
FROST & SULLIVAN
Supporting Business Finland to drive exports by improving its insight on trends
Smart Ports
Report
Date: 12/11/2019

SUMMARY

PROJECT CONTEXT

Strategic Imperative: Help Business Finland drive greater export success

- Business Finland aspires to strengthen Finland's position as an exporter of products, solutions and services for a range of sectors and segments
- Recent technology developments in the information technology space have opened new horizons for the maritime industry. 'Digital Ports' refers to the application of digital technologies such as machine learning, data analytics, visualization, cloud and advanced wireless communications technology to the Port Ecosystem that are driving innovations and enabling business efficiency
- Business Finland has requested for assistance in the gathering of market intelligence on the technology development scenario, technology & application adoption, and benchmarking of certain countries

Project Key Objectives:

Objectives :

To conduct research on the topic of Smart Ports, to gather specific intelligence on technology development and adoption, business applications and to benchmark different countries

Project Scope, Definition and Coverage

Definition: Digital Ports / Smart Ports

Digital Ports refers to the application of digital technologies such as machine learning, data analytics, visualization, cloud and advanced wireless communications technology to the Port Ecosystem

Geographies

- Germany
  (Hamburg, BremenPorts)
- Holland
  (Rotterdam, Amsterdam)
- France
  (Haropa Le Havre)
- Belgium
  (Antwerp)
- United States (Focus only on the East cost)
  (Port of NY & NJ)
- Singapore

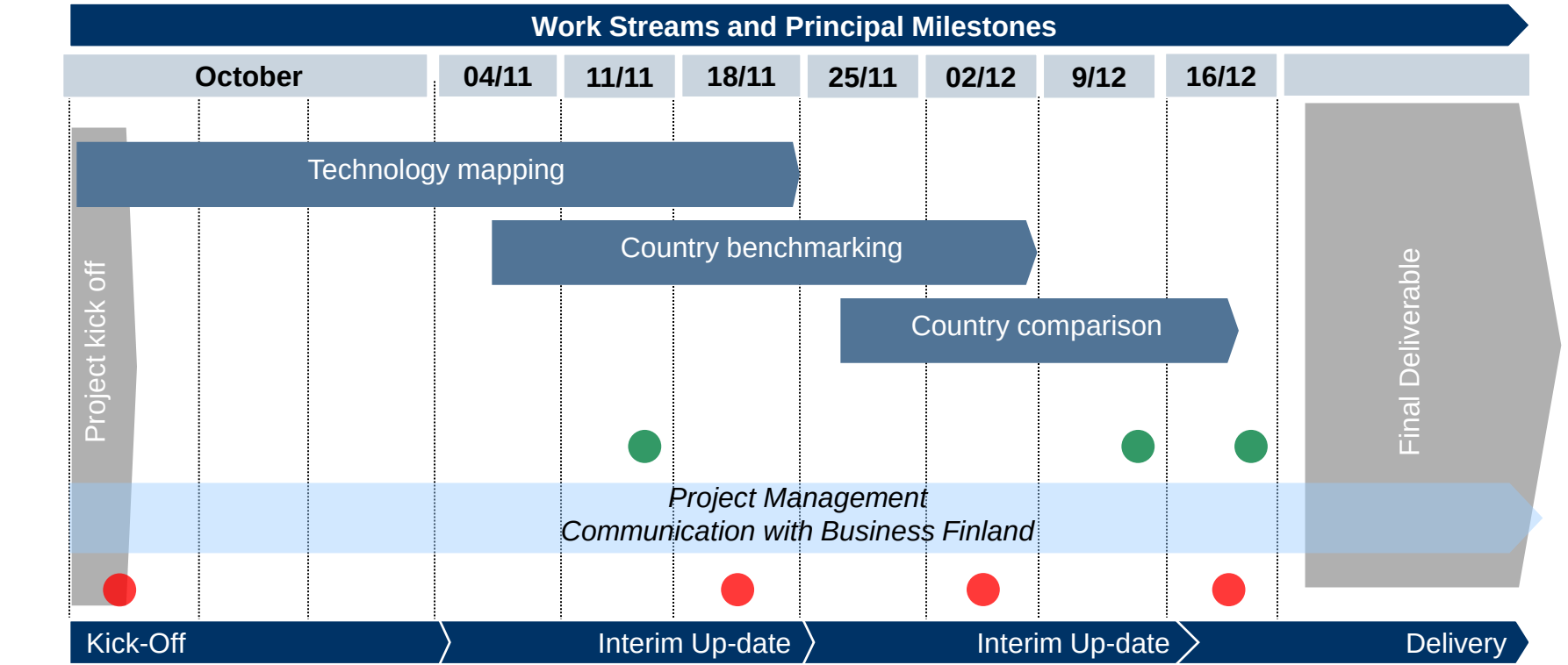
Applications

- Terminal Automation
- Digital Port Call
- Space Optimisation & Port Access
- Digital Infrastructure Management for multi-modal capacity
- Energy Transition & Regulation

Technologies Covered

- Big data & data analytics
- Artificial Intelligence/ Machine Learning
- Cybersecurity
- Sensors & Drones
- Automation systems / Remote control systems
- Image/Video analytics (including surveillance)
- Advanced wireless communication technologies – Port community systems
- Predictive maintenance
- Data driven traffic management
- Tracking solutions
- Digital Twin

Project Timelines



EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

1 PORT ECOSYSTEM

- The ecosystem is composed of multiple types of **PLAYER** which interact within ports: Shareholders, Port Authorities, Operators, Users, Technology Providers, Authorities and Innovators
- The key targets are the biggest **CONTAINER PORTS** with **BUSINESS PROXIMITY** to Finland: the North Sea and Channel Ports, the US East Coast, Singapore

2 DIGITAL TECHNOLOGY

- Digital technologies are designed for smart port **APPLICATIONS AREAS**: Terminal automation, Digital port call, Onshore operations, Infrastructure management, Energy transition
- Each technology is **UNEQUALLY ADOPTED** by port players and ecosystems with a range from mature applications to early stage developments

3 PORT ADOPTION

- Major container ports are driving digitisation and use 'smart' solutions for both **BUSINESS EFFICIENCY** and as a **COMPETITIVE FACTOR**
- The Port of Singapore and Port of Rotterdam are leading technology adoption. Large **CONTAINER PORTS**, especially in **THE NORTH SEA** such as Antwerp and Hamburg, are following suit
- **TERMINAL** operation and **PORT CALL** are the two entry points for ecosystem digital adoption

4 COUTNRY BENCHMARK

- **SINGAPORE** city state hosts the world's first class smart transhipment port, run jointly by the MPA and the global operator PSA
- **NETHERLANDS**, lead by Rotterdam (the largest European port) and supported by Amsterdam, is leveraging opportunities offered by digitisation
- **GERMANY** is building on its innovative ecosystem, leading container ports and its dynamic economy

PORT ECOSYSTEM

KEY STAKEHOLDERS

The ecosystem is composed of multiple types of players which interact within ports

PORT SHAREHOLDERS

For larger ports, shareholders are in most of cases public players: the State, Region or City authorities. The owner usually holds land and infrastructure and the port is the 'managing company'. For smaller ports, most activities could be managed by a private operator

PORT AUTHORITIES

Port authorities are responsible for infrastructure and implementing regulations but, in most cases, they also look after all port management and commercial activities. Competition stems from ports based on their geographic location, industry focus, capacity

PARTNERS/OPERATORS

Terminal operators are key partners as they operate infrastructure, including ship operations. Terminals can be managed by subsidiaries of shipping companies, branches of global terminal operators, local companies or by the port itself. Ownership is complex and varies

USERS/CUSTOMERS

Port customers are the multiple users of port infrastructure and related services. The main clients includes shipping companies but trade and freight forwarders and logistics companies are also end-users

TECHNOLOGY PROVIDERS

Tech providers are companies that partner with other players to provide equipment, systems and technologies that enable operations and optimise efficiency. They are diverse, from data analytics and software companies to crane, vehicle or sensor manufacturers

