



الأكاديمية العربية للعلوم والتكنولوجيا والنقل البحري  
Arab Academy for Science, Technology & Maritime Transport



The International Maritime Transport and Logistics Conference "Marlog 9"  
Impacts of the Fourth Industrial Revolution on Port-City Integration  
"World Port Sustainability Program Aspects"



**Physical and Technological Infrastructure and their  
Role in the Sustainability of Marine Ports**

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## Goals of the Presentation are to recognize :

- The significance of **Shipping industry**
- The impact of **Shipping industry** on the environment
- IMO regulation
- Marine port stakeholders
- Working definition of Sustainability & Sustainable Port development
- The significance of technological infrastructure
- Examples of methodologies & tools used in sustainable port projects



**Shipping** is considered as the most efficient mode of transport in economic and environmental terms, which carrying 80% of total world trade. However, its impacts on climate change through greenhouse gas emissions and on human health from air pollutants released near residential centers cannot be ignored Nikitakos (2012).

Ports Should Plan and Manage their Operation and Expansion in a Sustainable way to Decrease the environmental Impacts.



Marine Ports act as a crucial connection between sea and land as a supplier of jobs..

Currently, There are more than 900 marine ports.

**In early 2019**, the total world fleet stood at 95,402 ships.

According to the International Chamber of Shipping, the worldwide population of seafarers serving on internationally trading merchant ships is estimated at 1,647,500.



American Association of Port Authorities (**AAPA 2007**)

Define port sustainability as “Business strategies and activities that meet the current and future needs of the port and its stakeholders, while protecting and sustaining human and natural resources”





**In June 2015**, UN set 17 goals for sustainable development from 193 countries with 3 dimensions (social, economic and environment).

Economic development has been identified in Goals No.8; 9 for industrialization ,and Goal No.1 to reduce poverty by increasing employment rates and structural transformation towards industrialization and promoting innovation and technological upgrading by focusing on sectors with high added value.



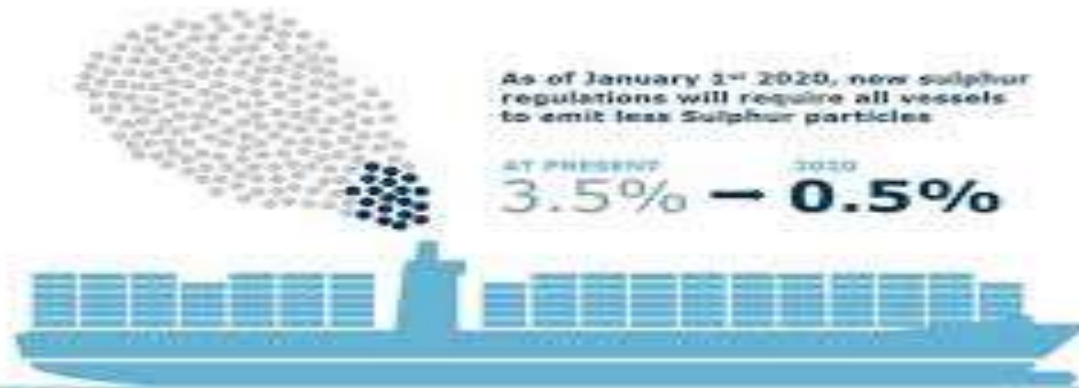
## Maritime shipping relies heavily on fossil fuels

About 3.5 million barrels of high Sulphur residual fuel oil (bunker fuel) per day were consumed by the sector in 2017, which represent about 50 per cent of the global fuel oil demand (McKinsey and Company, 2018).



**1 January 2020** ,was the full implementation of the IMO 2020 regulation reducing the content of Sulphur in fuel oil from 3.5 per cent applied since 2012, to 0.5 percent.

IMO 2020 Regulations:





## **For carriers to comply with the new IMO 2020 regulation**

Three main options are currently available as outline below, each has its advantages, disadvantages and cost implications.

(CAI International, 2019).



