Digitalization of Sea Ports – Challenges and Perspectives

Dipl.-Ing. Ralf Fiedler

M.Sc. Julius Kuechle

BPO Conference Riga 2020

Outline

1 Challenges

2 Perspectives and Barriers

3 Conclusion

Fraunhofer
CML

Outline

1 Challenges

2 Perspectives and Barriers

3 Conclusion

Goals, Challenges, Means

Growth
at limited areas and infrastructures as well as demographic development
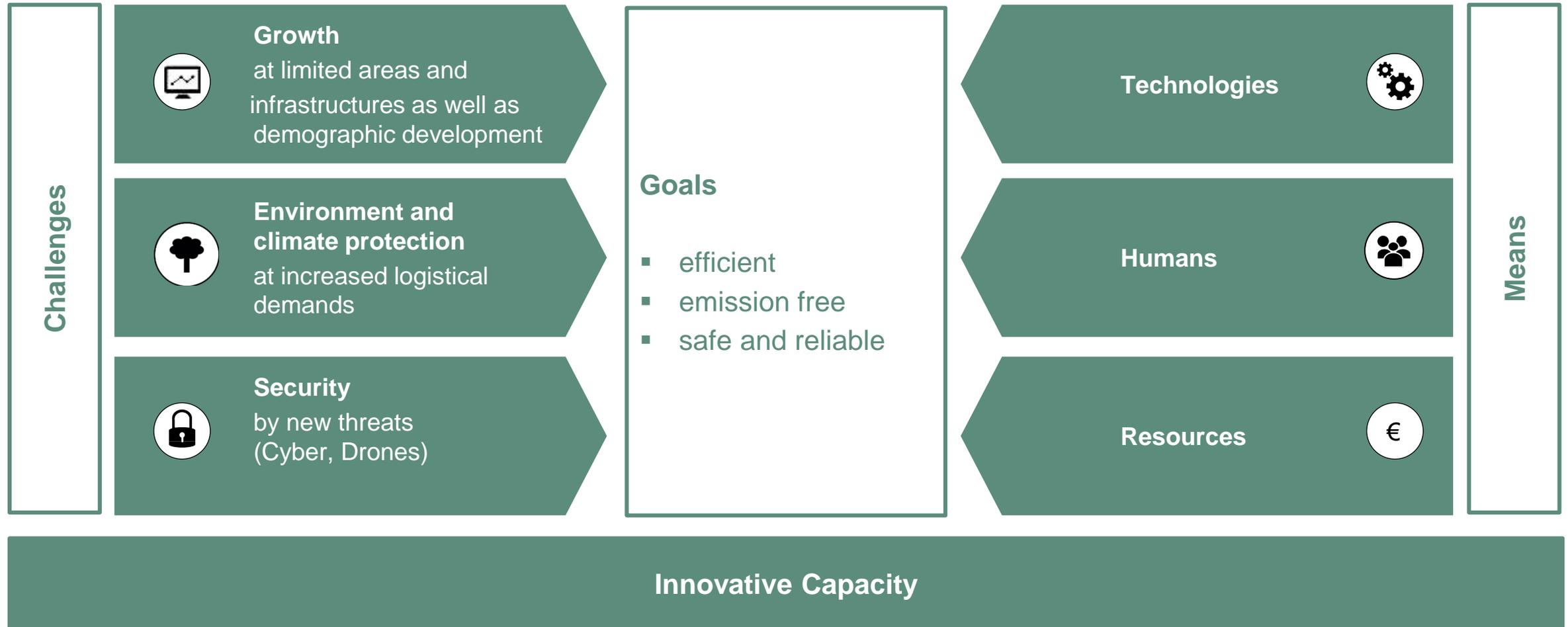
Goals

