**	**Smart Port**
Mechanical operation	Free Zone	International network	Global Network	ITS port
Handicraft works	Industrial area	Integrated centre	Port community	Logistic community
	Free tax port	Commercial area	Logistic area	Smart City
		EDI services	Intermodal services	Smart Hinterland
			Internet services	Multimodal services
				Sustainable port

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.

4.4 EU Smart Port model

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:

TRANSPORT	ENERGY	ICT
COM 2011(144) • Roadmap to a Single European Transport Area Directive 2013/1315 Trans European Network • Core Network • Core Network Corridors • Comprehensive Network	Directive 2013/33 • Sulphur Emission Control Area Directive 2014/94 • Clean Power for Transport	Directive 2010/40 • Intelligent Transport Systems Directive 2010/65 • Electronic Single Windows

4.5 Smart Port mode from Ports

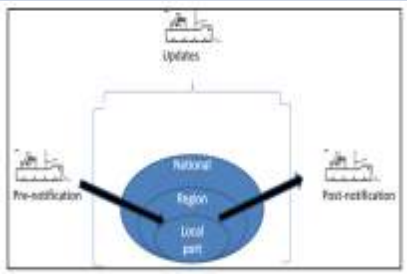
Like cities from the megalopolis to the rural village have embarked on projects called "Smart City" regardless of content or budgets Ports also follow a similar path, from large international ports to the smallest local port , labeling as "Smart Port" any initiative, project or service that has any content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

4.6 Smart Port internal services

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 l 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

Top-down
Regulatory approach

IMO Smart port
(standardization)

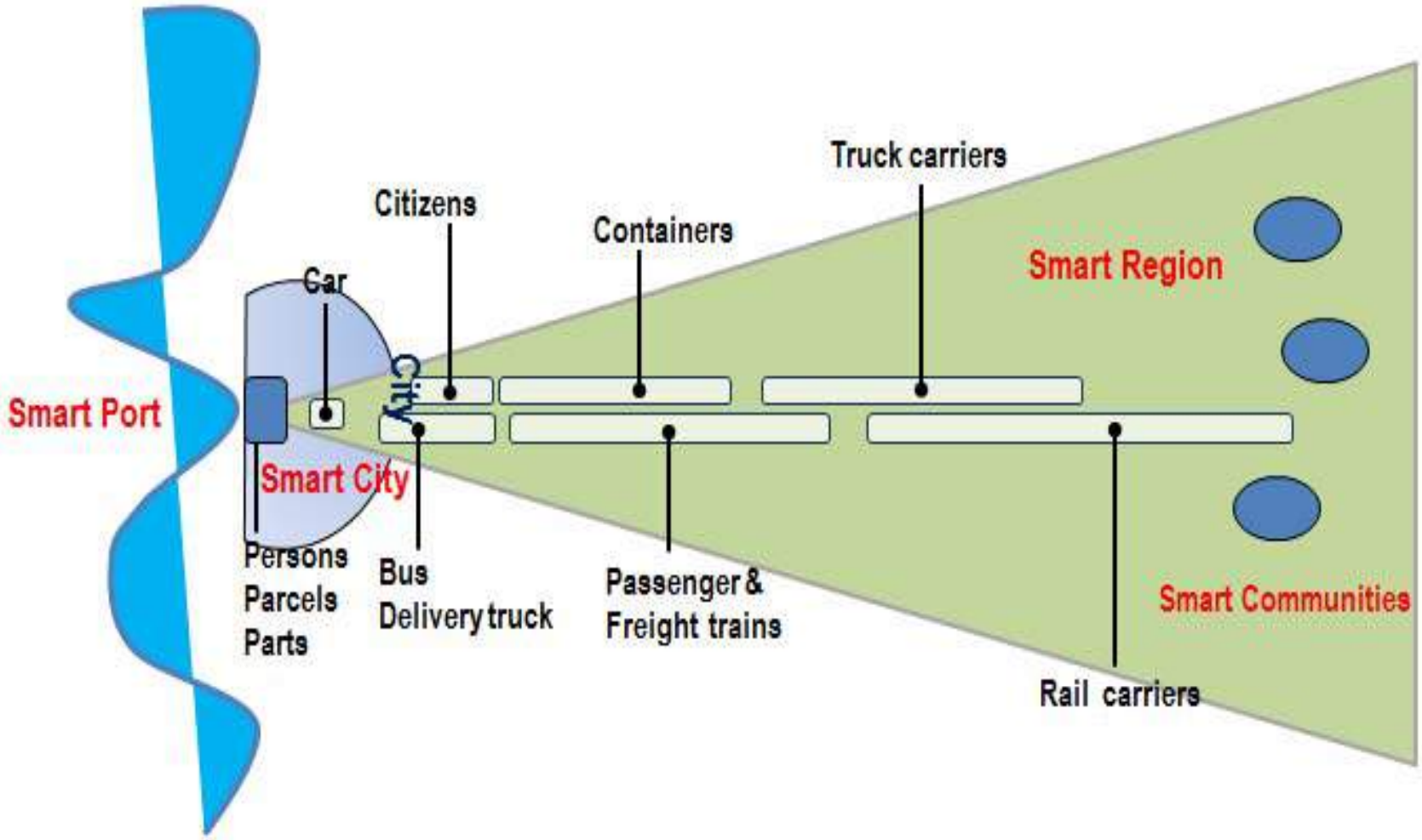
EU Smart port
(regulation)

(services)
Ports Smart Port

(services)
UNCTAD Smart Port

Technology approach
Bottom-up

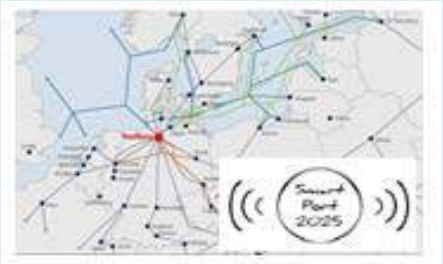
4.8 Relationship Smart City , Smart Region and Smart Port