AUTHORITIES & REGULATIONS

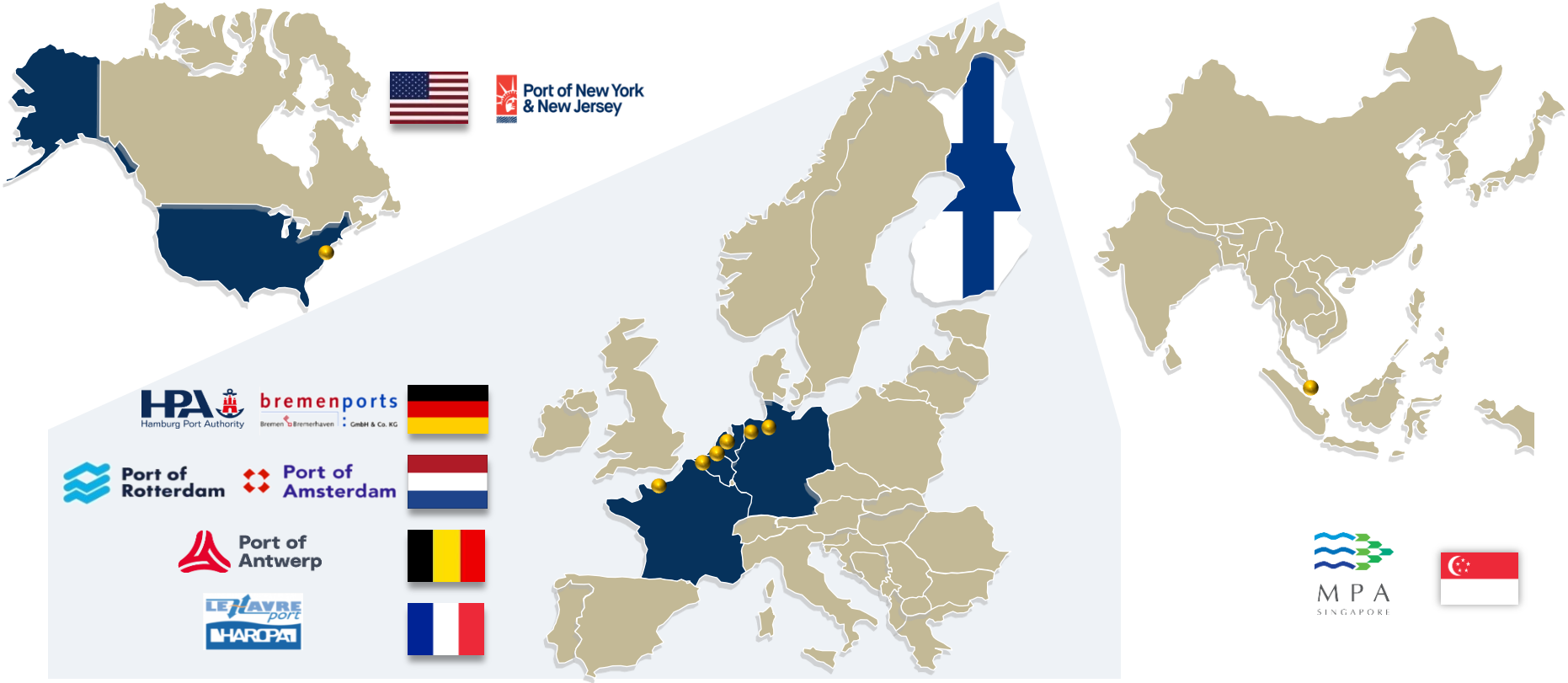
Organisations and authorities accomplish necessary tasks and state duties within the port area and operation process. These include harbour masters, pilots, navigation and customs authorities

INNOVATION ORGANISATION

Port Authorities, often in partnership with public players, industry players, universities and investments players are pushing for innovation through several structures : projects, labs, consortiums, incubators, dedicated funds to the maritime economy and port ecosystems

COUNTRY SCOPE

Priority is given to major container ports with close commercial proximity to Finland



COUNTRY SCOPE

Priority is given to major container ports with close commercial proximity to Finland

Port	Country	TEU volume (2017)	Regional rank (TEU)	Presumed Digital Adoption	Country share of Finland total export / imports*
Singapore	**Singapore**	33.7 M	2	High	Hub to whole Asia
Rotterdam	**Netherlands**	13.7 M	1	High	X=6.6% / I=5.7% (Hub)
Antwerp	**Belgium**	10.4 M	2	High	X= 3.9% / I= 2.5%
Hamburg	**Germany**	8.9 M	3	High	X=13% / I=16%
New York/New Jersey	**US East cost**	6.7 M	3	High	X=7.9% / I=3.1%
Bremenports	**Germany**	5.5 M	4	High	X=13% / I=16%
Savannah	**US East cost**	4 M	4	High	X=7.9% / I=3.1%
Haropa (le Havre)	**France**	3 M	9	High	X=3.5% / I=3.7

*OEC

TECHNOLOGY LANDSCAPE

PORT ECOSYSTEM DIGITAL APPLICATIONS AREAS

Digital Technologies are designed for the smart port applications areas

Technology landscape
TERMINAL AUTOMATION

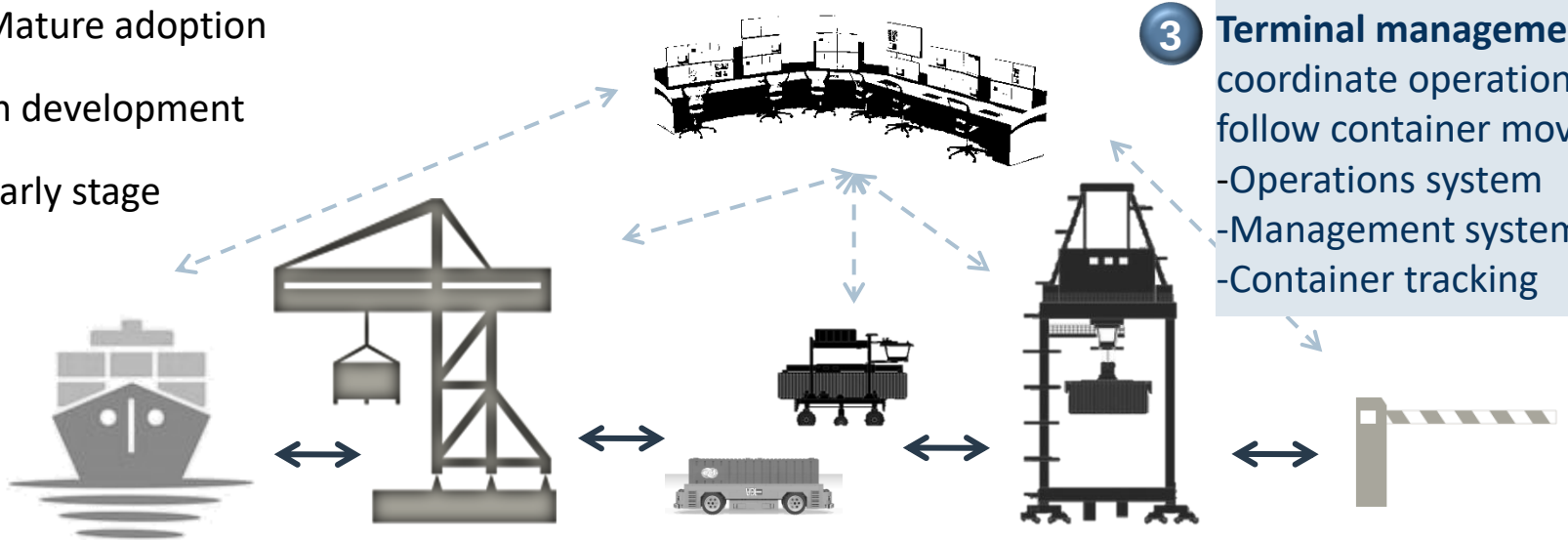
TERMINAL AUTOMATION

Digital technology enable higher logistic efficiency for terminal operator

M Mature adoption

D In development

ES Early stage



3 **Terminal management** to coordinate operations & follow container moves
-Operations system
-Management systems
-Container tracking

Container ship Digital Ship, Panamax, Ultra-Large

Ship-to-shore handling to load/unload container. **Automated Quay Cranes** 1

Automated Carriers for horizontal move from the quay to the yard **2**

Yard storage, to move an store container on land before further movement. **Automated Yard Cranes** 1

Gate automation: Manage access of trucks and in and out container tracking

TERMINAL AUTOMATION

Remote control & automated cranes

Automation of cranes are enabled by the following **TECHNOLOGIES**: laser, infra-red sensors, advanced camera imaging, navigation sensors (RF, optical, inertial) and Crane Management systems. The key adoption driver is to **REDUCE 'COST PER MOVE'** (per handled container). It exist several level of crane automation, from **REMOTE CONTROL** to **FULLY AUTOMATED** (Level 3) They could fit with Panamax & super-Panamax

ABB KONECRANES kinz KALMAR TMEIC

Automated Ship-to-Shore Cranes

ES

Quay cranes: Automated STS cranes are early stage development and mainly semi-automated (remote controlled). The variety and precision of tasks are still difficult to be fully managed by AI

Automated Rubber Tyred Gantry Cranes

ES

Yard cranes: Early stage development, RTGC fit with brownfield development. Mainly semi-automated. These includes position detecting systems and other specific telematics capabilities as they are not fixed on a rail

Automated Rail Mounted Gantry Cranes

M

Yard cranes: ARMG Cranes are designed for greenfield projects, considered to be fully automated, they operates on Yards. Adoption is broad for advanced terminals in major Ports

Crane control systems

M

Processing data from laser, infra-red, video etc.. systems enable cranes to operates and to **coordinate several operations:** container recognition, crane moves, container moves, space appreciation

TERMINAL AUTOMATION

Automated horizontal transport

Automation of yard includes '**HORIZONTAL' CONTAINER MOVES**. Several types of vehicles were designed combined with cranes to manage remotely and even automatically container moves from ship to inland network and the other way around. Major driver for adoption is **REDUCING COST PER MOVE.** The vehicles are managed and monitor by Terminal operation and logistic system as well as equipment monitoring systems

