



Federal Ministry
for Economic Affairs
and Energy



MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

energy solutions – made in Germany

Dipl.-Ing. Ralf Fiedler, 04.04.2017, Houston



Facilitator

FRAUNHOFER CENTER FOR MARITIME LOGISTICS AND SERVICES

CML

Smart Ports – Digitalization for Green and Efficient Operations in Ports



OVERVIEW

1. About Fraunhofer

- Fraunhofer-Gesellschaft
- Fraunhofer CML
- The maritime logistics chain

2. Digitalization in Ports and Terminals

- Smart Ports
- Digitalization as enabler
- Green Ports - Sustainable Energy Use in Ports and Terminals
- Outlook

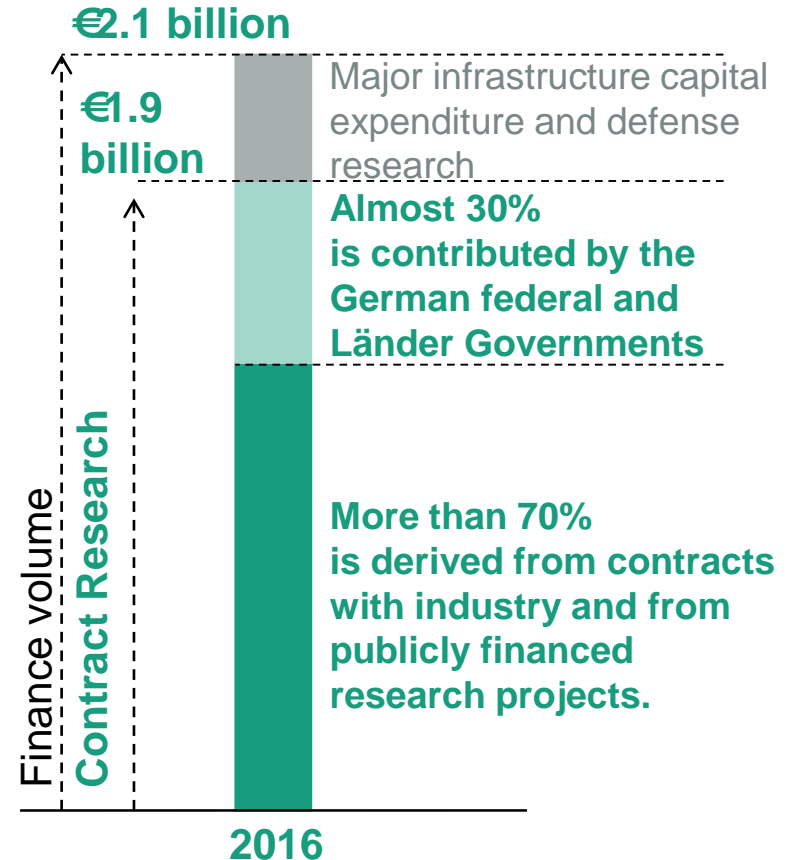
The Fraunhofer-Gesellschaft at a Glance

The Fraunhofer-Gesellschaft undertakes applied research of direct utility to private and public enterprise and of wide benefit to society.