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"

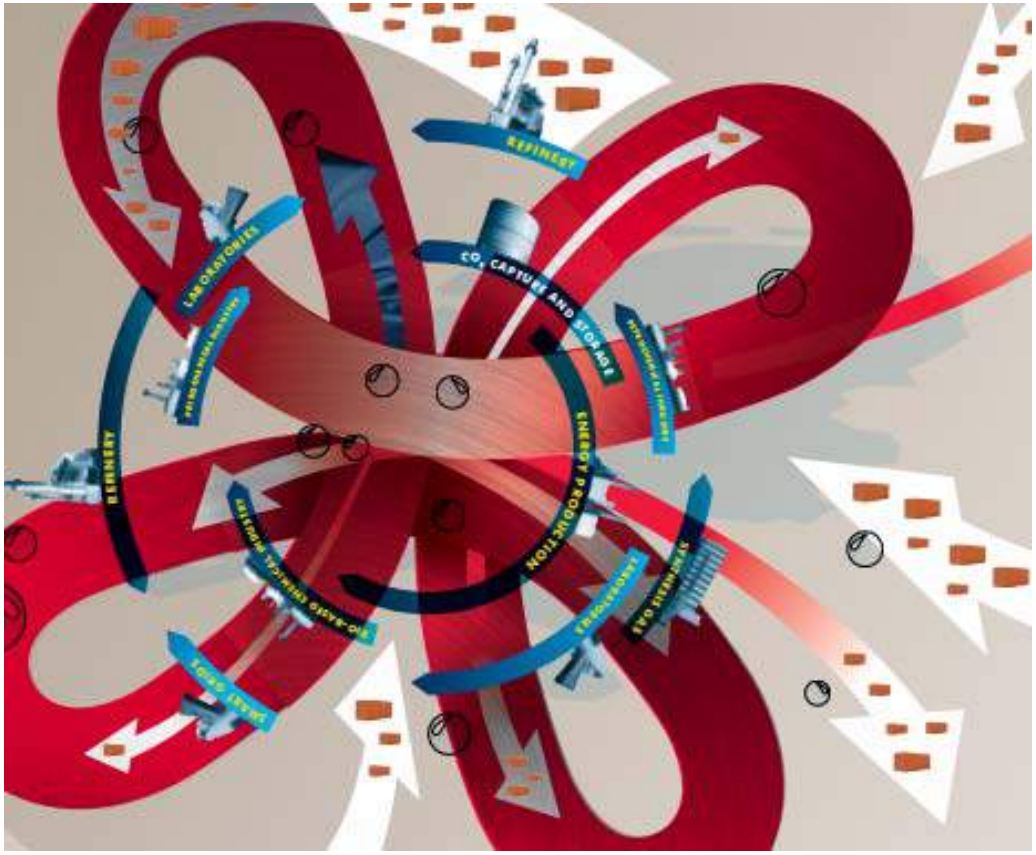
Smart Port KANSAS

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

	http://www.espo.be 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 p of Port KPI in Operations and Environment.
	http://www.epcsa.eu/ IPCSA is the successor to the European Port Community Systems Association (ECPSA) launched in 2011 by 6 l 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 .
	http://www.iaphworldports.org/ 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.
	http://www.aivp.org 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 & Smart Cities.

- Smart Port
- Containers Scanning
- Port Energy Management
- Long term Strategic Model




Why High Volume Scanning?
Port of Rotterdam
Mega-volumes demand new inspection concepts.
Global trend towards increase in Export scanning (WCO Framework, US-Policy).
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.

4.13 Containers Scanning : Port Safety and Security


Advantages High Volume Scanning
Port of Rotterdam
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.