KONECRANES | GOTTWALD

VDL GÖTTING

KALMAR GAUSSIN MANUTISTIQUE

Automated Guided Vehicles

D

AGVs are receiving box (sev. sizes) from quay cranes and delivering to the yard. multidirectional, it works with wires and sensors, directional tapes, Modulated laser piloting or Pulsed laser piloting. gyroscope and transponders help direction. AGVs are controlled by computer navigation

Automated Straddle Carriers

D

ASCs are picking box from ground or over another box. It uses sensors for automated picking, and navigation systems such as magnetic navigation. Operation are controlled by computers

Lithium-Ion battery charging

ES

Lithium-Ion batteries enables more efficient electricity propelled vehicles. Smart chargers, Fast chargers and wireless chargers are typical innovations that reduce downtimes of operations

AGV communication Systems

D

Communication is enabled by wireless data transmission through RF. A traffic control system enable AGVs to work simultaneously

TERMINAL AUTOMATION

Terminal management

In order to optimize increasing number of containers handled through terminal, Operators and Ports are investing in optimised and automated **TERMINAL OPERATING SYSTEM**. Thanks to big data and connectivity system are being implemented to integrate data gathered from various areas of the terminal. Management enables to **COORDINATE OPERATION AND MONITOR LOGISTICS MOVES** of container: entry, moves, stock, exit

Gate automation — D

The Gate operating system that manage traffic is enabled by OCR (optical character recognition) container, truck and train **identification** and **access control**. It is enhanced by video monitoring, damages, regulatory and safety inspections imaging. It communicates with trucks and train

Terminal Management system — M

Terminal operation system (TOS) coordinate equipment actions and support human actions and controls

Container tracking — D

The use of GPS or reference nodes enhance a more **accurate positioning** of containers and consequently better **inventory management**. Automatic system location define where to store the container

Terminal IoT — ES

The data connection of the several equipment in the terminal and automation system enable **coordination** and **automated operations** of the terminal

TERMINAL AUTOMATION

Terminal automation enablers

Several additional areas are subject of **DIGITISATION.** On the container terminal, automated mooring solution are adopted **IN THE MOST ADVANCED PORTS**. Terminal management are also optimized in the infrastructure and maintenance through **PREDICTIVE MAINTENANCE**

Automated mooring

ES

Auto-mooring **optimise turnaround time** and eliminate the need for mooring line and reduce dependence on tug boats and human factors. Mooring is **directly managed** from the ship by RF communication with the mooring units. Within the concept of **smart quay** (cf Port Operation), quay are being equipped with prevent ship to take extra space. In addition, mooring can be support by Automated and underwater Tug.

Crane Predictive maintenance

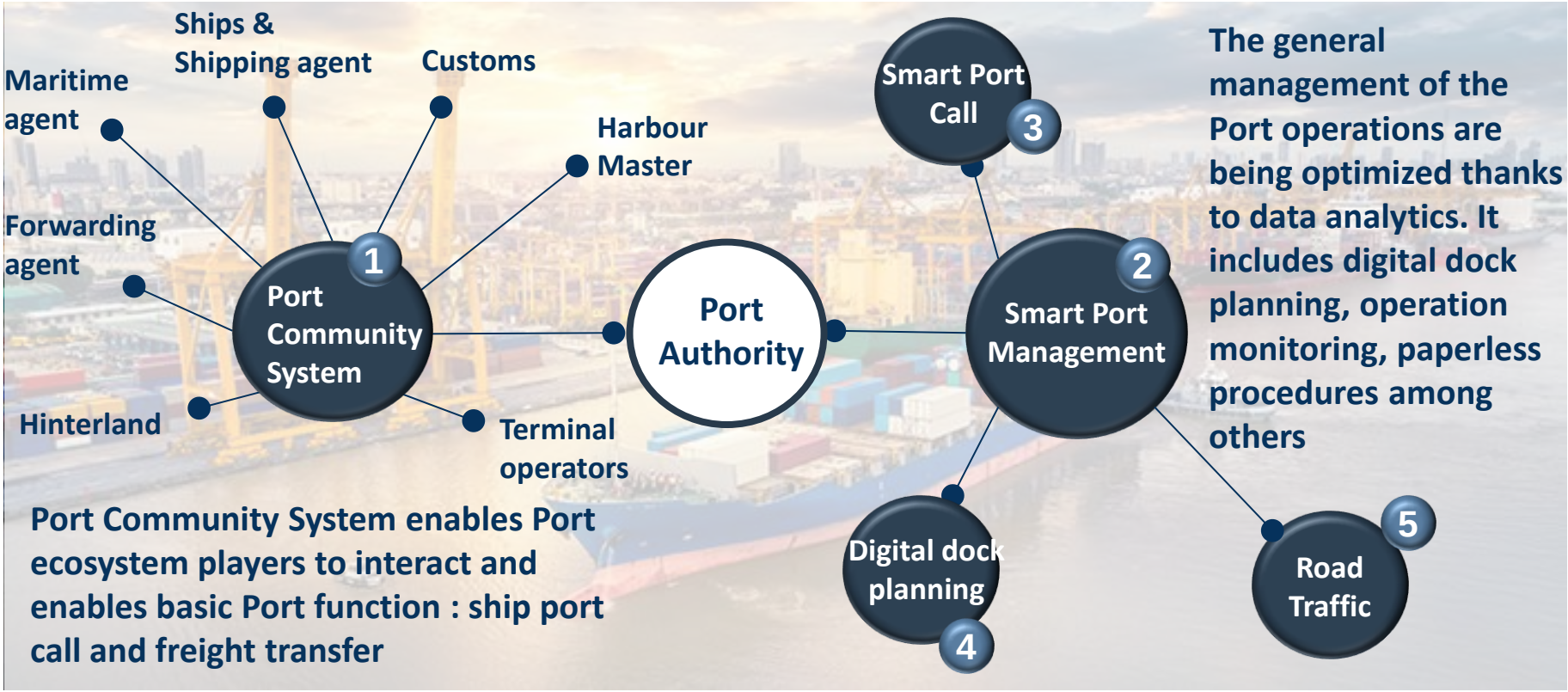
ES

Sensor and reported information from the diverse part of a crane can be analysed and consequently **improve crane MRO**. The data analytics algorithms are improved by global **collection of available crane data**

Technology landscape
DIGITAL CALLS & ONSHORE OPERATIONS

DIGITAL CALLS & ONSHORE OPERATIONS

Ship calls and onshore operation can be optimised both sides by analytics



DIGITAL CALLS

Port community systems

Port Community System set in relation Port stakeholders systems. Already **BROADLY ADOPTED** it reveals several level of digitisation and integration. PCS can be **INTEGRATED** with digital ships, with other Port systems, within a larger shipping ecosystem with hinterland logistic players to enable a continuity of operations and coordination along the entire value chain. Satellite communication could enhance broader integration and system efficiency.

Port Community System

M

PCS is an open electronic platform that securely exchange information between stakeholders. It enable fluid communications and enable **interoperability and paperless administration tasks.** It optimised logistics processes

Enhanced communications – 5G

ES

5G enable transmission of an high number of data from smart sensors of several stakeholder – harbour master, Engineering team, traffic control etc.. enabling rapid treatment of the information and **reactivity** of the Port Authority and its ecosystem

Integrated PCS

D

PCS can be connected with shipping fleet, with other PCS (Portbase, IPCSA). PCS can i**ntegrate hinterland logistics players** to enhance the fluidity of the logistic process. PCS can be integrated with the **Port Management system** providing and benefiting from the data gathered through the platform.

DIGITAL CALLS

Port management (1/2)

Port Authorities needs to manage Port operation and especially ship call. The multiples stakeholders are seeking for **OPTIMISED LOGISTIC EFFICIENCY**. In order to offer the highest level of services, large ports are enhancing their process thanks to **DATA ANALYTICS AND CONNECTED DEVICES**. Ships and freight are monitored and their moves optimised. Before, during and after the call. Level of implementation are diverse and functionality may differ from port to port

Port of Rotterdam · Port of Amsterdam · SAAB · proDEVELOP Integrating technologies · SAP · empross · INCHCAPE SHIPPING SERVICES

Digital docking and dock planning — M

Ports are managing and optimising their dock planning thanks to software and data analytics. as an interface, **software platforms** that enables **booking of berth** and can includes management of duties and invoices. It includes navigations information

Optimized port management system — ES

Based on management modules integration and enabled by **big data and AI**, advanced port management systems perform and enable in one system the **multiples Port Authority tasks** planning operations, control, reporting, administration, waste management etc. The communication is ensured by the PMIS

Data driven monitoring & control — ES

At Port level, container or ship status are monitored thanks to **automated reporting** thanks to sensor or human reporting through digital devices or traditional software. It enables quickest ship call management, **logistic efficiency** and **capacity management** of docks

Smart Quay — ES

The concept of smart quay includes infrastructure monitoring and operations. Automated mooring controlled by sensors and cameras **optimised the speed and space** used by ships by a strict space use

DIGITAL CALLS

Port management (2/2)

Smart Port Management rely on **technology enablers** such as data analytics algorithms, Positioning systems and infrastructure operations

SIEMENS Ingenuity for life · IBM · Microsoft · SAP · EY · Port of Amsterdam

Vessel Traffic System

D

Enabled by Automatic identity system (transponders or satellite), Differential GPS, RFID, the Vessel traffic system enable ship monitoring and fleet management within the Port. It enhance incident prevention and logistics optimisation

Sea-lock / bridge management

D

Operating and control systems of key infrastructures enables ship flows on estuary Ports.