- efficient
- emission free
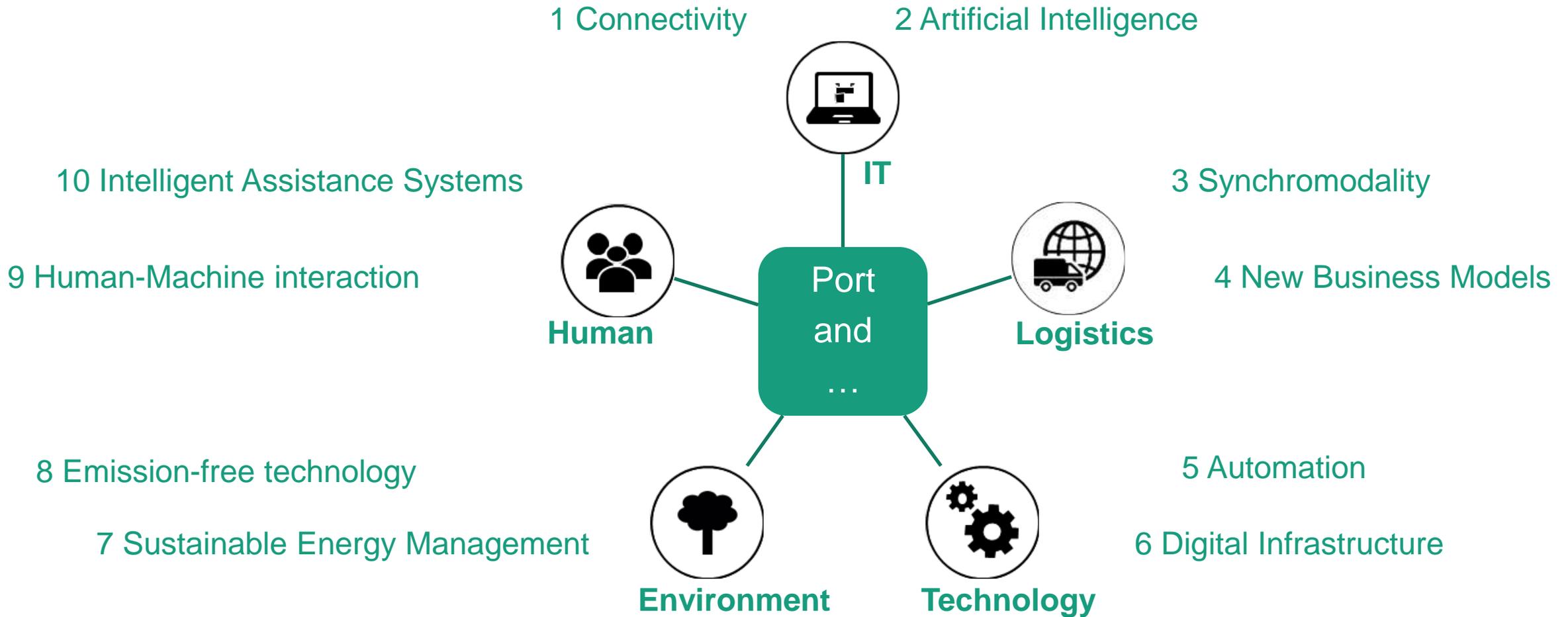- safe and reliable

Fraunhofer
CML

Goals, Challenges, Means

Challenges

Growth
at limited areas and infrastructures as well as demographic development

Environment and climate protection
at increased logistical demands

Goals

- efficient
- emission free
- safe and reliable

Fraunhofer
CML

Goals, Challenges, Means

Challenges

Growth
at limited areas and infrastructures as well as demographic development

Environment and climate protection
at increased logistical demands

Security
by new threats (Cyber attacks, terrorism)

Goals

- efficient
- emission free
- safe and reliable

Fraunhofer

CML

Goals, Challenges, Means

Challenges

Growth
at limited areas and infrastructures as well as demographic development

Environment and climate protection
at increased logistical demands

Security
by new threats (Cyber, Drones)

Goals

- efficient
- emission free
- safe and reliable

Technologies

Humans

Resources

Means

Innovative Capacity

Fraunhofer
CML

Outline

Perspectives
Port Industry 2040

1 Connectivity

2 Artificial Intelligence

IT

10 Intelligent Assistance Systems

3 Synchromodality

9 Human-Machine interaction

Human

4 New Business Models

Logistics

Port and …

8 Emission-free technology

5 Automation

7 Sustainable Energy Management

6 Digital Infrastructure

Environment

Technology

Fraunhofer
CML

Perspectives – and Barriers
Port & IT

1. **Connectivity**

   Actors in maritime transport and ports are comprehensively and cyber-securely connected by open IT platforms. The broad use of sensor and communication technology (Internet of Things) provides real-time information regarding location, condition of equipment, vehicles and cargo carriers (intelligent containers) on a permanent basis.