4.15 Containers Scanning : integrated inspection

Our Vision:
Inspections integrated in Logistics

Port of Rotterdam

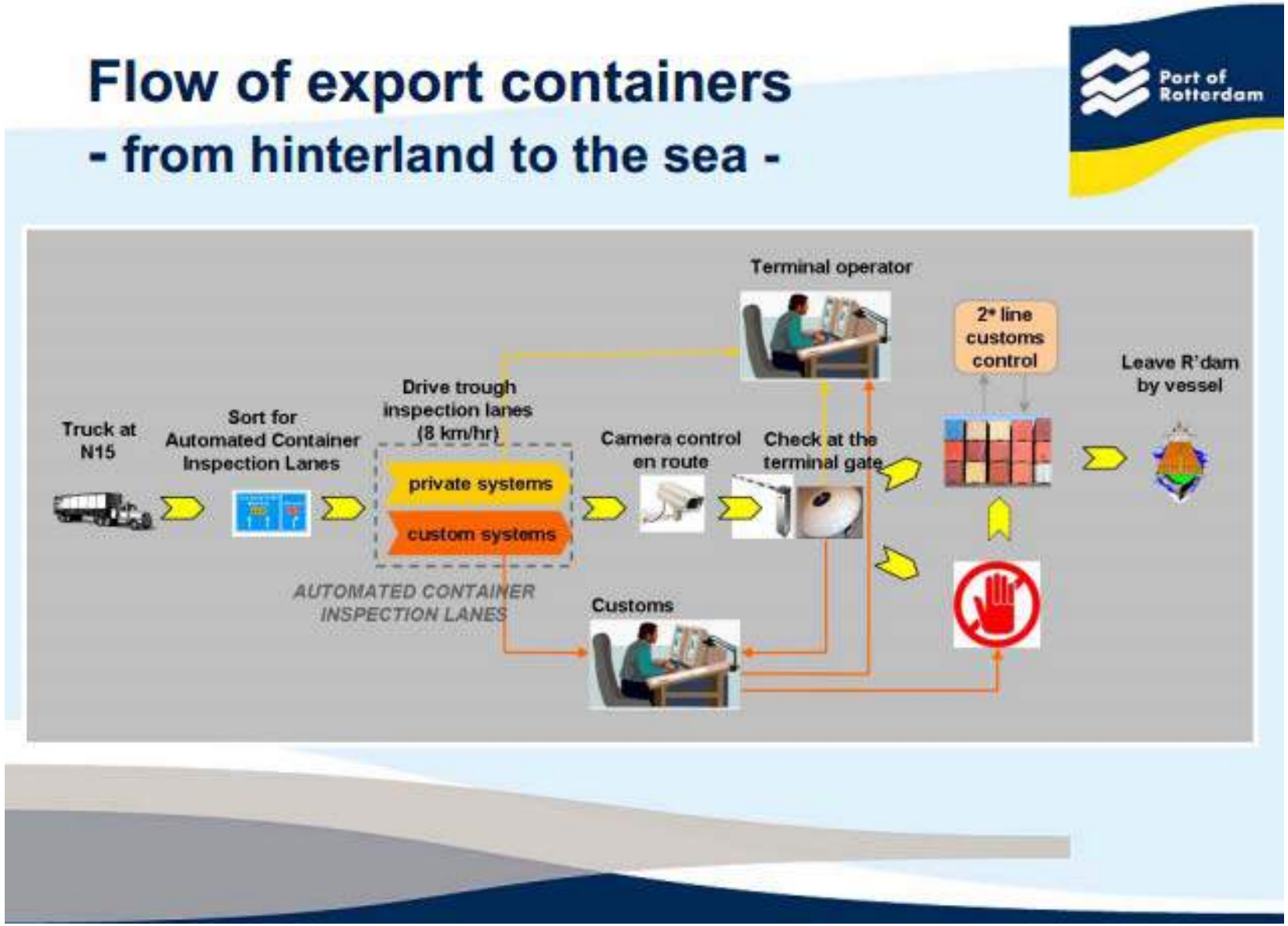
Rotterdam Automated Container Inspection Lane
Joint project of Customs, Port Authority and Port Business

Automated Container Inspection Lanes

Port of Rotterdam

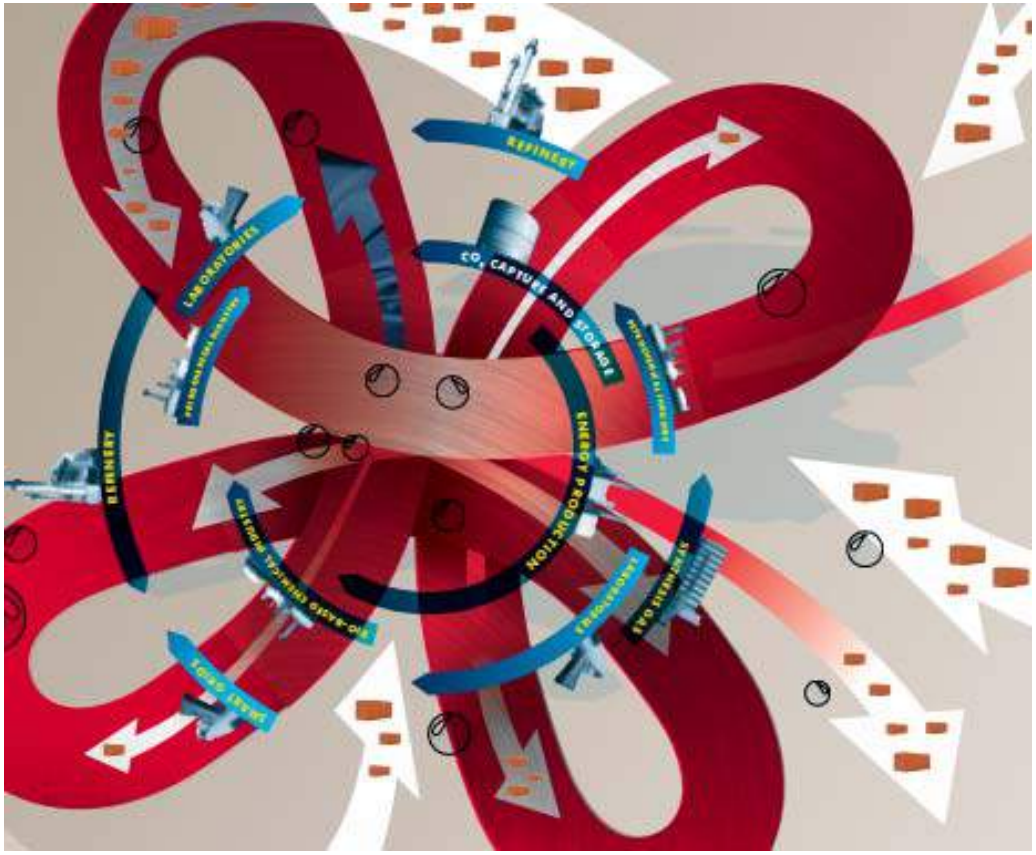
Rotterdam Automated Container Inspection Lane
Joint project of Customs, Port Authority and Port Business