# IMO 2020

## Options to comply with new SOx Requirements

1. Use of low sulphur Fuel
2. Use of Alternate Fuel such as LNG
3. Fitting Exhaust gas cleaning (scrubber) unit

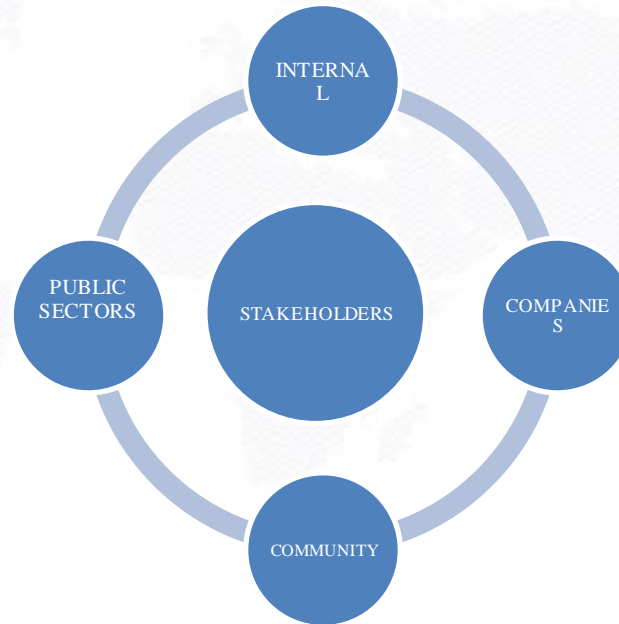


**In total,** Of the 95,402 ships in the UNCTAD maritime database, as of **1 January 2019.**

Vessel type	Percentage of vessels fitted with ballast water treatment systems	Percentage of vessels fitted with scrubbers	Percentage of vessels compliant with tier III regulations to reduce nitrogen-oxide emissions
Bulk carriers	23.32	4.03	0.05
Chemical tankers	10.72	1.15	0.86
Container ships	18.88	5.05	0.19
Ferries and passenger ships	1.36	2.13	0.57
General cargo ships	2.16	0.65	0.21
Liquefied natural gas carriers	28.76	1.45	1.45
Offshore supply vessels	2.37	0.03	0.96
Oil tankers	11.99	3.71	0.46
Other/not available	2.82	0.30	0.19
<b>Total</b>	<b>7.66</b>	<b>1.58</b>	<b>0.53</b>

## Stakeholders

(Jasmine& Wei, 2019) divided them into four groups as follow:



- 1) Internal stakeholders: employees, shareholders, managers and owners,
- 2) The public sector: Port Authority, Ministries "Transport, Finance, Environment, Justice" and Workers Unions.
- 3) Companies: transport companies and loading and unloading companies
- 4) Community; interest group like (residents; consumer; non-profit organizations and media)



**For Examples,** The **Global Industry Alliance** to Support Low-carbon Shipping, launched in 2017, is a public–private partnership initiative involving leading ship owners and operators, classification societies, engine and technology builders and suppliers, big data providers, and port and oil companies. In March 2019, the Panama Canal Authority became the first developing country entity to join the Alliance.



**GLOBAL INDUSTRY ALLIANCE  
TO SUPPORT LOW CARBON SHIPPING**



## One of the most important stakeholders are knowledge centers

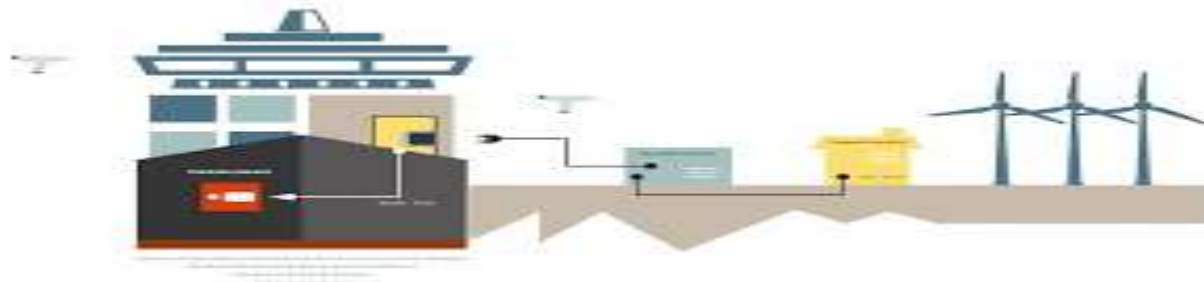
The role of **the knowledge centers**, mostly the **universities and research institutions**, are very unique among the above-mentioned stakeholders since approaching the Port of the Future of any port concept requires new initiatives, innovations and solutions to support the current port challenges (Docksthefuture,2018)

In general, Communication with all stakeholders is the most important factor for marine port sustainable development. Reconciling differences between various stakeholders, public-private partnerships, and policies negotiated by consensus can foster port sustainability.



## Some best practices:

- **Antwerp** provided electricity for ships. Onshore power supply scheme by which ships get electricity on shore. (ESCAPE,2016), The port of Antwerp has provision for seven onshore power connection points at one terminal, for barges. In **Hamburg**, LNG barges are deployed that provide power to vessels at berth. (ZIS T.,2019).





## Some best practices:

- **Los Angeles** Port reduced by 77% Matter emissions and nitrogen oxide 56%, by using high-quality diesel for goods transport equipment to reduce emissions and increase green areas in the port (NAC,2014; Jasmin&wei,2019)



## **Port of Long Beach,**

Has built new infrastructure to provide shore-side electricity (also known as cold-ironing) to container ships (POLB, 2011).