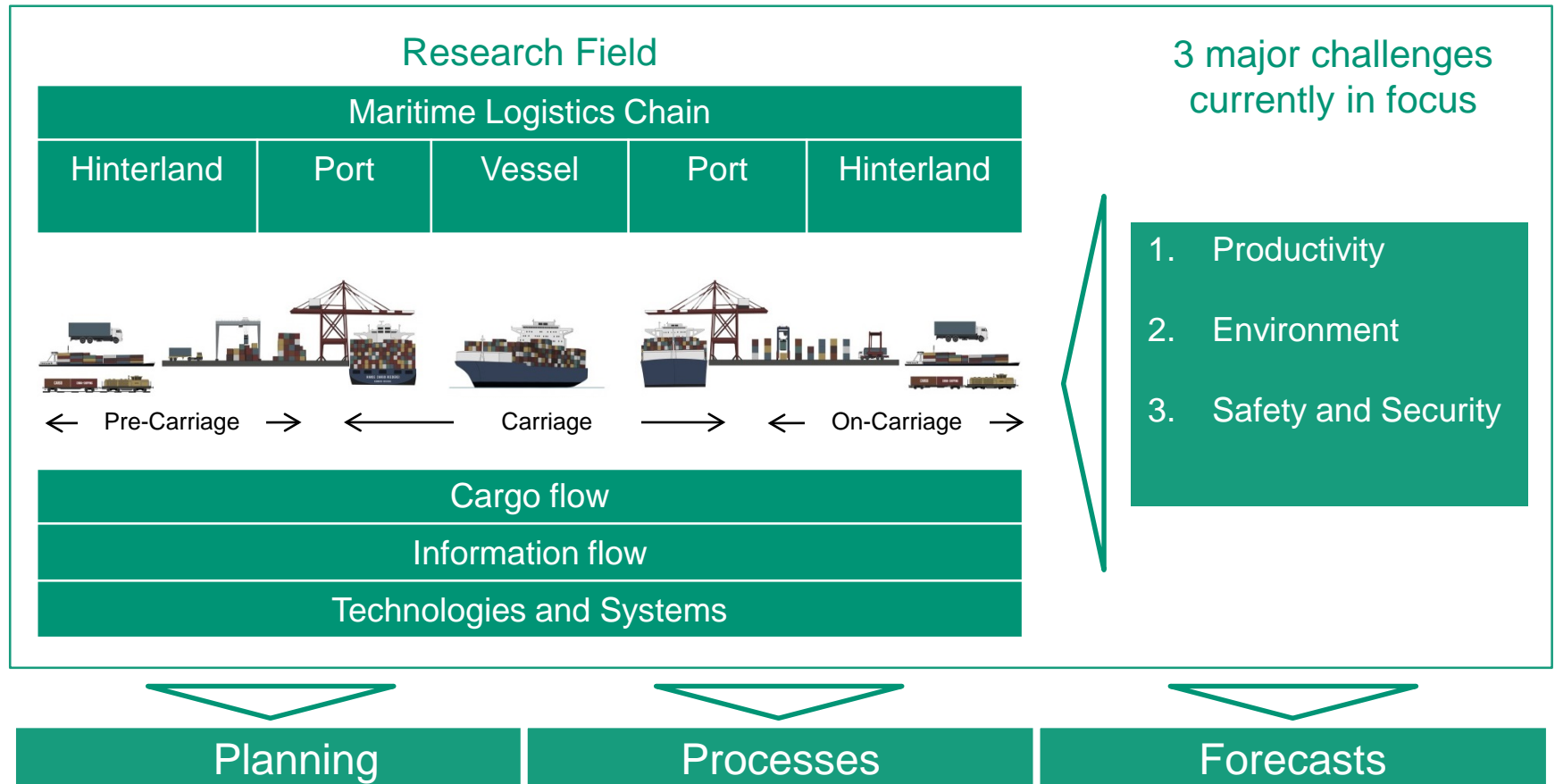

24,500 staff



69 institutes and research units



Fraunhofer CML addresses major challenges along the maritime logistics chain



OVERVIEW

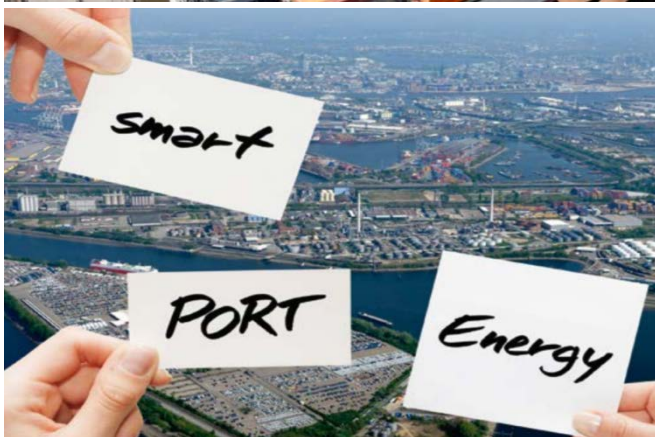
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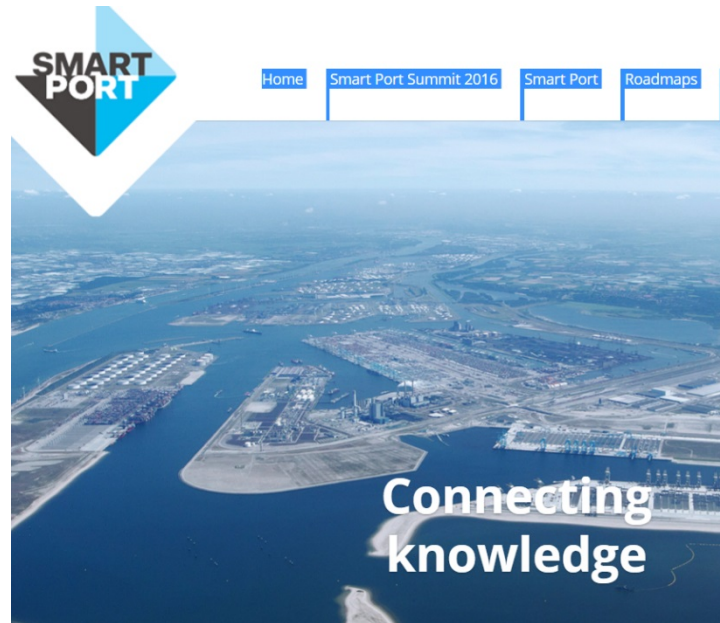
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What are „Smart ports“?



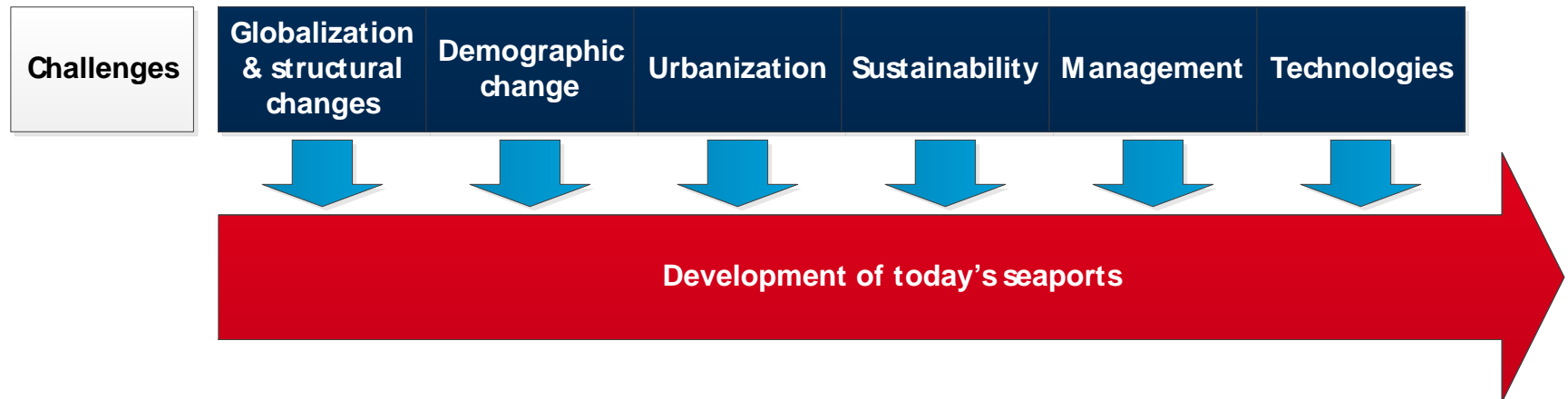
Sources: HPA, Smart Port Rotterdam



chainPort-Initiative

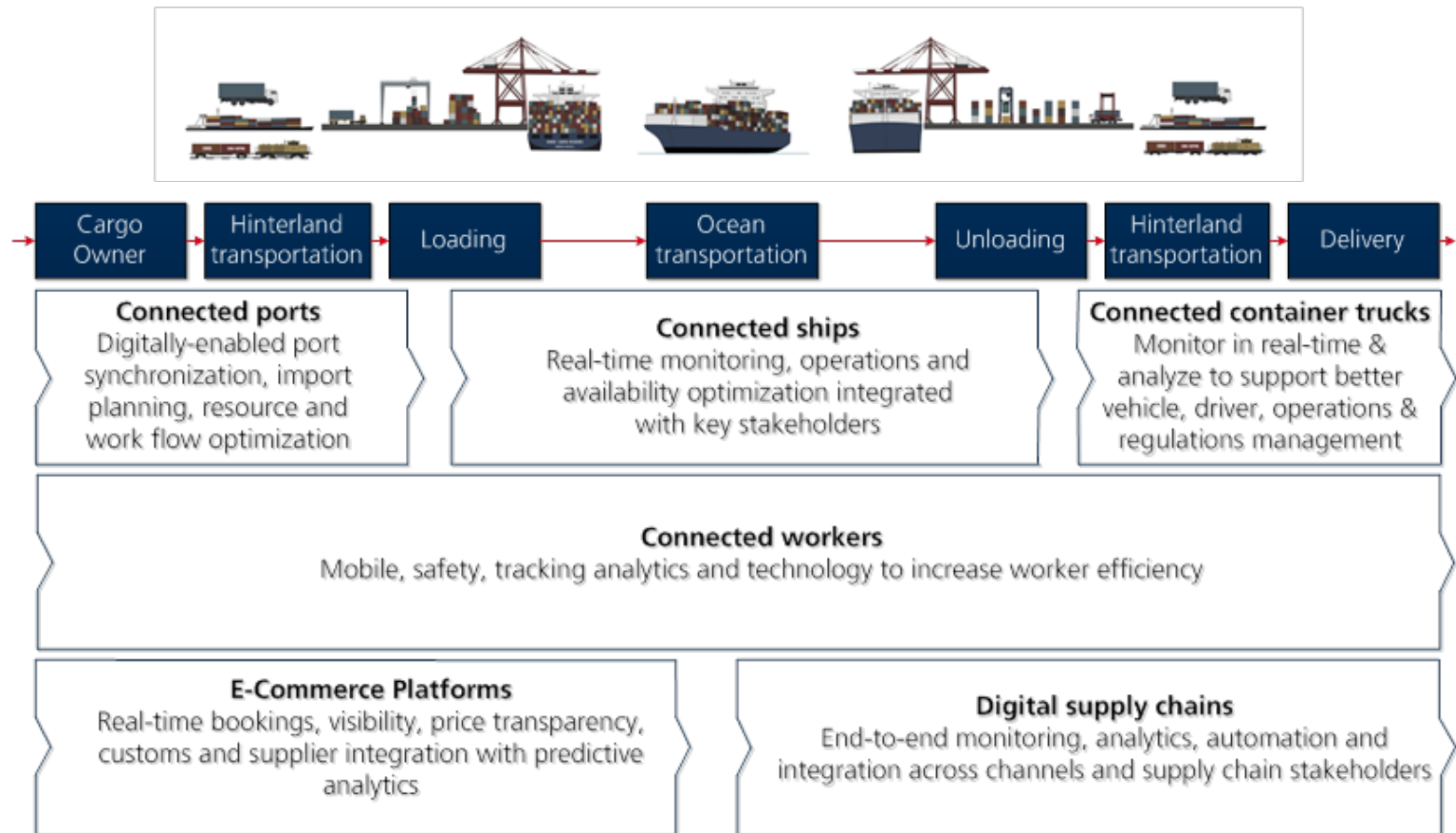
Busan, Singapore, Shenzhen, Los Angeles, Felixstowe, Hamburg, Antwerp