4.17 Containers Scanning : containers flow

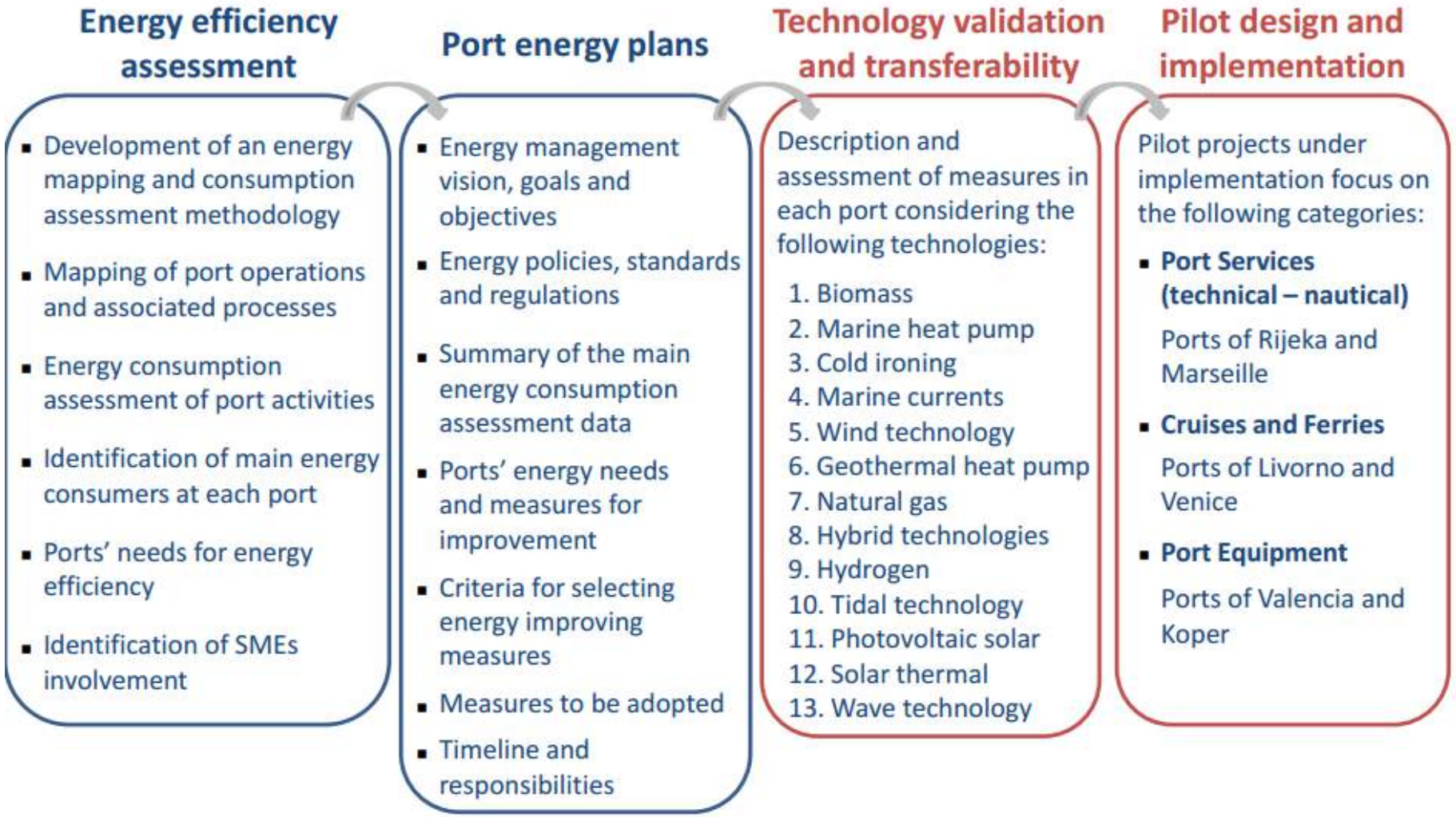


4.18 Port of Rotterdam : objective to move 30 MM TEU