Data Analytics

D

A key enabler of Port management is data analytics, and especially Predictive and Prescriptive analytics that enables prediction of moves and time load optimising the flows

DIGITAL CALLS

Smart calls

Ports needs to welcomed smart ships, and make their new capabilities valuable for the business. **NAVIGATION TECHNOLOGIES** as well as **ANALYTICAL TOOLS** enabled by cloud and advanced communication network is giving sense to smart port calls

Digital twin — ES

With the multiplication of sensors measuring a high numbers of metrics and producing data, some Ports are able to model a **virtual representation** of the port to **ease both operations and planning**

Blockchain Technology — ES

Blockchain is tested to build cargo information platform to ease and secure **freight information sharing**. The aim is to speed and secure security checking, customs, as well as improving logistic management

Geographic information system — D

Using multiple data sources, from AIS ship positioning, hydrographic, economics, metro etc.. GIS is enabling providing **visual managing tools** that can **optimise operations**. Can be cloud based for smaller ports, shared through mobile devices

Digital route planning — ES

With route planning systems powered by **AIS** and related vessel fleet management used by ship-owners, **waiting time can be reduce** and port can optimise their navigable areas, **dock capacity** and port call

ONSHORE OPERATIONS

Road traffic management

Effectively managing passenger and freight **TRAFFIC WITHIN, OUTSIDE AND AS IT ENTERS** ports is key to increasing efficiency and profitability whilst improving safety and security. Operators are borrowing and, in some cases, adapting solutions from the road traffic and other areas which leverage cameras, sensors and other inputs to provide a **HOLISTIC VIEW OF CURRENT AND HISTORICAL VEHICLE MOVEMENTS**

veovo

Daitek

ORBITA PORTS&TERMINALS

Video analytics for road traffic — D

Deploying **video** analytics allows operators to draw full value from often already installed security cameras, automatically monitoring traffic to improve safety (e.g. by identifying vehicles) and increase efficiency (e.g. by monitoring movements)

Automated port access checking — D

Erecting OCR-based **automated** entry and exit gates to ports facilitates easy and quick access for hauliers whilst supporting users with monitoring and checking containers and their contents for dangerous and/or other unwanted cargos

Data driven traffic management — ES

Installing sensors on the roads leading to a port helps local authorities to alleviate congestion, collecting non-personal **data** from drivers' devices to track travel times and, in turn, adjust traffic lights or signage to facilitate smooth traffic flows

Technology landscape
INFRATSRUCTURE MANAGEMENT

INFRASTRUCTURE MANAGEMENT

INFRASTRUCTURE MANAGEMENT

Advanced infrastructure monitoring

Monitoring infrastructure to enable operation is one of the main task of a Port Authorities. Thanks to **SMART SENSORS** and **ADVANCED COMPUTING** and especially **VIDEO-ANALYTICS**, Port Authorities are being able to **MONITOR MORE EFFICIENTLY THE LARGE AND DIVERSE INFRASTRUCTURES** they have to manage. It includes network, Road, rail, access, restricted areas and access warehouse & stock, quays, banks, water depth, locks

Smart camera & Computer vision

D

Connected camera and computer **image analytics** enable **changes detections.** It could reveal damaged infrastructure, areas intrusion, use status and enable automated reporting needing action to be taken

Road / Rail network Monitoring

D

Network of road and rail need to be **constantly monitor** to avoid any load break. **Smart sensors** including connected cameras can managed efficient and automated **control of the network**

ASV/UUV monitoring

ES

Estuary Ports are specifically requiring a way to **manage water depth** and **berth status** to enable ship moving and mooring within the port. **sounding drones** with ultrasonic sensors or cameras can maintain a **constant monitoring** of the depth and berth and give Engineering teams the needed data to perform dredging and maintenance operations

INFRASTRUCTURE MANAGEMENT

Predictive maintenance

Ports Authorities need to maintain infrastructure operational. **MAINTENANCE OF THIS INFRASTRUCTURE** are being optimised and automated through PREDICTIVE MAINTENANCE and condition based maintenance. Data gathered from sensor or human reporting is analysed and enable **PREDICTION OF INCIDENT** and eventually **AUTOMATED PLANNING** of control operations and maintenance actions called Prescriptive Maintenance.

Rail Predictive maintenance

D

Rail network is a key areas where infrastructure maintenance plays a key role in **operation continuity** as it enables multimodality.
Prediction of incident from **monitored data and algorithms** enable more **efficient MCO**

Building information modeling

ES

BIM generate **3D models** of assets, enabling the assessment of collected data. It gather **current and historical data** of an asset. It enhance the **infrastructure management** in relation with **VR tools**, and predictive maintenance

Predictive maintenance for Infrastructure

D

Thanks mainly to CCTV, authorities are able to **predict damaged**, cracks etc.. on port pavement. Vehicles equipped with cameras feed constantly computer systems that **rise potential issue** on the Port areas.

Prescriptive maintenance

ES

In addition to predictive maintenance more advanced Port are considering implementing **automated action prescription systems** for infrastructure maintenance and management

INFRASTRUCTURE MANAGEMENT

Others

A number of emerging technologies, notably additive manufacturing and Unmanned Aerial Vehicles, are finding their application in ports. 3D printing is very much in its infancy with operators establishing collaborative incubators to explore the potential, whilst drones are already being used to conduct selected missions. Together, they promise efficiency and safety/security gains

3D printing for spare parts — D

3D printing facilities are being tested on-site at ports globally. Additive manufacturing and the development of “factories in a box” has the potential to transform the aftermarket, reducing excess inventory, minimising storage costs and delivering spare parts to operators in minutes or hours rather than days or weeks

Drones for port inspections — D

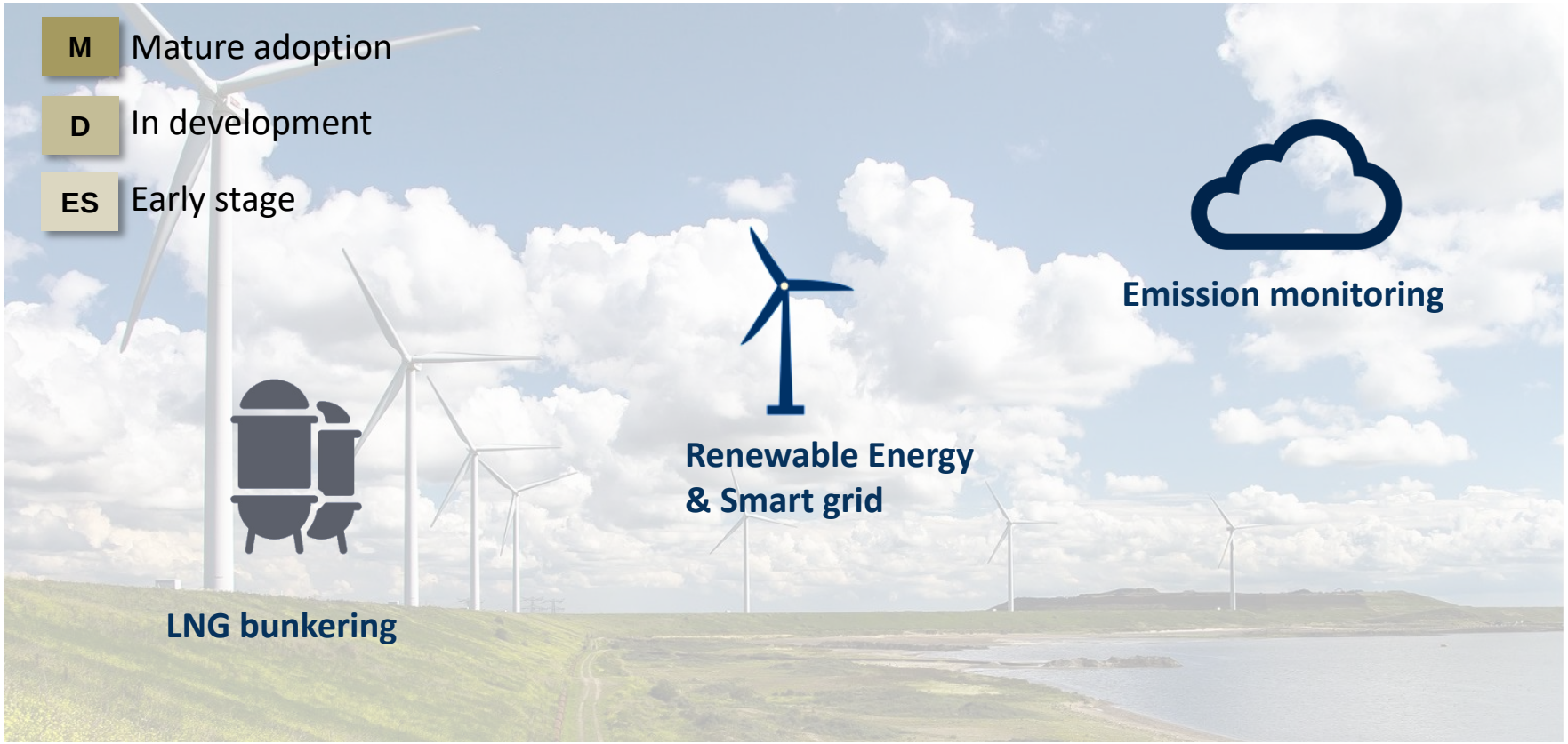
Drones are used regularly to inspect the equipment and buildings in ports which would otherwise be difficult and/or dangerous to access. Unmanned Aerial Vehicles (UAVs) can also be leveraged for security and health & safety purposes or to monitor sea- and land-based traffic and other movements