Ports in the context of global challenges



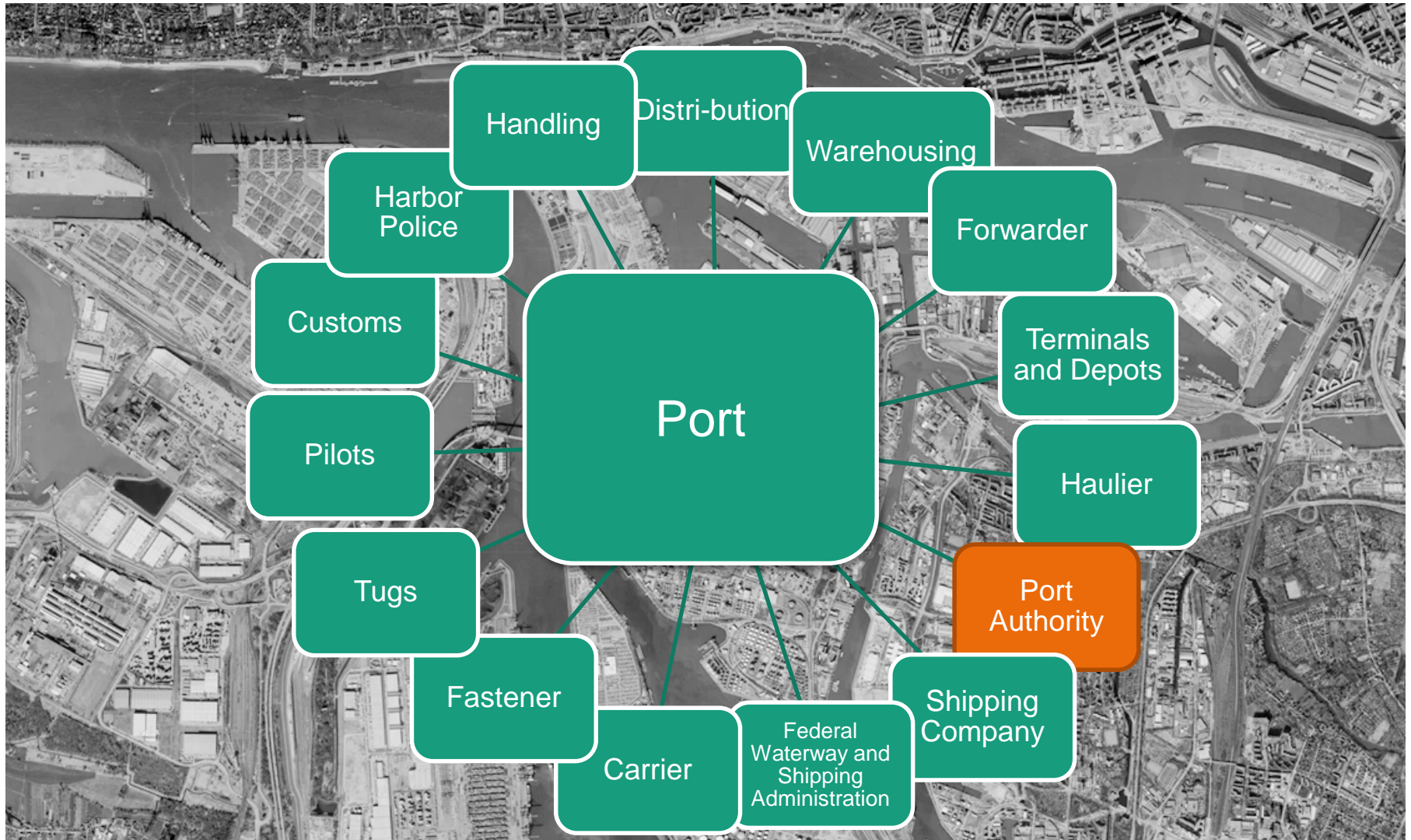
With all societal changes putting pressure on the ports, technologies become available addressing some of these issues

Digitalization of the maritime transport chain



Source: based on Accenture (2016)

Many different actors in Port Logistics – Overview



Source: Wasser- und Schifffahrtsverwaltung des Bundes (Federal Waterway and Shipping Administration) with own amendments

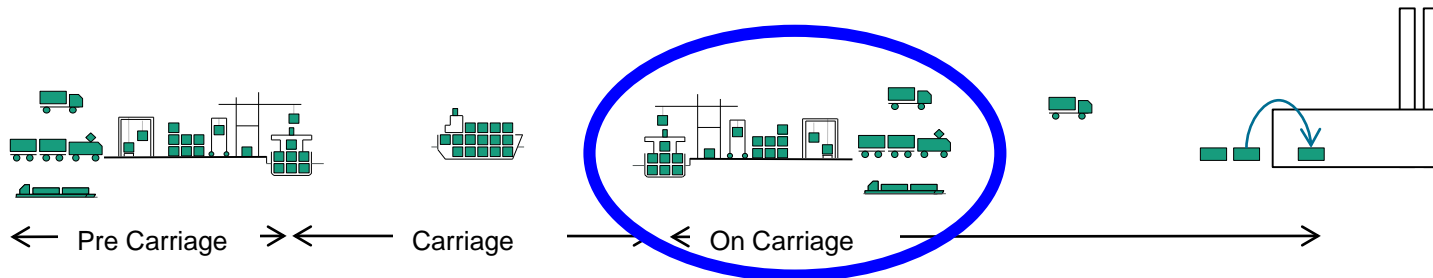
Digitalization as enabler

Challenge
Productivity

Speed

Reliability

Flexibility



Approach

Efficiency through planning and synchronizing of resource management

Enabler
Digitalization

Big Data
Analytics

Automation of
Knowledge
Work

Connectivity

IoT, CPS*

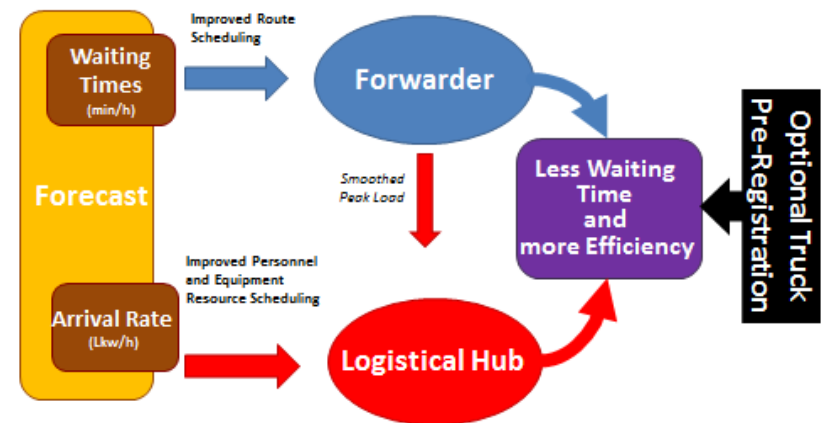
* IoT Internet of Things
CPS Cyber-Physical Systems

Forecast of truck waiting times at logistical hubs

Motivation

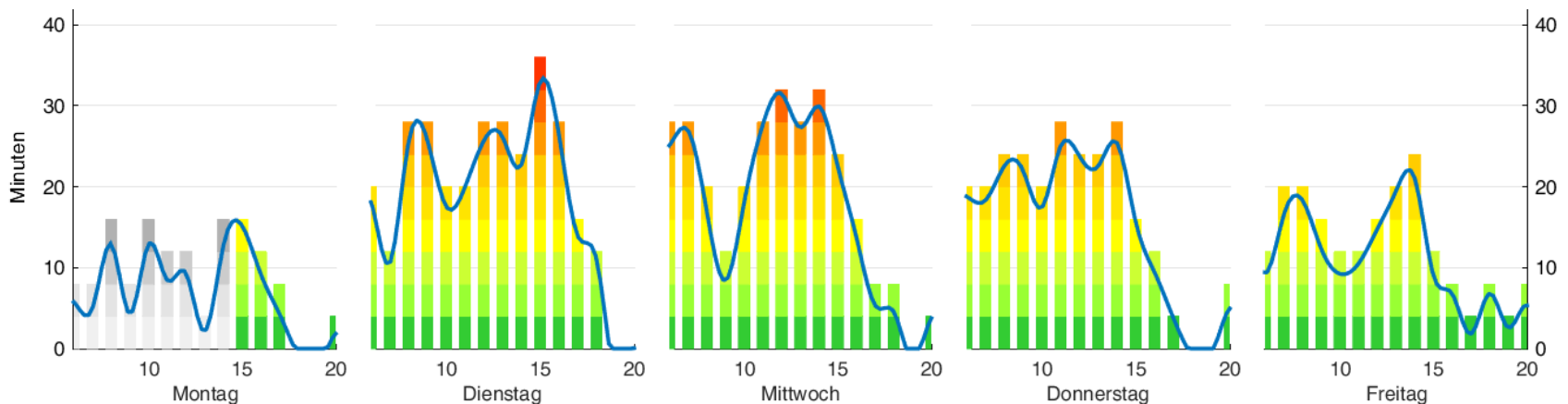
Frequent peak loads and stochastic operational and environmental influences lead to uncoordinated truck arrivals at logistical hubs such as depots.