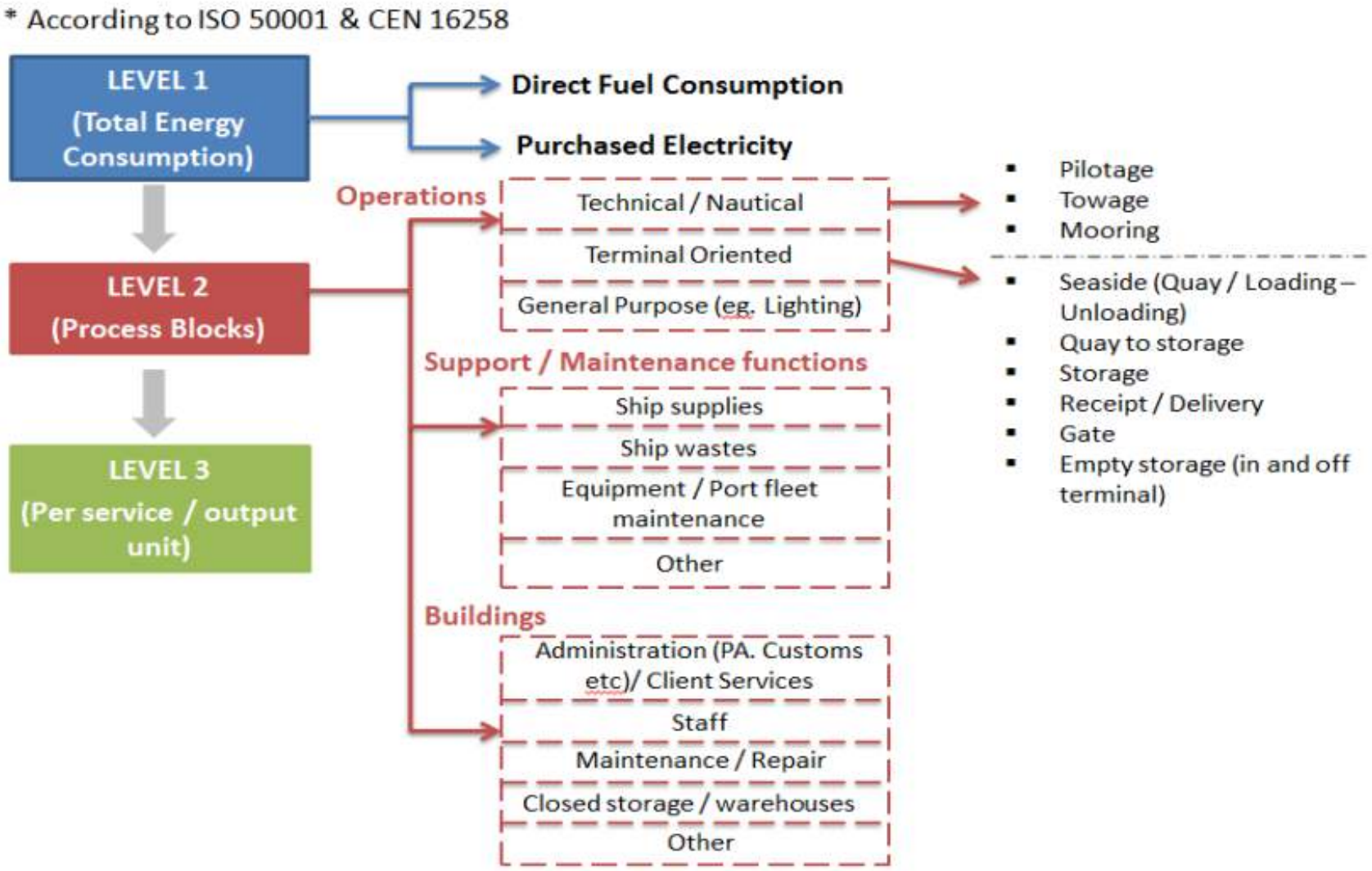
- Smart Port
- Containers Scanning
- Port Energy Management
- Long term Strategic Model