Incident / Fire reporting — M

The Port management Information system (PMIS) enable harbour master and partners to intervene as quickly as possible on the incident, especially for ship collision of infrastructure fires

Technology landscape
ENERGY TRANSITION

ENERGY TRANSITION



ENERGY TRANSITION

Fuel consumption and emission monitoring

Matching regulations for both on shore and on board is a **PRIMARY CONCERN AND DUTY** for European Ports (Port state control, Harbour master etc...) **ENERGY TRANSITION**, **WASTE MANAGEMENT** and **REGULATION CONTROL** and enforcement are enable by a various range of **DIGITAL TOOLS** and specific **MONITORING TECHNOLOGIES**

WÄRTSILÄ · Bigbelly · TOTAL · Aeromon · avantida by E2OPEN

Emissions monitoring system — D

Co2, NOx and SOx could be monitored through **scrubber data collection** form temper proof sensors, liquid fuel testings' data collections, optical **measurement of plume**, sensors monitoring such as sniffers on bridges. **Continuous in-situ EMS** would become the norm to enhance permanent control. Measurement can be done by drones. **Satellite analytics** will be able to measure exhaust contents

Road transport efficiency — ES

Platforms driven by **data analytics** increase avoidance of **empty container transport**

Smart waste collection system — ES

Ship waste management in addition to proper port waste is a big challenge for port and enable ship owners to match there regulations requirement. Waste **compression system**, and **sensors**, enable **optimisation of waste storage and collection**.

LNG capabilities — D

Major ship owners are starting to operate LNG ships to match IMO regulations. Consequently Ports are developing **LNG fuelling & storage capacity**

ENERGY TRANSITION

Energy efficiency

The intensive use of energy on land and at sea is damaging to ports' environmental footprints and economic performance. Authorities and operators are therefore looking for ways in which to **reduce consumption** and switch to **renewable sources** in order to become more attractive and competitive. Most of the energy efficiency solutions deployed in ports are borrowed from other industries and settings

Smart grids

D

Deploying smart grids facilitates the integration of distributed/renewable sources and allows operators to monitor power usage and assess energy needs across diverse stakeholders. Ultimately, it can enable the establishment of Virtual Power Plants

Renewable energy (vessels)

ES

Using renewable/sustainable energy sources and increasing the efficiency of carriers and other vessels can reduce air pollution, carbon emissions and fuel consumption. Authorities are exploring the option of operating hydrogen fuel cell powered tugs

Renewable energy (ports)

M

Leveraging ports' on land estates to construct e.g. a solar farm or biomass plant has the potential to make a material difference to their energy mixes. In addition, many ports provide operations/maintenance bases and expertise for offshore wind farms. It includes providing electricity from Shore-to-Ships to reduce fuel consumption and pollutant emissions in Ports

Technology landscape
TECHNOLOGY ADOPTION MATURITY

TECHNOLOGY ADOPTION EVOLUTION

Adoption differs from port to port but a general trend can be observed

Mature

- Terminal Management system
- Gate automation
- Container tracking
- ARMG Cranes
- AGVs / ASCs
- ARTG Cranes
- Automated Ship-to-Shore Cranes
- Lithium-Ion battery charging
- Crane Predictive maintenance
- Terminal IoT
- Automated mooring

Early stage

- PCS
- Port Management systems
- Dock planning
- Advanced monitoring
- Sea Lock/bridge management
- GIS & Digital route planning
- Smart Quay
- Smart Vessel Traffic Management
- Digital twin
- Blockchain Technology
- Advanced communication – 5G

- Video analytics for road traffic
- Automated port access checking
- Data driven traffic management

- PMIS
- Road / Rail network Monitoring
- Smart camera & Computer vision
- Building information modeling
- Predictive maintenance
- Drones monitoring
- 3D printing
- Prescriptive maintenance

- Emissions monitoring system
- Smart waste collection system
- Road transport efficiency
- LNG capabilities

COUNTRY BENCHMARK

Country benchmark
NETHERLANDS

STAKEHOLDERS

PORTS SHAREHOLDERS

City of Rotterdam

City of Amsterdam

Kingdom of the Netherlands

PORT AUTHORITIES

Port of Rotterdam

Port of Amsterdam

PARTNERS - OPERATORS

DP WORLD

msc

VCK logistics

APM TERMINALS

APM Terminals Rotterdam

CTVREDE - STEINWEG B.V.

HUTCHISONPORTS ECT ROTTERDAM

HCT

USERS - CUSTOMERS

MAERSK

msc

Hapag-Lloyd

Shell

abc logistics

lyondellbasell

SAMSKIP

CMA CGM

COSCO

YANG MING

DHL

TECHNOLOGY PROVIDERS

National

CERTUS PORT AUTOMATION

portbase

VDL

PortXchange

Foreign

IBM

esri

CISCO

axians

KALMAR

INCHCAPE

AUTHORITIES & REGULATIONS

Belastingdienst

Dutch Customs

Centraal Nautisch Beheer Noordzeekanaalgebied

Rijkswaterstaat Ministerie van Infrastructuur en Milieu

water ministry

POLITIE

Koninklijke Marechaussee

Human Environment and Transport Inspectorate - Ministry of Infrastructure and the Environment

Infrastructure & Environment

INNOVATION ORGANISATION

prodock.

Mainport Innovation Fund II

TU Delft

PORT INNOVATION LAB

SMART PORT

PORTXL

BlockLab

PORT OF ROTTERDAM

Specificity : **Container Port** and transhipment, Liquid bulk, Dry bulk

Figures 2018 : **469 M tonnes,** 30K sea-going vessels, 100K inland vessels, **14,512K TEU.**
dec. Revenue 707.2 M E,
dec. Profit: 254.1M E,
inc. Operating expense : 267.8 M E,
inc. gross investments: 408.1 M E

Infrastructure : **12,713ha,** 6,275 ha rentable sites. 77.3 km quays, 202 km banks, 125 jetties

Additional : Direct and Indirect AV represent **6.2% of Dutch GDP**

Specific needs / Key pain points

- Keep leading position / competition with Antwerp (ship calls and land lease)
  - Ultra-large ship capacity
  - Digital readiness
  - Logistic efficiency
  - Regulation Compliance & Safety ratios
  - LNG capabilities
- Comply with Partner & Public requirement
  - Environmental compliance
- Diversify revenue streams > Consulting services, system solutions
- Manage cost structure with Increasing operating expenses (digitisation & Energy transition)

Smart Port Achievements

- *Portbase* PCS
- *HaMIS* is the PMIS for Harbour master to plan, monitor and adminstrate shipping traffic
- *IoT platform*, collecting data from various sensors within a cloud platform, processed in real time to improve Port services (IBM, Esri, Cisco, Axians)
- Objectif of *4D digital twin*
- *Operating flow model* OSR (monitoring networks, meteo and hydro information's such as water levels, speed. (part. Rijwaterstaad)

- Simpler discount scheme for green ships
- Fisrt LNG bunkering by Shell (Aframax tanker)
- Hydrotreated vegetable oil propelled harbour patrol boats and hybrid diesel-electric patrol boats reduction of CO2 and PM emissions

- Multi party camera surveillance pilot in Waalhaven
- *Pronto application* > Communication & Call Optimisation application that aim at reducing vessel waiting time
- *Mainport Traffic Monitor* > real time information sharing from road traffic, handling time and empty depots for logistic players
- *5G* testing to enable use of large scale wireless sensors
- *McNetiq*: magnetic jetty anchors for smart and safe maintenance
- APIs based services: ETA predictions, information on ship journey, container journey : *Boxinsider* track and trace container with ETA-D etc.. (ABC logistics)
- Vessel Traffic services improvement

PORT OF AMSTERDAM

Port of Amsterdam

Specificity : **Multi-function,** Liquid bulk (1st petrol handling port in the worlds), dry bulk, agro-bulk, cruise and containers

Figures 2018 : **82,3 M tonnes** (101.8 M total North-sea canal) around 20 M in transhipment,

17,950 sea vessel in the NS canal,
41,250 inland vessel
425K passengers,
Inc. Revenue :157,4 M E
Inc. Profit : 68.5 ME
Inc Operating expense: 29 M E

Infrastructure:**4,500 ha**. North-Sea canal & Sea lock, Energy Infrastructure.
inc. 45.1 hectares land leased

Additional: Direct & Indirect added value is **7.2 B E**

Specific needs / Key pain points

- Avoid volume losses
  - Added Services and Digital readiness
- Mitigate Estuary constraints
  - Sea-lock and space optimisation
- Manage City proximity and related requirement (Port City & Ij bridges)
  - Environmental
  - Space & navigation optimization
- Mitigate Risks and safety issues