- Forwarders/Truckers:
large share of unproductive operational time
- Logistical Hubs:
inefficient use of personnel and equipment



Forecast of truck waiting times at logistical hubs

- Forecast of truck arrivals and waiting times
- Stochastic factors, e.g.:
 - Traffic situation
 - Ship arrivals
 - Resource breakdowns
 - Weather
 - Economic indicators



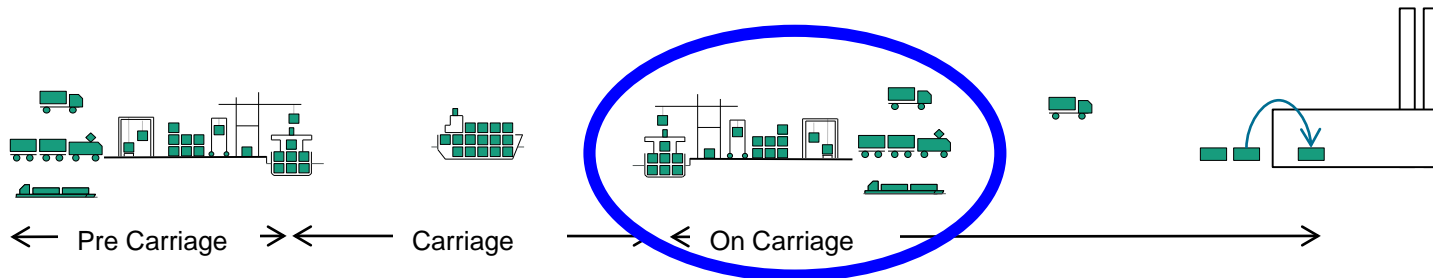
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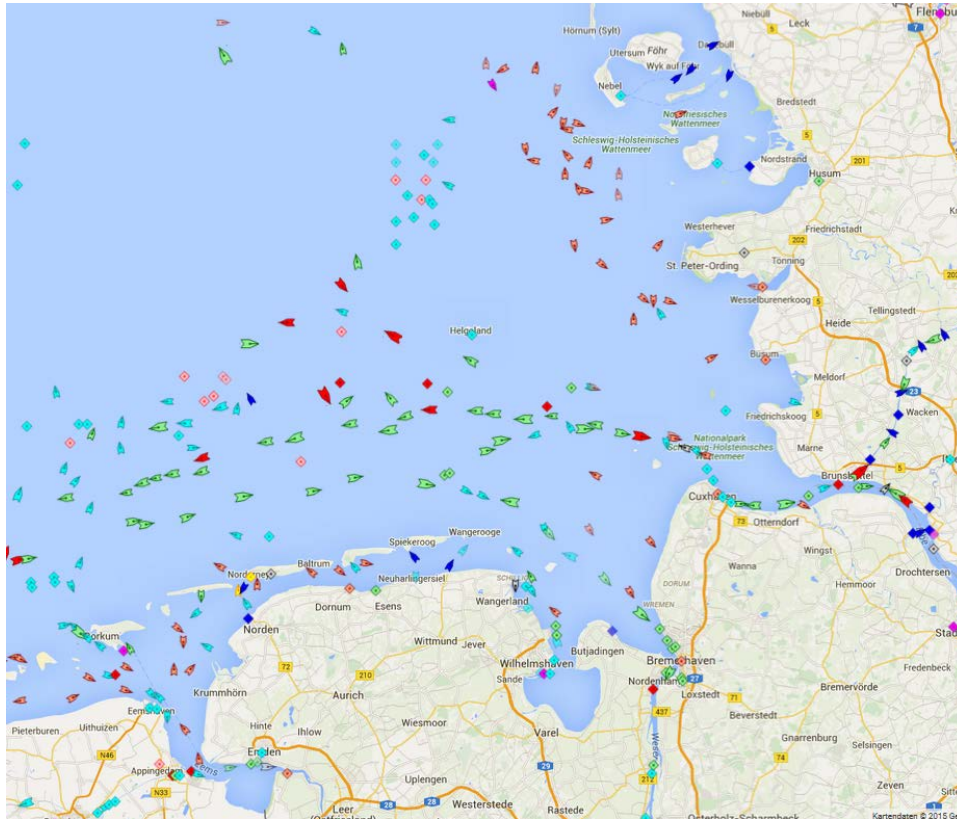
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Ship information

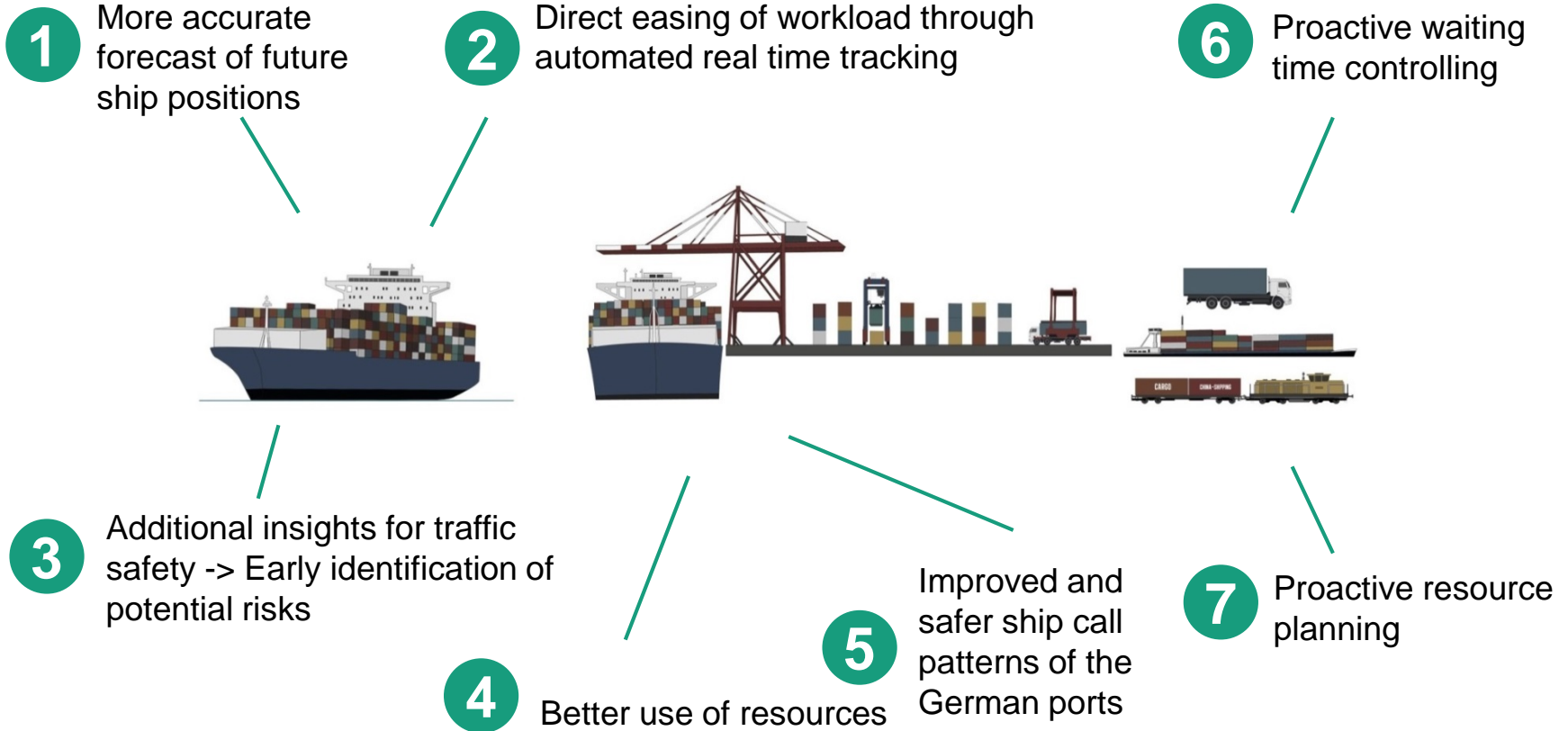


Example of Traffic in the German Bight © MarineTraffic

- Display of current situation, port of departure and port of arrival, ETA (estimated time of arrival), course and speed, draught, route (historical view)
- For an extra charge additional options are available
- Added value?