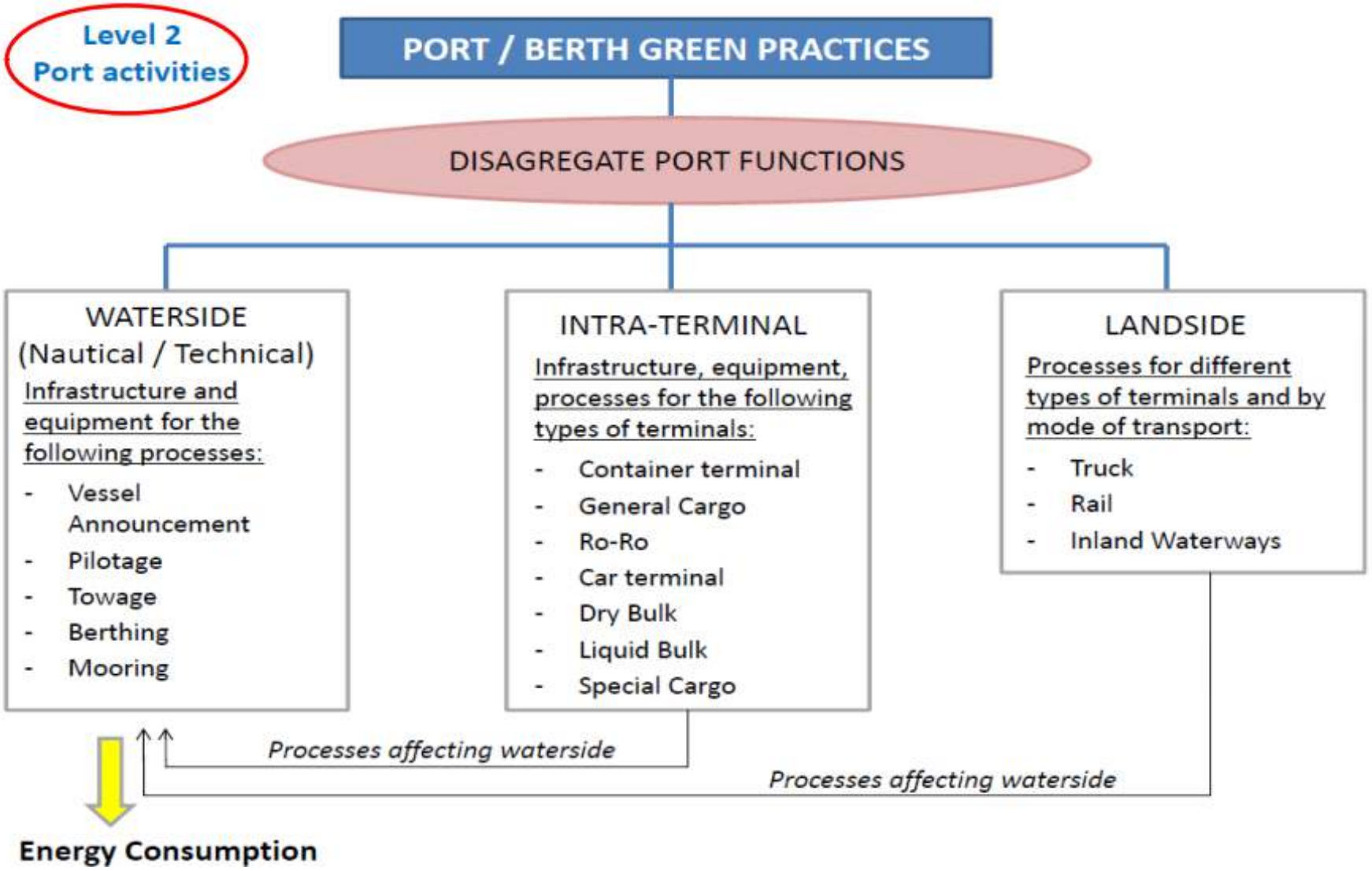
4.19 Port energy efficiency procedure



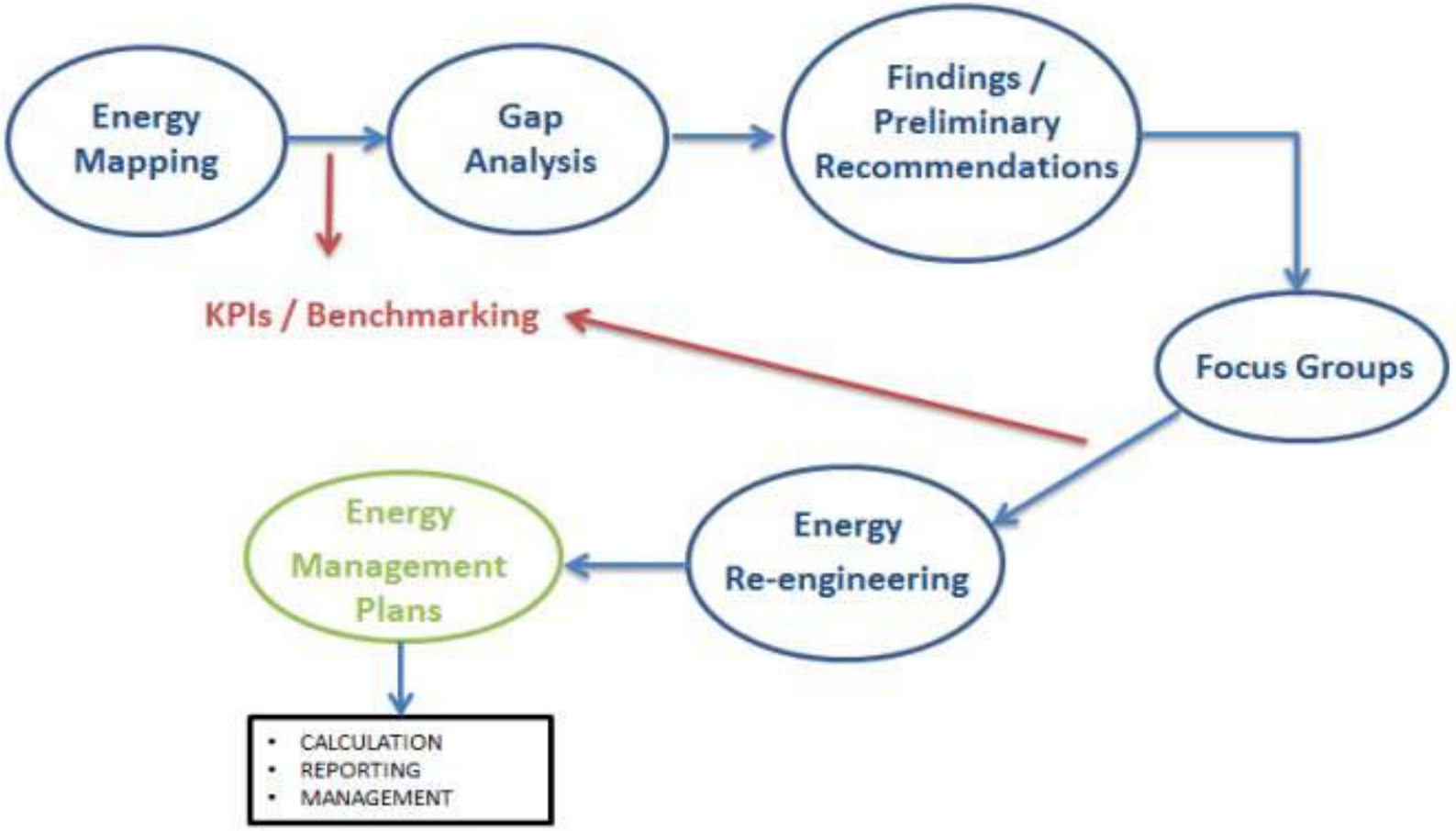
4.20 Generic energy mapping in Ports from demand side