   > BUT; which actor really welcomes transparency? How to handle transparency of data?

2. **Artificial Intelligence**

   AI helps to evaluate the multitude of available data in a targeted way; insights into logistical, economic and technical contexts and forecasts. Algorithms make scheduling decisions and control processes efficiently and securely.

   > BUT; AI needs the right data to learn, biased data exists

Fraunhofer
CML

3. **Synchromodality**

IT networks and IoT create end-to-end transparency in the logistics chain. The history, location, condition, handling of the goods as well as other pending processes and their options are known to the relevant actors. This makes synchromodal logistics chains possible and the existing logistics resources and infrastructures are used more efficiently.

BUT; Are these spare resources really available? At what costs? With whom is the contract made?

4. **New Business Models**

In the course of AI-supported data generation, evaluation and use as well as automation, new business models and new operating concepts for technical systems are emerging.

BUT; Do port authorities benefit? Can it be embedded in the PA business goals?
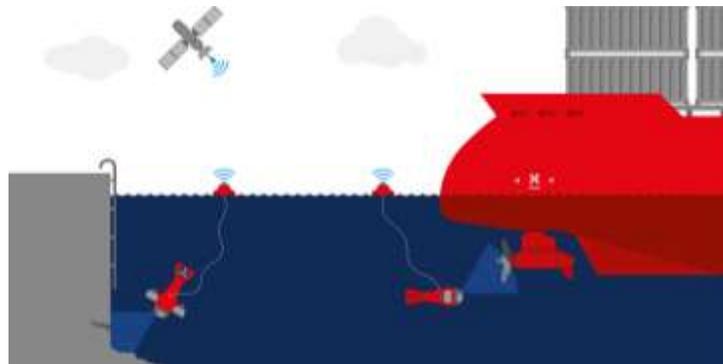
Perspectives and Barriers
Port & Technology

5. **Automation**
   The port and logistics sector becomes more automated. Automated, semi-automated and autonomous systems are used for transport, storage and handling processes. The machines are connected and communicate with each other.

   BUT; If the reasons for automation are weak efficiency and high wages, how come that only few fully automated terminals have emerged?
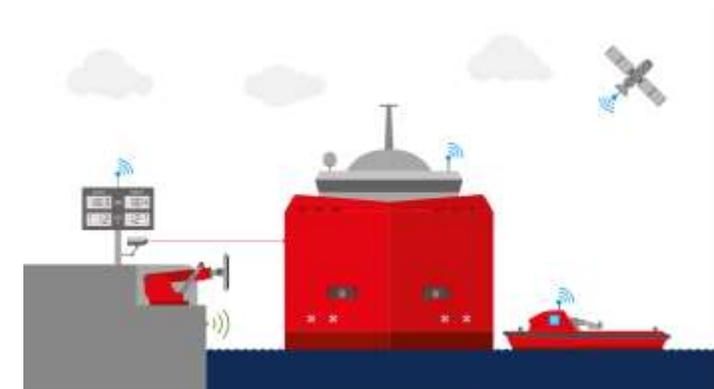
6. **Digital Infrastructure**
   In order to enable autonomous driving on land and sailing on water, the ports are equipped with a comprehensive digital infrastructure. Vessels, vehicles and load carriers can be located and controlled in real time.

   BUT; Since req. technologies rapidly change, how can PA reduce uncertainty in such digital infrastructure investments?

Fraunhofer

CML

7. Sustainable Energy Management
Renewable energies (wind, sun) are generated and used to cover the energy requirements in the port. Energy supply and demand in the port are synchronized across all actors and managed in an energy-saving manner (Smart Grid).

BUT; Renewables can be unstable. Availability of green energy remains an issue. Actors are not used to co-operate for saving energy.

8. Emission-free Technology
Technical systems on land and at sea are designed to prevent emissions. Many electric as well as gas and hydrogen propulsions are in use. Shore power for ships is rolled out widely.