Project VESTVIND

Benefits – Increase of the planning horizon of stakeholders



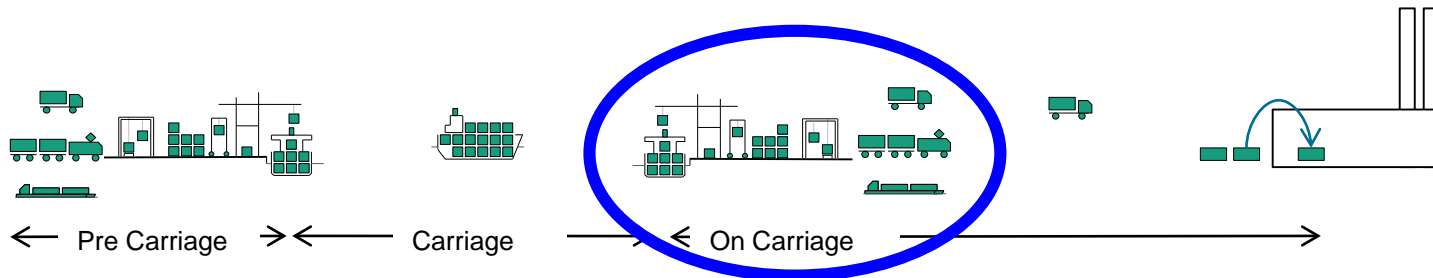
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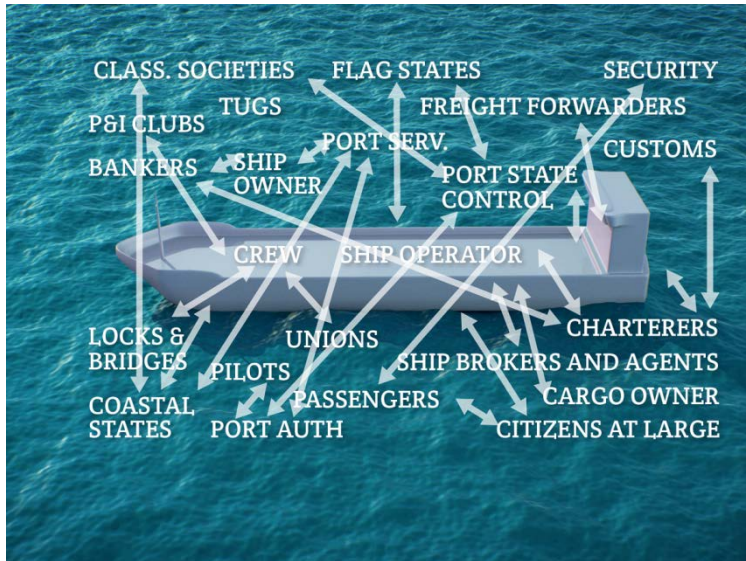
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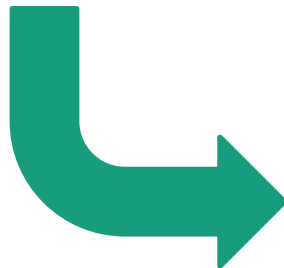
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Project STM Validation



As-is-situation



To-be-situation

- EU Ten-T
- 39 Partners
- 43 Mio. €
- 2015 - 2018

EU-Project: STM-Validation

SeaSWIM (System Wide Information Management)

- interoperability
- Maritime Cloud

Voyage management

- route planning
- route exchange
- route optimization
- focus: ship

Flow management

- overall traffic flow (dense traffic, particular navigational challenges)
- focus: land organizations and ships

Port Collaborative Decision Making

- information sharing
- collaborative decision making
- focus: all stakeholders

European Maritime Simulator Network (EMSN)

- demonstrate and validate the target concept
- large-scale test beds
- 300 vessels, 10 ports and 3 shore based traffic

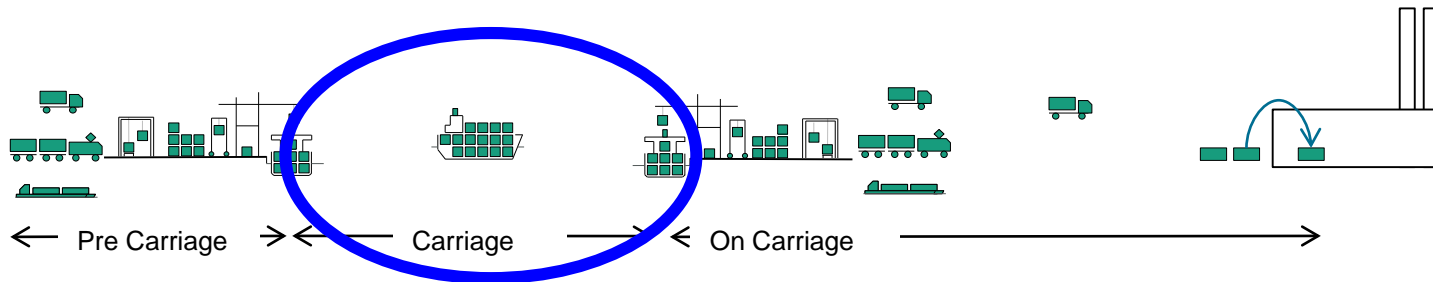
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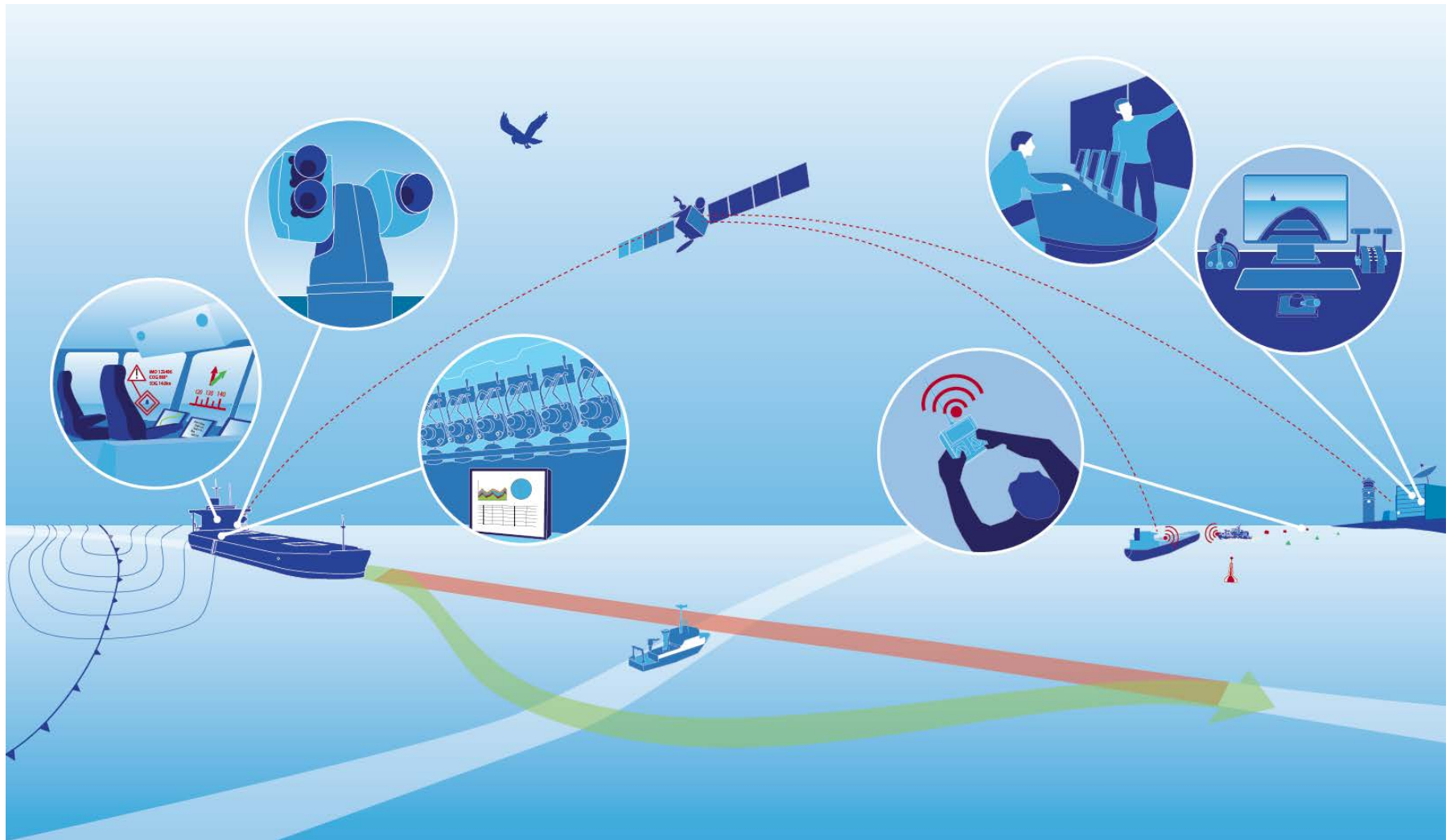
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EU-Project MUNIN