4.21 Port energy mapping and consumption assessment

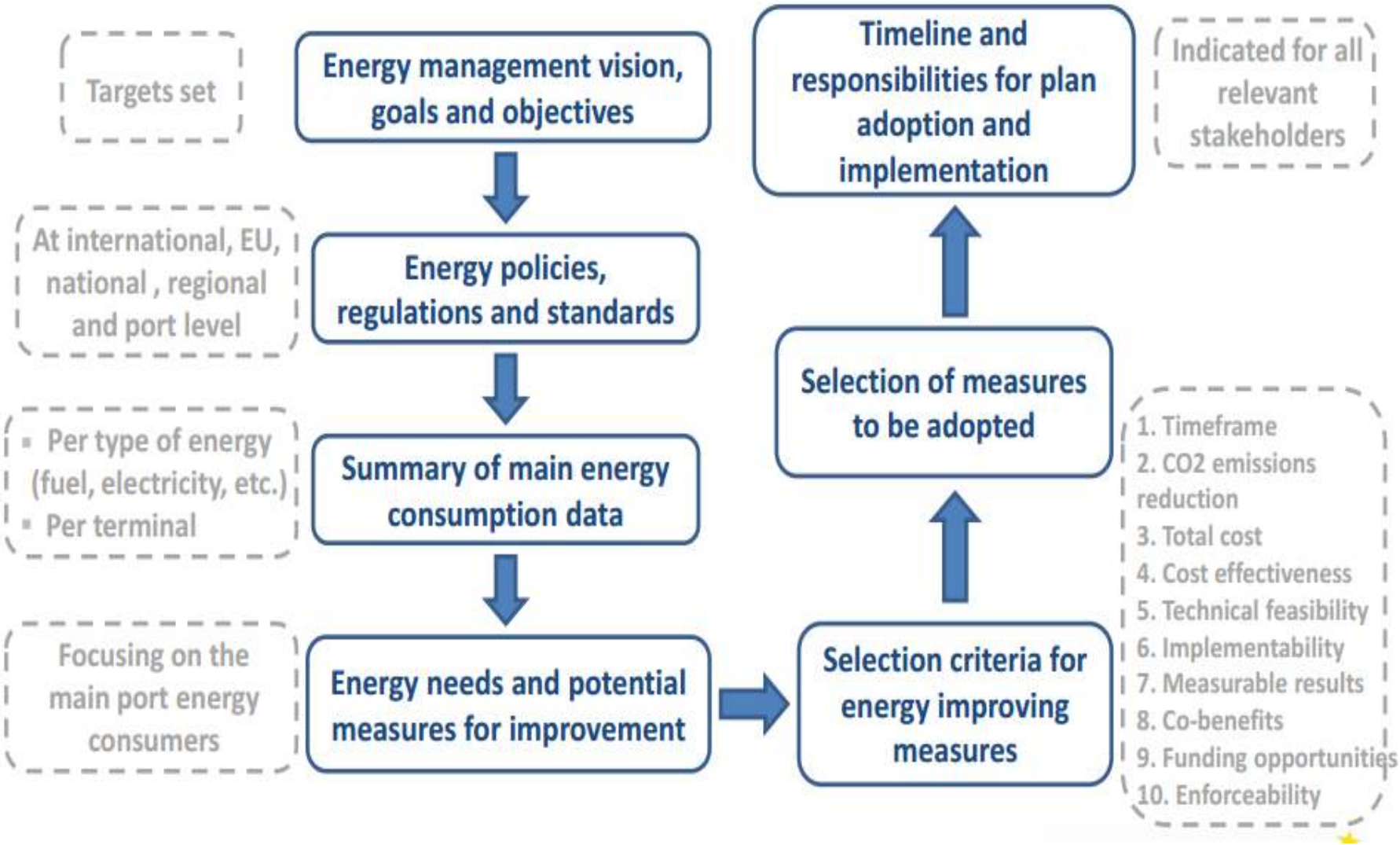


4.22 Process for developing port energy management plan



* Benchmarking KPIs
* Traffic Demand Dependent
* Energy Demand vs Energy Supply (micro grids / Virtual Power Plants)

4.23 Port Energy Management Plan



4.24 Technology validation and transferability

Port energy management plan

Main result

Identification of promising energy improving measures

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

Analysis of relevant available technologies

Considering

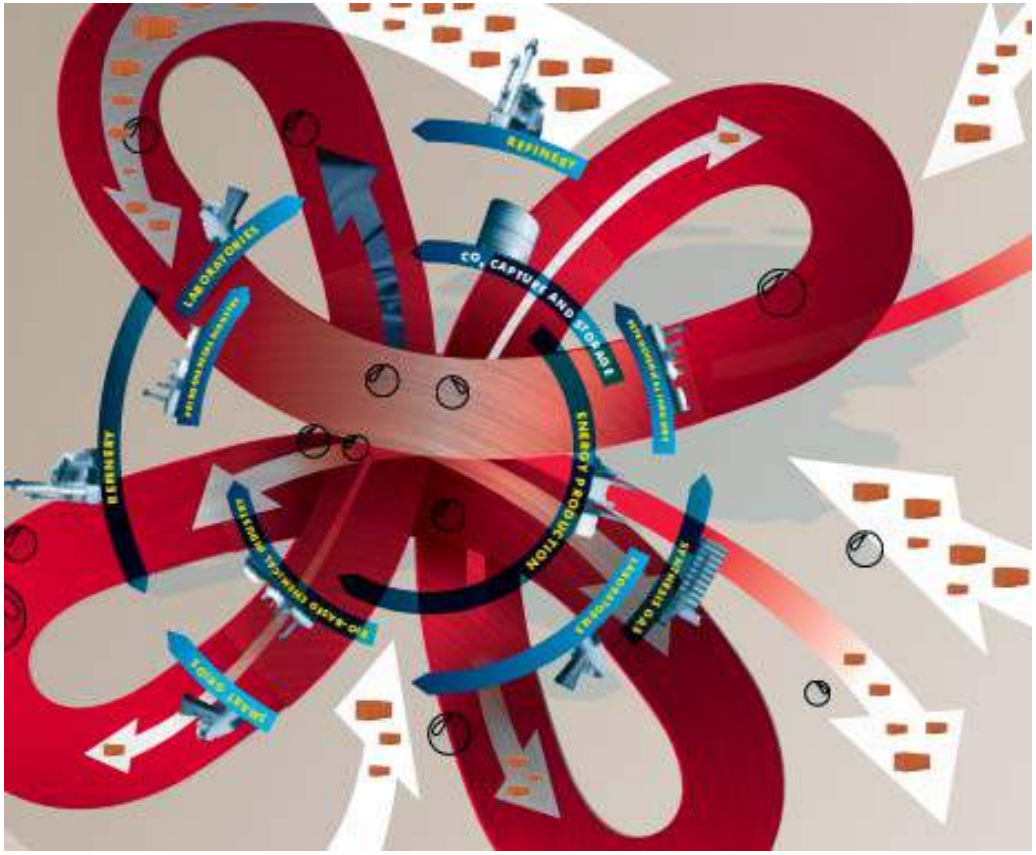
Technological fields
1. Biomass
2. Marine heat pump
3. Cold ironing
4. Marine currents
5. Wind technology
6. Geothermal heat pump
7. Natural gas
8. Hybrid technologies
9. Hydrogen
10. Tidal technology
11. Photovoltaic solar
12. Solar thermal
13. Wave technology

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)

Technology assessment

Pilot testing of selected technology

- Smart Port
- Containers Scanning
- Port Energy Management
- Long term Strategic Model