Smart Port Achievements

- Roadmap Digital Port for 3 core fields: nautical operations, commerce, assets & infrastructures. It includes pilot projects for the use of data, IoT, sensors.
- *HaMIS* PCS* was developed by Rotterdam (Portbase).
- *MOBIapp* for ISPS certification checking (Harbour master 7 Security officers;
- *BLIS* for connected inland vessels, mooring and docking
- *RiverGuide* (Netherlands route & berth data sharing on Dutch waterways)
- *Easydock* app for inland cruise ships docking and paperless duties
- *DSP* Dynamic lock planning to minimise waiting times
- Technical coordination centre TCC for Harbour master operation
- Rail Freight transportation programme (PoR and *ProRail*)
- Start-ups: *Parcompare* platform connecting mobility solutions, *Synple* market place for empty truck and cargos
- Test on traffic and parking optimisation (sensors & analytics)
- AIS data analytics for waterway monitoring, berth occupancy evolution
- Strong Interest in drones applications for monitoring – tests with partners
- Hydraulic asset digital inspection reporting
- 1240 Solar panels, Tata Steel Hydrogen plant and LNG bunkering 2019, wind Farms with 2021 goal of 100 MW, CO2 Capture & Reuse
- Circular economy : *Chain craft*, *Bin2barrel* recycling plants
- Air Measurement and noise measurement#
- Automated traffic light optimisation

Country benchmark
GERMANY

STAKEHOLDERS

PORTS SHAREHOLDERS

Free city of Bremen

Free city of Hamburg

PORT AUTHORITIES

PARTNERS - OPERATORS

USERS - CUSTOMERS

TECHNOLOGY PROVIDERS

National

Foreign

AUTHORITIES & REGULATIONS

Customs

Coast Guards

INNOVATION ORGANISATION

Bremen & Bremerhaven innovation fund

PORT OF HAMBURG

Specificity : **Container**, Dry Bulk, Liquid Bulk,

Figures 2017 : **135.1 M tonnes**
8,8M TEU (3.2 transhipment, 5.6 Hinterland traffic)
2.2 M cars, 870k passengers, 5,200 inland vessels
2016 Inc. Revenue :185 M E
Inc. Profit : 68.5 ME
Inc. Operating expense: 29 M E

Infrastructure:**4,460 ha**, 142km road, 62 bridges

Additional: 265,000 directs or indirects jobs

Specific needs / Key pain points

- Avoid volume losses against competition / Exchange reduction
  - Mitigating container dependence
- Avoid overcapacity
- Manage duties level with low freight rate
- Maintain efficient access in the Elbe & environmental standards improvement

Smart Port Achievements

- 5G program with Telekom and Nokia
- Building Information Modelling (BIM) used to enhance planning and operation
- LNG bunkering project & cold Iron to reduce emissions
- VR and AR studies
- Intermodal *Port traffic centre* for traffic flow monitoring and optimisation.
- *InfoPORT:* Data capture and sharing for logistic efficiency. Sharing information on, traffic, parking, infrastructures, bridges closures.
- Monitoring of vehicles and infrastructure through centralised information by *control room software*
- Tests : ASV Water drones that survey the port with eco-sounders for water depth and surface monitoring,
- DIVA system (dynamic information on traffic volumes)on traffic information sharing coupled with informative LED panels – Managed in the Port Road Management centre
- Short to ship renewable energy provided
- Predictive maintenance of railway network through sensors data collection and analytics#
- Current development of a mobile GPS sensor feeding the HPA system for intelligent fleet management. It will provide data for temperature, wind, pollution.
- Infrastructure monitoring and finally predictive maintenance using human mobile devices reporting. For Bridges, roads and track
- Reduction of empty container movement by info sharing through a cloud based system
- Electric mobility with charging and e-taxis operations
- Parking optimisation app for trucks
- *TransPORT rail* : Traffic Management system for Rail transport – optimisation & user data sharing

BREMENPORTS

Specificity : **Container**, Ro-Ro & Cars, General cargos

Figures 2018 : **74,3 M tonnes** (12.3M in Bremen, 62 in Bremerhaven), **5.5M TEU**
2.2 M cars, 238k passengers, 5,200 inland vessels
Inc. Revenue :157,4 M E
Inc. Profit : 68.5 ME
Inc. Operating expense: 29 M E

Infrastructure:**4,460 ha**, 38 km quays, 33 km banks, 178km rail network, 99km road, 5 locks

Additional: 18,4% of the Federal land of Bremen employment

Specific needs / Key pain points

- Manage Overcapacity in deep sea Bremerhaven port
  - Commercial targets / competition with Rotterdam, and Hamburg (Zebrugge for cars)
- Related infrastructure cost including rail & road network
- Environmental protection of the Weser River
- Port Economy and Maritime sector is first driver of Bremen economics > Need to leverage a maximum of value

Smart Port Achievements

- DBH provides the PCS system (partner with SAP sigma n3)
- DBH provide ship information system for vessel tracking and traffic management
- 2018: settlement of Infrastructure Data Management System for the Bremen port railway (IDMS) for Management and predictive maintenance. (Sersa group).
- PRO.FILE IT infrastructure for document management and process control,
- Use of CAD systems and GIS for Port management

Country benchmark
FRANCE

STAKEHOLDERS

PORTS SHAREHOLDERS

French State

Represented by :Ministry of Transport

PORT AUTHORITIES

PARTNERS - OPERATORS

USERS - CUSTOMERS

TECHNOLOGY PROVIDERS

National

Foreign

AUTHORITIES & REGULATIONS

Customs

Maritime cost authority

Inland navigation network

Ministry of Transport

INNOVATION ORGANISATION

HAROPA – PORT OF LE HAVRE

Specificity : Liquid bulk **Container**, General cargos, Agri-bulk

Figures 2018 : **120M tones (**94,7 M tones Maritime, 22.1M tones inland), **3M TEU**
430K Passenger

Infrastructure:**6000 ha of land,** 57 terminals, 150km of roads, 200km of railway, 100 bridges and locks

Additional: 32,000 direct jobs and 16,500 indirect

Specific needs / Key pain points

Heavy entry and compliance procedures
- Process optimisation & Digitization

Seveso Area Security
Hinterland access and network issue
- Road traffic congestion
- Transhipment from terminal to network
- Avoid overcapacity
- Compete with North sea port for transhipment and hinterland competition especially with Antwerp

Smart Port Achievements

- *SOGET PCS S)one*.(Le Havre based company – partnership with Microsoft)
- *SOGET S-Wing* : Vessel traffic management
- *Delta system* : e-customs procedures
- Interconnected systems thought the *'smart corridor'* (Whole HAROPA). Since 2018, two 100% digital calls in Le Havre.
- *Optiroute* and TAS (*SOGET*) for road traffic management.
- *Timad HM* hazardous material management
- Smart Data Service Platform launched in Le Havre (Le Havre City, SOGET, Orange, Cisco) for data analytics of transport to optimize both urban services and Logistic flows
- *SOGET, UMEP and Airbus* partners
  - to combine VTS management system and Styris VTS radar to improve mobnitoring and optimise port operations and calls
  - Security Operation Centre enhanced by cybersecurity

Country benchmark
UNITED STATES

STAKEHOLDERS

*

PORTS SHAREHOLDERS

State of New York

State of New Jersey

PORT AUTHORITIES

THE PORT AUTHORITY OF NEW YORK & NEW JERSEY

PARTNERS - OPERATORS

GLOBAL CONTAINER TERMINALS

MAHER TERMINALS

PNCT

USERS - CUSTOMERS

NEPTUNE GROUP

ACL

SEABOARD MARINE

TECHNOLOGY PROVIDERS

KALMAR

DMI DRIVING MOBILE INNOVATION

BYD

AUTHORITIES & REGULATIONS

Waterfront Commission

US Customs & Border Protection

US Immigrations & Customs Enforcement

US Army Corps of Engineers

INNOVATION ORGANISATION

There is no evidence of any significant innovation organisation

**Only East-cost*

PORT OF NEW YORK & NEW JERSEY

Port of New York & New Jersey

Specificity : **Container**, cars, dry and liquid bulk, cruises, ferries

Figures 2018 :
7.2m TEU
0.6m rail lifts
0.6m cars
0.9m cruise passengers

Infrastructure: 3,900km2 port district including 5 facilities; Port Newark, Elizabeth Port Authority Marine Terminal, Port Jersey Port Authority Marine Terminal, Howland Hook Marine Terminal, and Brooklyn Port Authority Marine Terminal

Additional: 3rd largest US port

Specific needs / Key pain points

- Limited capacity;
  - Container volumes are predicted to double or triple in 30 years
  - Road and rail network is congested
- Restrictions on the way in which the largest modern container vessels are able to use the vital Kill Van Kull waterway
- Ageing infrastructure; many of the current facilities were built before 1950
- Signatory of the Paris Climate Agreement
  - Requirement to reduce Green House Gas emissions by 35% by 2025