Maritime Unmanned Navigation through Intelligence in Networks



Sensors and autonomous navigation

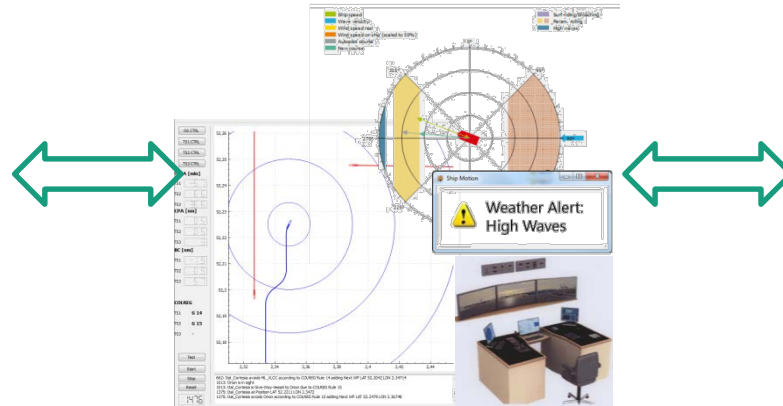
Form concepts to prototype implementation



Advanced Sensors System

Electronic lookout

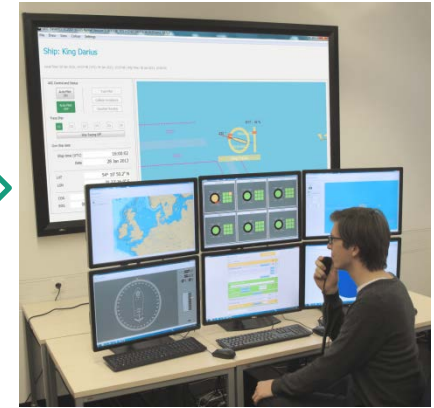
- Detect small objects
- Detect weather phenomena



Autonomous Navigation System

Op. decision-making

- Avoid collisions
- Ensure stability in harsh weather



Shore Control Centre

Human element

- Monitor voyage and vessel
- Problem-solving

How can a port or terminal become more green or sustainable?

- Increase Modal Share of more environmentally friendly transport modes in the hinterland e.g. rail and barges
- Increase efficiency through planning, avoid congestions
- Support cleaner vessels through port tariff systems
- Offer facilities for cold ironing and maritime waste facilities
- Plan and steer energy consumption
- Produce your own green energy (renewables or through energy harvesting)

Emission reduction measures in ports and terminals

Terminal-Level

Reducing energy consumption

- Technical – fuel-efficient, low/zero emission fleet
- Operational – optimize processes (optimize layout)
- Behavioral – train equipment drivers

Port-Level

- Technical – fuel-efficient, low/zero emission fleet (e.g. cars, service vessels)
- Regulatory – setting rules

Vessel-Level

- Providing facilities for Onshore Power Supply
- Providing facilities for LNG bunkering
- Applying an incentive system for environmental performance of vessels

Renewable Energy Production

e.g. EUROGATE (Hamburg / Germany) 2013:

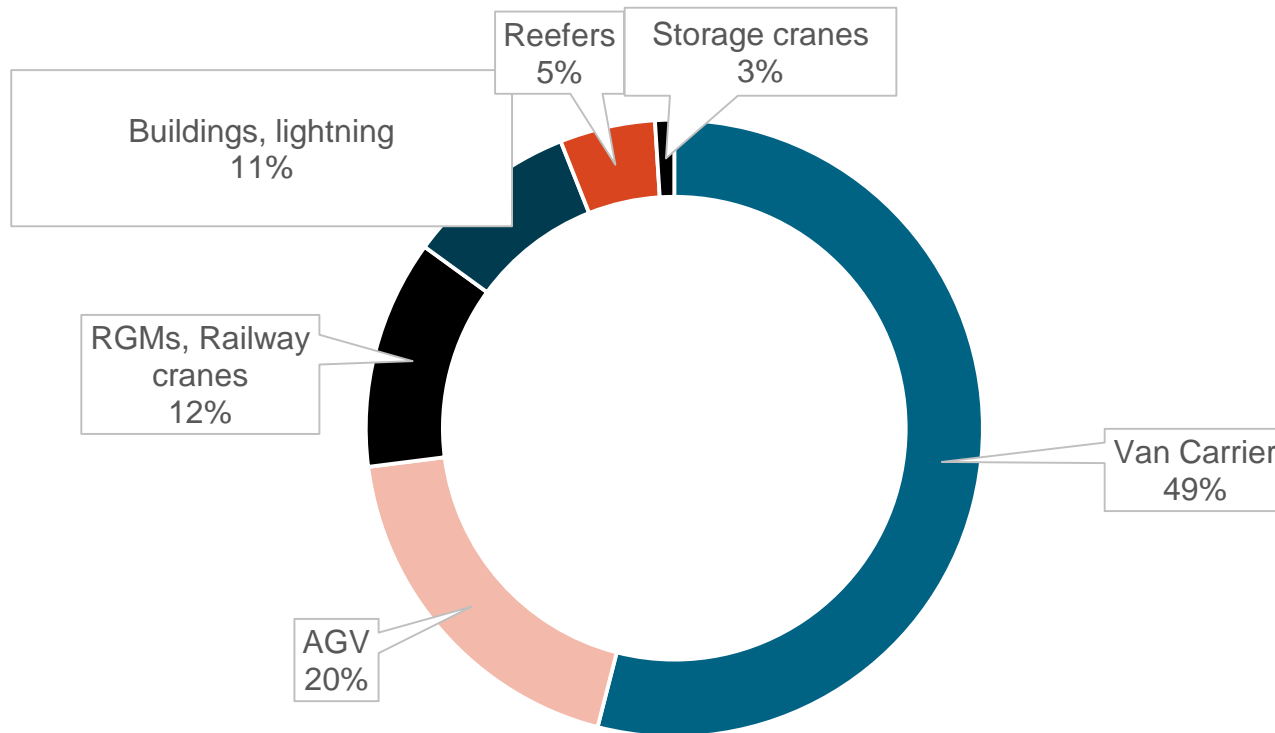
- Rated power: 2.4 MW
- Output: 8.7 Mio kWh
- Output used to cover 30 – 50 % of their yearly consumption