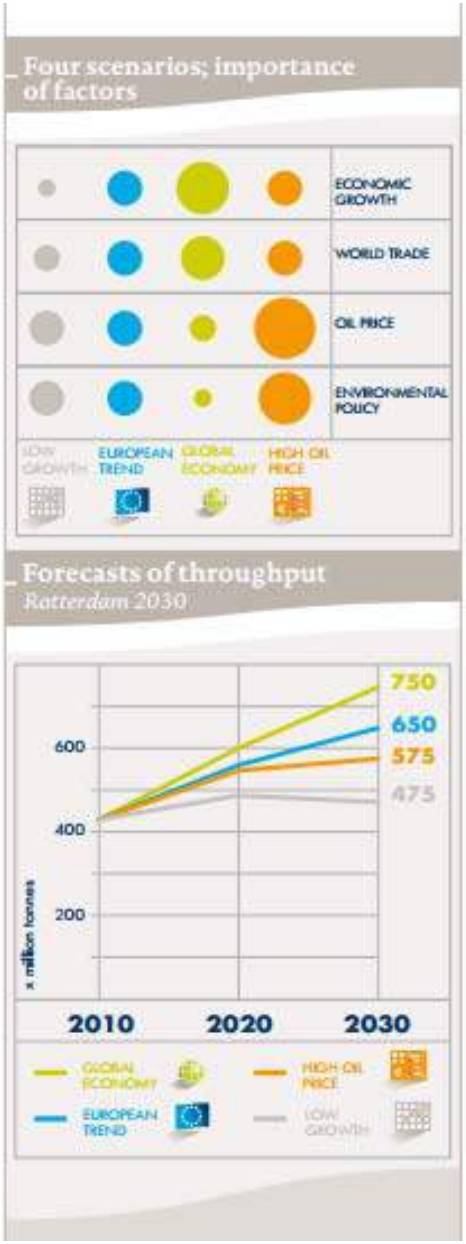
4.25 Port of Rotterdam : Strategic Model 2030

4.26 Port of Rotterdam : Port vision process

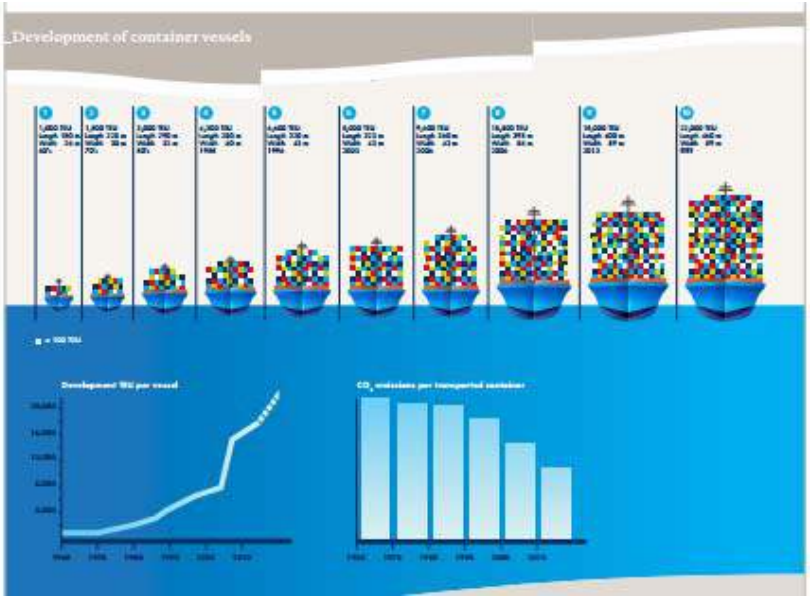
Analysis of trends & developments
The port operates on an international playing field. It is vital to identify and understand the global developments affecting the port, so that opportunities can be seized and risks dealt with adequately and promptly. The analysis of trends and developments serves as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

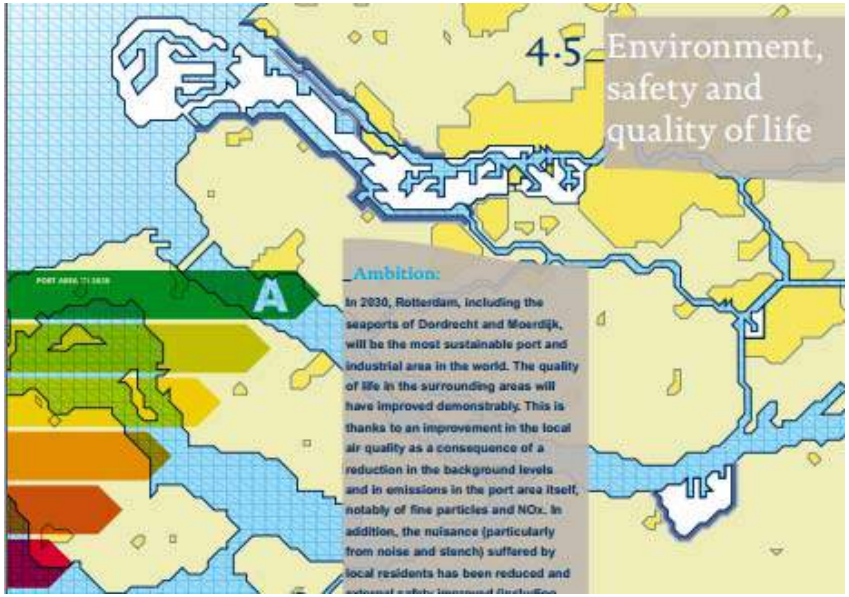
Forecasting
Based on the analysis of trends and developments, macroeconomic scenarios from the European Commission can be selected. Using the Global Economy, European Trend, High Oil Price and Low Growth scenarios, long-term calculations can be made for the potential size and makeup of freight passing through the port.

4.27 Port of Rotterdam : analysis of the key factors



4.28 Port of Rotterdam : analysis of the key factors





4.29 Port of Rotterdam : future models

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.

4.30 Port of Rotterdam : 2 possible future models

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

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