Smart Port Achievements

- "Integrating new technology into port operations" forms a key plank of PANYNJ **Master Plan 2050** which was published in July
- There is a particular focus on;
  - E-commerce
  - 3D printing
  - Autonomous vehicles
- Piloting "zero-emission cargo transfers" using electric truck tractors together with tenant **Best Transportation** and **BYD**
  - Electrifying its shuttle bus fleet
- Leveraging the **E-Zpass** road tolling system to capture live traffic data and track the movement of vehicles outside the facility
- Rolling out version 2.0 of **PortTruckPass**, PANYNJ proprietary web-based Port Community System
- Deploying new gate systems which reduce truck turnaround time by 25% using **OCR devices** and upgraded Weigh In Motion machines
- Working with Via to launch **LGA Connect**, an app-enabled ridesharing service for passengers at LaGuarda
- Trialling, together with Maher Terminals, an all **electric Kalmar straddle carrier**, the first of its kind to be deployed anywhere in the US
- Offering **3 apps**, CrossingTime, MyTerminal, RidePath, providing real-time travel information for port visitors

Country benchmark
BELGIUM

STAKEHOLDERS

PORTS SHAREHOLDERS

City of Brugge

City of Antwerp

PORT AUTHORITIES

Port of Antwerp

PORT OF ZEEBRUGGE

North Sea Port

PARTNERS - OPERATORS

DP WORLD Antwerp

PSA

EUROPORTS

MPET MSC PSA EUROPEAN TERMINAL

ANTWERP CONTAINER TERMINAL

USERS - CUSTOMERS

CMA CGM

MAERSK

msc

CMB

TECHNOLOGY PROVIDERS

NxtPort

nallian

PORT-WIFI

Microsoft

proximus

AUTHORITIES & REGULATIONS

Federal Public Service FINANCE — *Customs & Excise*

Saniport: Port Health authority

Police Fédérale Federale Politie — *Shipping Police*

Maritime Access department

Agentschap Maritieme Dienstverlening en Kust — *Flemish Agency for Maritime Services & Coast*

INNOVATION ORGANISATION

CITY OF THINGS

imec

COREALIS THE PORT OF THE FUTURE

PORT OF ANTWERP

Specificity : **Containers, liquid bulk,** break bulk, dry bulk

Figures 2018 **: 235.3 M tones ; 11.1M TEU** ; 14,000 seagoing ships, 52,000 barges, 1.3M cars ; 75.7M tones of liquid bulk

Infrastructure: 15 main terminals, **12,000 ha** port area, 7.2m m3 liquid bulk storage capacity, 7 sea locks, 1000 km of pipelines

Additional: 144,000 indirect and direct jobs

Specific needs / Key pain points

- Limited capacity by physical geographical limit to expansion
  - capability to welcome ultra-large ships
  - Need to optimise space usage
- Estuary specific constraints
  - 7 sea locks operations require fine management
  - Specific Management of the navigation on the Scheldt
- Inland access issue – congestion on the Antwerp city ring
  - Traffic management and logistic optimisation

Smart Port Achievements

- APICA – virtual assistant , virtual reality – real time.
- Blockchain pilot project for hygiene & phytosanitary certificate
- IoT project – city of Antwerp : sensors enabling docking
- Automatic image recognition: Preventive maintenance, traffic management.
- Test for autonomous trucks in terminals
- Data driven digital dart port community Platform NxtPort (Antwerp based company). Includes logistic optimisation tools such as ETA predictions
- Customer platform: 'Connectivity Platform' (collaboration with Port+)
- Use of drones to monitor water-depth.
- *Echodrone* : Automous water depth monitoring (collaboration with *dotOcean*)
- *Seafar* developed the *Tuimelaar an* unmanned multifunction vessel in testing
- *Hydrotug* is a hydrogene propelled tug boat in operation (manufactured by CMB)
- Circular economy: heat plants
- Shore to ship electricity provider – from renewable energy sources
- *iNoses* : Air chemical composition sensors and changes analysis for incident prevention

Country benchmark
SINGAPORE

STAKEHOLDERS

PORTS SHAREHOLDERS

Singapore Government
Integrity • Service • Excellence

EDB singapore

PORT AUTHORITIES

MPA
SINGAPORE

PARTNERS - OPERATORS

PSA

ONE
OCEAN NETWORK EXPRESS

jtc
Breaking New Ground

USERS - CUSTOMERS

COSCO SHIPPING 中远海运集装箱运输有限公司 COSCO SHIPPING LINES CO., LTD.

OOCL

RoyalCaribbean INTERNATIONAL

EVERGREEN

CMA CGM

NOL

DREAM CRUISES

TECHNOLOGY PROVIDERS

ST Engineering

IBM

WÄRTSILÄ

VDL

FUJITSU

XJERA LABS
videos to insights

Microsoft

GAUSSIN MANUGISTIQUE

AUTHORITIES & REGULATIONS

MPA
SINGAPORE

Customs

INNOVATION ORGANISATION

PIER71

PSA UNBOXED

Agency for Science, Technology and Research
SINGAPORE

NUS National University of Singapore
Centre of Excellence in Modelling and Simulation for Next Generation Ports
Faculty of Engineering

PORT OF SINGAPORE

MPA SINGAPORE

Specificity : **Container**, cruises

Figures 2018 :
36.6m TEU
130k vessel calls
At any one time, the Port can accommodate 1,000 vessels

Infrastructure:
84 berths
>24km of quays
>200 cranes
>9000 hectares

Additional: accounts for 5,000 maritime establishments, contributing 7% of Singapore's GDP and employing 170,000 personnel; 2nd largest global port with the $15b Tuas Mega Port under construction

Specific needs / Key pain points

- Limited and heavily utilised anchorage space in the context of increasing ship calls and potential land reclamation for other uses
- Possible diversion of Asia-Europe trade away from the Malacca/Singapore Straits with climate change opening up alternatives

Smart Port Achievements

- The Port of Singapore strives to;
  - "Enable the industry to embrace technology", one of four key pillars in its **Sea Transport Industry Transformation Map**, published in 2018
  - Position itself as "the premier global maritime hub" for "Connectivity, Innovation and Talent" as recommended by the **International Maritime Centre**
- **Investing**, with ST Electronics, in a *Next Generation Vessel Traffic Management System*
- **Installing** a *Very High Frequency Radio*
- **Trialling** *Body Worn Cameras* for surveillance
- **Rolling out**, with IBM, *Sense-making Analytics for Maritime Event Recognition*
- **Testing**, with Xjera, AI for site safety/security
- **Conducting**, with Microsoft, sessions to build a blockchain platform for *Smart Contracts*
- **Leveraging** *Remote Inspection* Services for ship surveys, including Unmanned Robotic Arms, Remote Operated Vehicles and Unmanned Aircraft Systems among others
- **Developing** a *Maritime Single Window*, a unique portal for ship reporting and submission of all port related documents for vessel, immigration and port health clearance
- **Drawing** up the terms of reference for an *Integrated Port Operations System*, covering command, control, communications and information for crisis management
- **Exploring** *Innovative Mooring Solutions* such as floating or other anchorage systems which have the potential to increase capacity by over 100% in the mid to longer term
- **Issuing** E-certs to Singapore registered ships
- **Collaborating** with Fujitsu and SMU in respect of AI based VTM, prediction and coordination

INNOVATION ECOSYSTEM (1/2)

ROTTERDAM

- Smart Port collaboration & Summit : Province of South Holland, Deltalinqs, Municipality of Rotterdam, Marin, Erasmus Univ., TU Delft, TNO, Deltares
- Container 42 initiative :
- PortXL accelerator : Van Oord, EY, Vopak, Shell, Royal IHC, Boskalis, Rabobank, City of Rotterdam, Apelmann, North Sea Port, ECE, InnovationQuarter
- Port of Rotterdam LAB : Application development
- PortXchange Subsidiary : offer Pronto plaform and related application (parntership with Shell & AP Moller Maersk)
- Blocklab : Blockchain technology lab for port application

AMSTERDAM

- Prodock 2.0 Industrial incubator
- Mainport Innovation Fund II supporting logistics start-ups for both port and airport

BREMENPORTS

- With the Metropolitan Region Nordwest launch the Digilab project supporting SMEs with digital transformation (BAB, Ubimax)
- Partner in the IWTS 2.0 (2018-2020) a European project for digital tool development for inland shipping

HAMBURG

- SmartPort initiative with BSU (Development and Environment) and BWVI (Economy, Transport & innovation) ministries in collaboration with Hamburg University of Technology, Harburg

ANTWERP

- ‘Smart Harbour’ part of the ‘Capital of Things’ programme led by the city of Antwerp. (Imec, Univ. of Antwerp) : Cameras, sensors, Waterview, an automatic sounding boat and a 3D model
- MAS Port Pavilion will be the innovation hub of the Port of Antwerp – building innovation plans and smart technology development
- European partnership program ‘Smart Ports Entrepreneurial Ecosystem Development’ SPEED (2018-2022) led by Antwerp Management school (Antwerp Univ, Startups.be, and multiple Belgians, UK, Dutch and French partners)

INNOVATION ECOSYSTEM (2/2)

HAROPA

- Trafis Lab (Haropa, soget, Univ. of le Havre)
- End 2018: “Le Havre Smart Port City” with the municipality of Le Havre. (similar projects in Rouen and Paris)