Source : Eurogate

CO₂-Sources in a container terminal, example HHLA

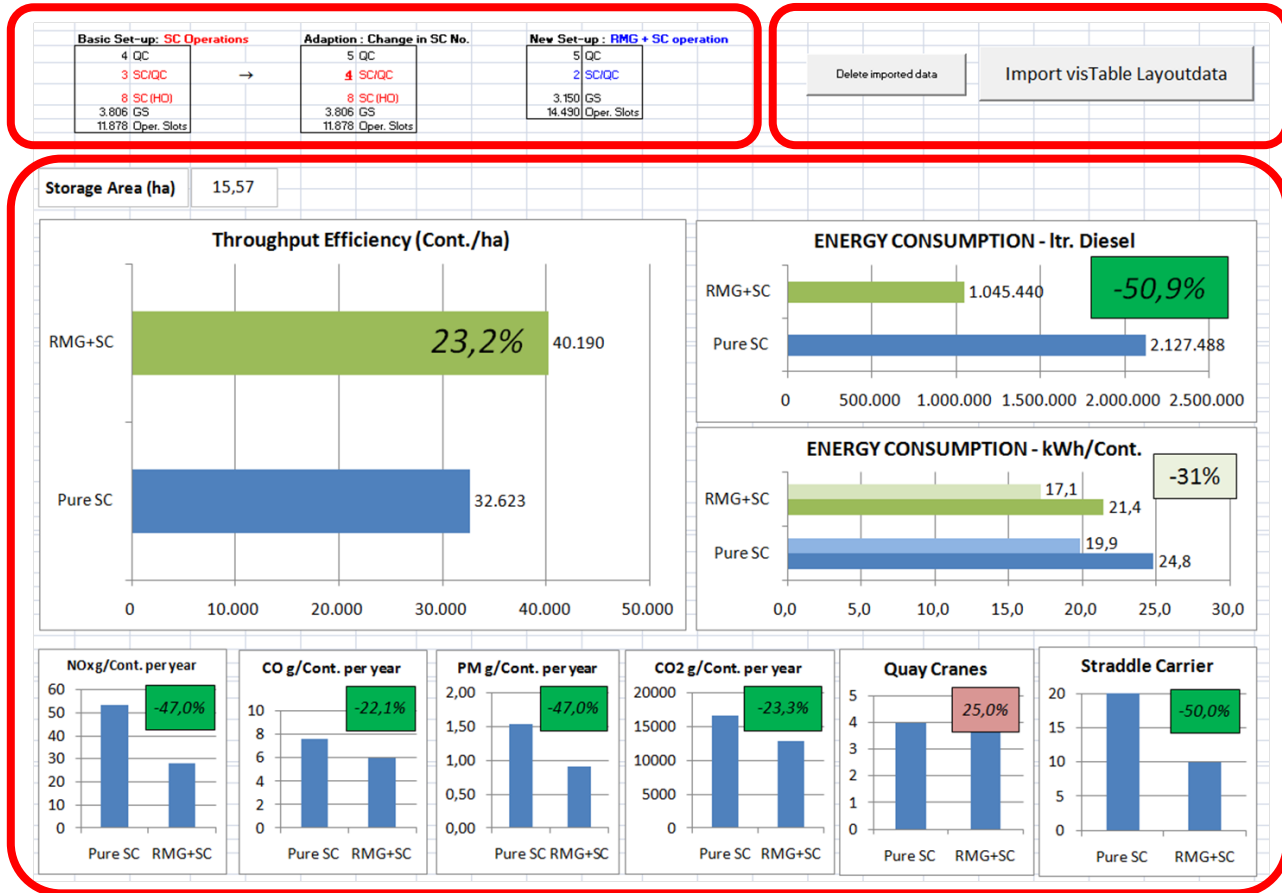
CO₂-Emissions of equipment types



Green Container Terminal: Comparison-cockpit

Overview of logistics systems to be compared

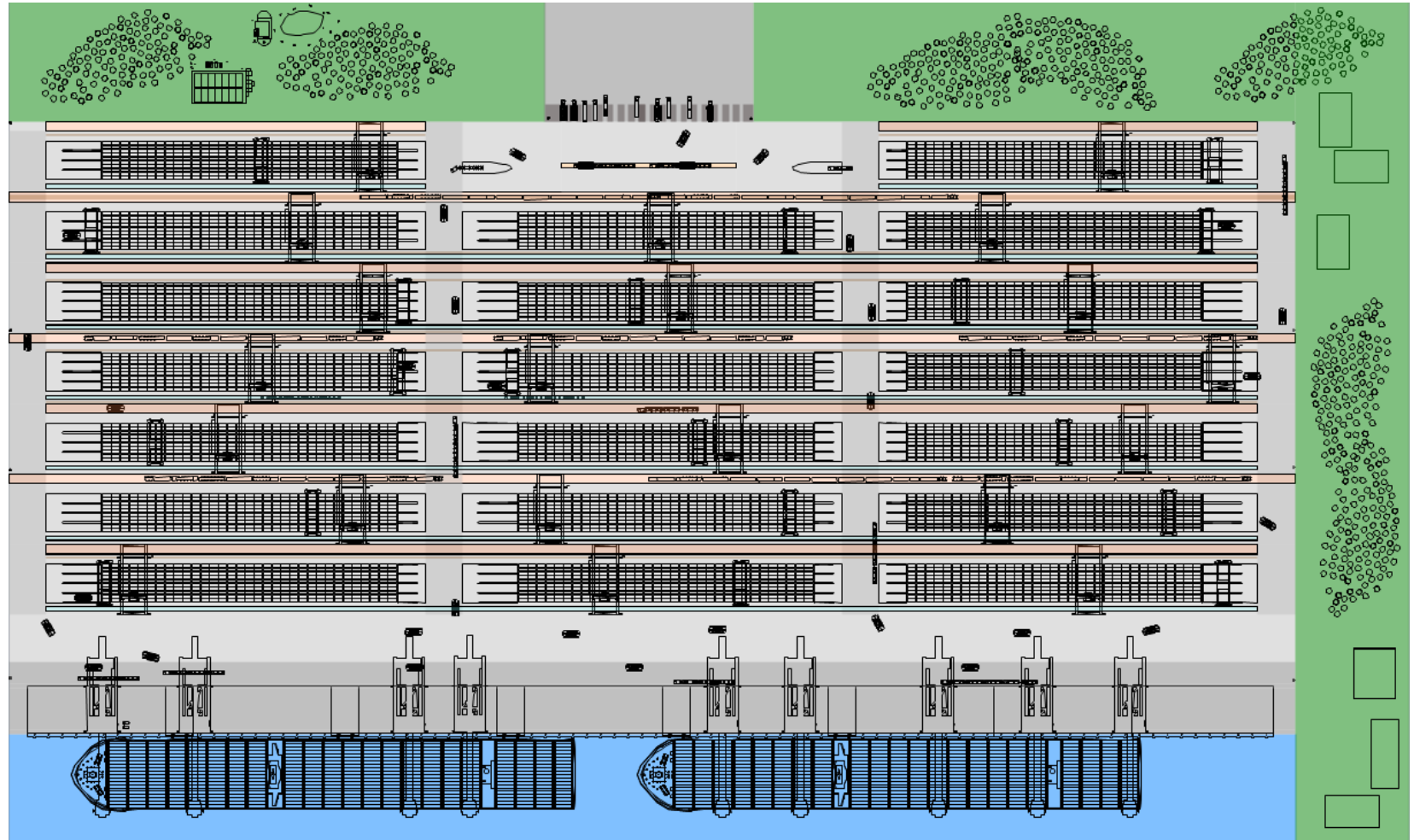
Operating element for data import



Presentation of key performance indicators for the comparison of two logistic systems