**In Singapore,**

Reduced port fees are required for ships that are using low-sulfur fuel or have good scores in their Energy Efficiency Design Index (EEDI),( Zis T.,2019)





## **The Port of Gothenburg,**

In Sweden has two ferry (Ro-Ro) terminals with cold ironing capabilities. Shore power is supplied by local surplus wind-generated power and is marketed as a zero-emissions solution. Ferries have in general lower electricity requirements compared to other types, mainly lighting and ventilation during loading/unloading of vehicles (Zis and Psaraftis 2017).



**In 2017, Damietta port in Egypt**

supplied 4 vessels on the berth with the necessary electricity instead of using their diesel engines as they were left on the berth (DPA,2017).



## **Technological Infrastructure:**

In addition, Technology, plays an important role to foster marine port sustainability. technology is responsible for making a difference between companies, Ports authorities will not be able to achieve sustainability through the adoption of best environmental practices and procedures, but also the adoption of best practices with technological systems that help in achieving sustainability.



**Currently**, the largest companies are no longer the largest in size or most productive companies, but they are the most advanced in technology such as **Apple, Ali Baba, Amazon, Google, Microsoft and Facebook.**

But we find that every new wave of industries creates unemployment for a decrease in demand for old skills and an increase in demand for new skills.

Of course, this led to comparative advantages for developed countries, while other countries were not able to adapt quickly enough to the new requirements. The result was economic growth for these countries and weakness of other countries.



**Accordingly,**

Many countries have created plans for industrial development to keep pace with global development and global competition and take a permanent place for their country in the global industrial and investment competition.





Many countries have established a new vision matching with 4.0 industries

<b>Country</b>	<b>year</b>	<b>vision</b>
GERMANY	2011	( industry 4.0)
USA	2011	(industrial IOT)
ITALY	2012	fabbrica intelligente
UK	2012	High value manufacturing
Sweden	2013	Production 2030
Korea	2014	Manufacturing innovation 3.0
Netherlands	2014	Smart industry
Japan	2015	Society 5.0
France	2015	L'industrie du future
Spain	2016	Industria conectada 4.
Check	2016	prumysl
China	2015	Made in china 2025
Singapore	2015	Singapore industry 4.0
Thailand	2016	Thailand 4.0
Mexico	2016	Crafting the future



**The maritime industry** has developed some potentially important technologies that are mentioned below and could help in changing the future in the maritime industry:



# Rolls-Royce participate in an alliance to create a trans-ocean Autonomous ship by 2035





## **Port of Rotterdam,**

The port authority uses digital dashboard to view the operations for all parties at the same time which enables the port to dock more ships every day and reduce the cost for the ship owners. This leads to minimizing the waiting time. Another technology is using 3D printing R & D in shipyards. This has been established to ensure the presence of spare parts of consistently high quality and at a competitive price. After that, a laboratory was established for 3D printing for the port and the shipping companies and provides all metal spare parts for ships upon request and as soon as possible after they used to take 6-8 weeks.

This can now be done within 200 hours to provide spare parts (IBM, 2018)



## The port of Amsterdam,

For example, has launched multiple apps.

The **I Am Port app** offers real time information on ships locations and itineraries in the port.

In addition, you can find information on arrivals and departures, size, draft and berth of each ship in the port. The **second** app, the Port Data app shows the historical market shares of the throughput of cargo of eleven ports in the Le Havre – Hamburg range in order to promote the idea of data sharing. Finally, the **third** app allows to tour the port aiming to increase local support for the seaport (Deloitte,2017)

The following points must be taken into account when planning new port infrastructure or develop the current berths:

- The sustainability plans are a dynamic effort requiring flexibility and continuous improvement.
- Reducing the number of sustainability indicators to be more effective and controllable.
- Achieve a win-win situation among all stakeholders to ensure long-term sustainability goals achievement



- Provide skilled human capital, especially in the fields of science, technology, engineering and mathematics, and establish research and development departments to enhance the innovation
- Ensure the provision of the necessary infrastructure, such as high-speed internet, to facilitate processing and analyzing of data in a fast and efficient manner.
- Providing incentives to those committed to implement sustainability terms and reduce emissions.



## Conclusion

Sustainable development requires ensuring that ports operate efficiently. Existing available infrastructure and the technology used must be optimized, maintained and modernized. Identification of the need for new infrastructure must be done before losing their position in global competition race, the fiscal and technological infrastructure are driving forces for sustainable growth, so the port authority has to involve other stakeholders to enhance their long-term plans and support to be sufficient and sustainable







**THANKS**