MARSEILLE

- Ze Box (Marseille) is the CMA-CGM incubator for port start-up innovation focusing on container operations improvement

PORT OF NEW YORK & NEW JERSEY

- There is no evidence of any significant innovation organisation

PORT OF SINGAPORE

- Runs an annual **Smart Port Challenge** and has a **Maritime Technology Acceleration Programme** which aim to encourage collaboration between companies, technology players and start-ups
- Tests promising solutions in “**Living Labs**”
- Launched the **Port Innovation Ecosystem Reimagined** “Pier71”, a technology accelerator with links with the Netherland’s PortXL and Denmark’s Rainmaking/Pier47
- Signed a MoU with the National Additive Manufacturing Cluster (NAMIC) and 3D Metal Forge to establish the first **on-site additive manufacturing facility** for ports
- Partnered with Singapore Polytechnic to establish a **Centre of Excellence in Modelling and Simulation for Next Generation Ports** (C4NGP) to handle increasingly complex operations

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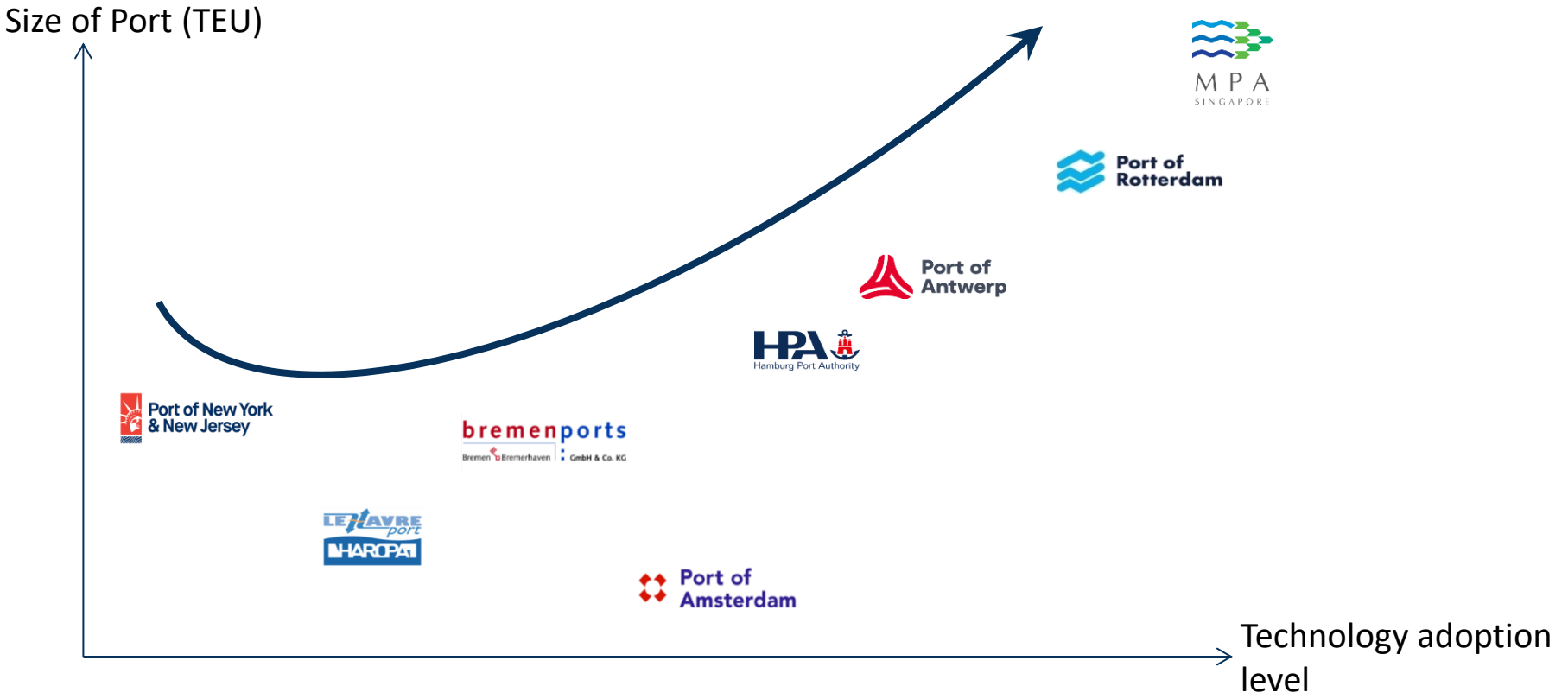
COUNTRY COMPARISON

PORT TECHNOLOGY APPLICATION ADOPTION



COUNTRY DIFFERENCIATOR

Smart capabilities are unequally adopted by countries and ports

- ❑ **Automated Terminal**
- ❑ **Data driven PCS**
- ❑ **Predictive Maintenance**
- ❑ Data sharing & Interface
- ❑ **Advanced VTM**
- ❑ Road Traffic Management
- ❑ Drones & Sensors
- ❑ 5G

- ❑ **Automated Terminal**
- ❑ **Data driven PCS**
- ❑ **Data sharing & Interface**
- ❑ **Port Optimisation**
- ❑ **Advanced VTM**
- ❑ **Road Traffic Management**
- ❑ **Drones & Sensors**
- ❑ Blockchain

- ❑ Data sharing & Interface
- ❑ **Data driven PCS**
- ❑ **Advanced VTM**
- ❑ **Road Traffic Management**
- ❑ **Drones & Sensors**
- ❑ Digital twin
- ❑ Blockchain

- ❑ **Data sharing & Interface**
- ❑ **Data driven PCS**
- ❑ Advanced VTM
- ❑ **Road Traffic Management**

- ❑ Automated Terminal
- ❑ Data driven PCS
- ❑ **Advanced VTM**
- ❑ **Data sharing & Interface**
- ❑ **Road Traffic Management**

- ❑ **Automated Terminal**
- ❑ **Data driven PCS**
- ❑ **Data sharing & Interface**
- ❑ **Port Optimisation**
- ❑ Blockchain
- ❑ **Road Traffic Management**
- ❑ **Drones & Sensors**
- ❑ **Predictive Maintenance**

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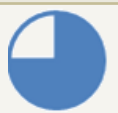
SMART PORT COUNTRY BENCHMARK

						Innovation Ecosystem	Total / Rank
							
							*29* / **3**
							*33* / **2**
							*24* / **4**
							*20* / **5**
 *							*14* / **6**
							34 / **1**

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‘TIER 2’ COUNTRY OVERVIEW

- *7 Chinese ports within the 10 busiest ports in the world (in TEU)*
- *Port of Shanghai is the busiest Port in the world with 42M TEU*

- Yangshan Deep Water Port in Port of Shanghai is the largest automated terminal in the world – 132M tones capacity – 26 bridge cranes, 130 AGVs, 120 RMGC
- Huawei is leading 5G communication for Port automation

- *UK Department of Transport is launching Maritime 2050 strategy to enhance maritime economy (partnership with Rotterdam, Antwerp & Singapore)*

- The Hutchinson Port terminal in Felixstowe (3.85M TEU) face issue with nGen Terminal Management platform in 2018
- Hutchinson Port terminal acquired in 2018 Ship-to-Shore cranes improving level of terminal automation

- *At global level, driven by geo-economics, Japanese Ports are in a peripheral position – Tokyo the biggest port in Japan is around the 20th world position. In APAC, Singapore and Shanghai hold the transhipment hub positions*
- *Port 2030 program is planning to improve terminal automation for container and Ro-Ro, Port communications and match Energy transition.*
- *Japan is investing in LNG bunkering capabilities (Jera, NYK, Toyota)*

- *Valencia Port, Algeciras and Barcelona Port are amongst the business Port in Europe with respectively 5.1M TEU. 4.8M TEU and 3.4M TEU in 2018*

- Terminal gate automation and container tracking pilots conduced in Port of Valencia (MSC terminal, *Traxens*)
- Automated terminal in Algeciras – APM terminal (RTG, gate automation *Certus*) & Total Terminal International

CONCLUSIONS

CONCLUSIONS & RECOMMENDATIONS

Use major container ports as a **BENCHMARK** for technology adoption. Strong competition amongst **GEOGRAPHIC NEIGHBOUR** should drive an overall increase in demand for digital technology to be able to meet new standards. Baltic and North Sea ports would be the first **POTENTIAL TARGETS**

EFFICIENT LOGISTICS, above and beyond terminal operations, such as those enabling inland access and vessel route planning, will increasingly be pursued by port stakeholders. The opportunity to solve major port and partners' pain points covers **VERY DIVERSE AREAS**

As stakeholders struggle to **SHARE INVESTMENTS**, a difficulty for technology providers will be to find players that agree to invest within the ecosystem. **PORT AUTHORITIES** supported by public players and **TERMINAL OPERATORS** are the main **DECISION MAKERS** but the various users & customers plays a critical influencing role

The less advanced ports should offer a growth opportunity for **TECHNOLOGY PROVIDERS**. Partnerships involving **MAJOR PORTS** would have a competitive advantage – they are leveraging their own experience and developments. **PARTNERING** with a leading port is often **A KEY MARKET ENTRY POINT** for technology providers

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