Green Container Terminal

2D Layout



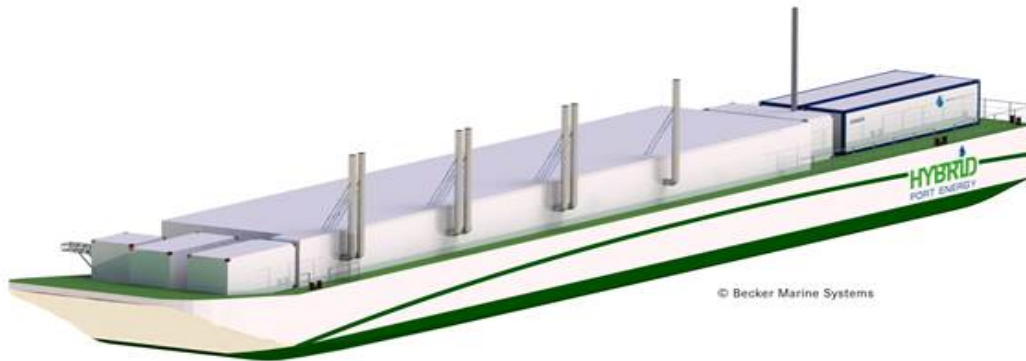
Battery-driven AGVs at Container Terminal Altenwerder



<http://hlla.de/de/pressemitteilungen/ueberblick/2007/06/hlla-plant-weiteren-ausbau-des-cta.html>

© Fraunhofer

LNG Hybrid Barge of Becker Marine Systems



Outlook

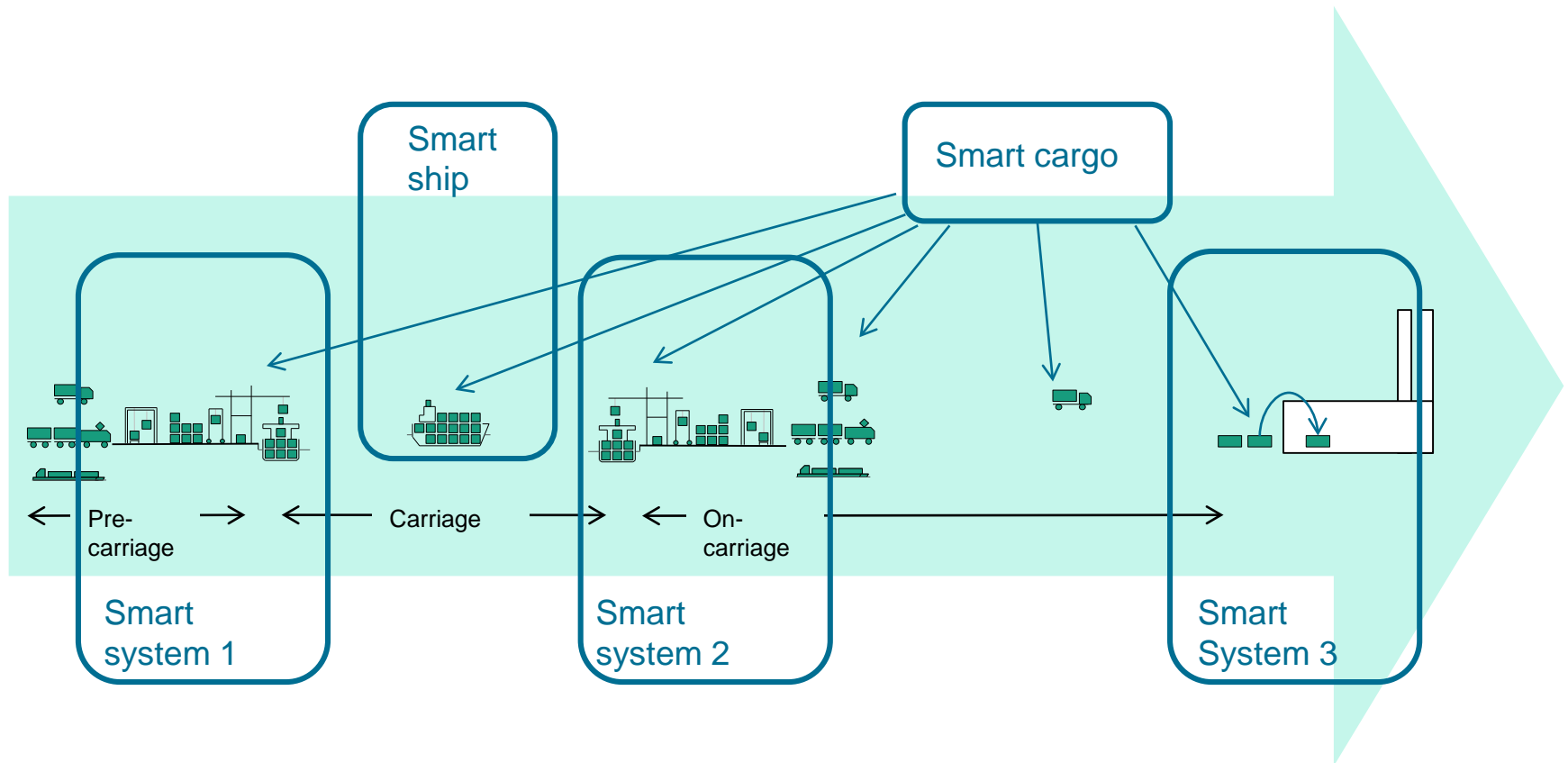
**“The future is already here -
it's just not very evenly distributed.”**

William Gibson, 1993
SF author, USA



Source: http://en.wikipedia.org/wiki/William_Gibson

Is the future already here? Smart transport chain



Outlook: Innovation gap between the large and small ports widens

- Ambitious programs of integration of smart technologies and smart energy use in large dominating world ports.
- However, most inland ports and smaller ports are far from any Port 4.0 vision, even though also they use appropriate IT integration for their customers and their processes.
- Is there a new role for Port Authorities in any disruptive business model?

Outlook Digitalization - the key challenge

- Technology enablers are the prerequisites for the implementation of agile digital structures across the whole supply chain.
- The technologies and applications are often used as isolated solutions.
- The expected success and penetration of these solutions in the port industry is missing so far.
- The real enabler and main success factor for increasing agility would be a continuous data stream across the entire supply chain.
- The challenge is the implementation of more open standards within companies as well as throughout the maritime supply chain.
- The Digitalization of the maritime supply chain and the associated effects are a broad field that requires scientific structuring and prioritization.
- Most ports or port authorities lack a framework that provides orientation

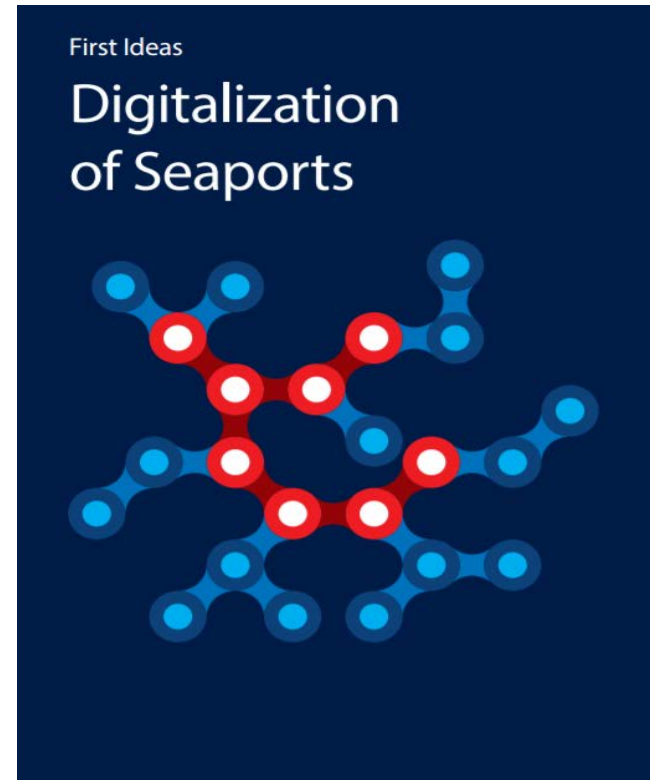
Stay in Contact

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www.cml.fraunhofer.de <http://publica.fraunhofer.de/dokumente/N-438478.html>





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Thank you for your attention!



Facilitator