BUT: On shore power supply is not always green. Electrical power does not come from renewables only. Costs of synthetic fuels are still high.

9. Human-machine Interaction
Routine physical activities are replaced by automation solutions or supported by cooperative robots. Human work focuses on complex maintenance tasks.

BUT; What to do with low qualified personnel? Are costs prohibitively high?

10. Intelligent Assistants
Dispositive and routine activities and decisions are handled by intelligent algorithms. The human concentrates on strategic decisions. Human work takes place more on the system than in the system.

BUT; Shouldn't decisions be comprehensible? AI often fails when the truly unexpected happens.

**Fraunhofer**
CML

Outline

1 Challenges

2 Perspectives and Barriers

3 Conclusions

Conclusions 1/2
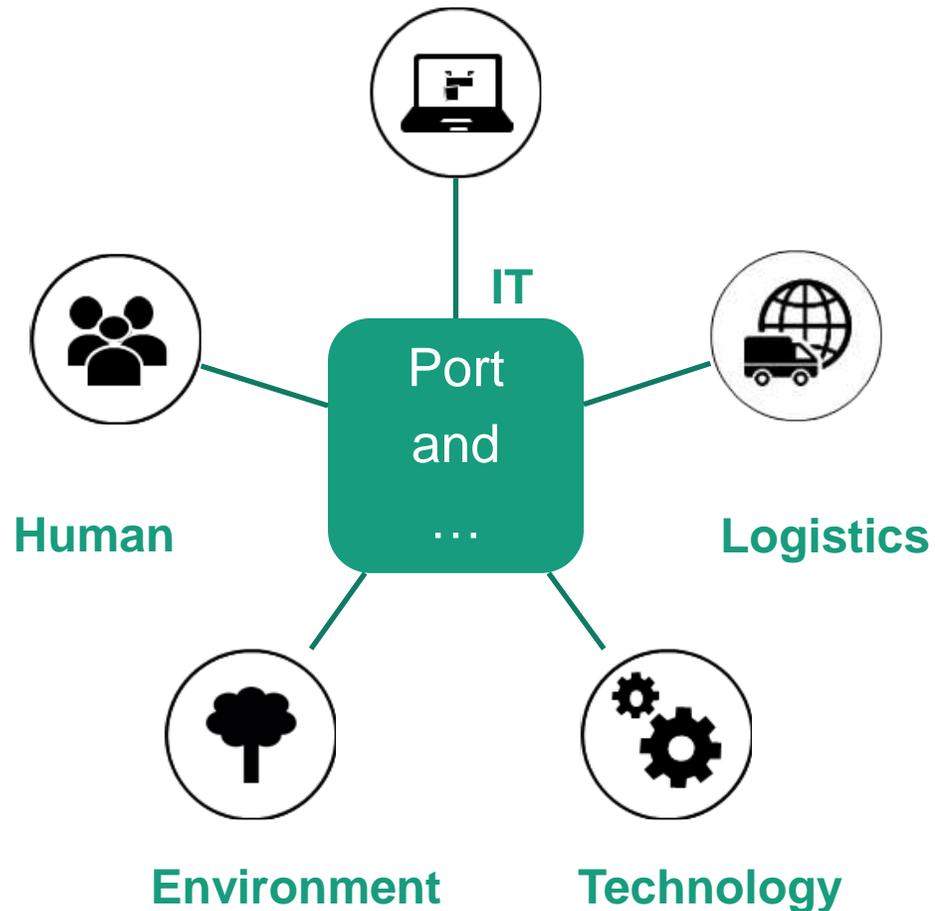
- Ports are more and more understood as connected high-performance logistics machines with synchronized, intermodal transport, transshipment and storage processes embedded in new logistical and technical services.

- Digitization, automation and emission avoidance have a major impact on technology development, infrastructure and human work

- Opportunities => Port as an innovation ecosystem: Shift from

  - the port as user of logistical innovations from other areas to

  - the port community as the driver of logistics innovations

Fraunhofer
CML

Conclusions 2/2

IT

Human

Port and …

Logistics

Environment

Technology
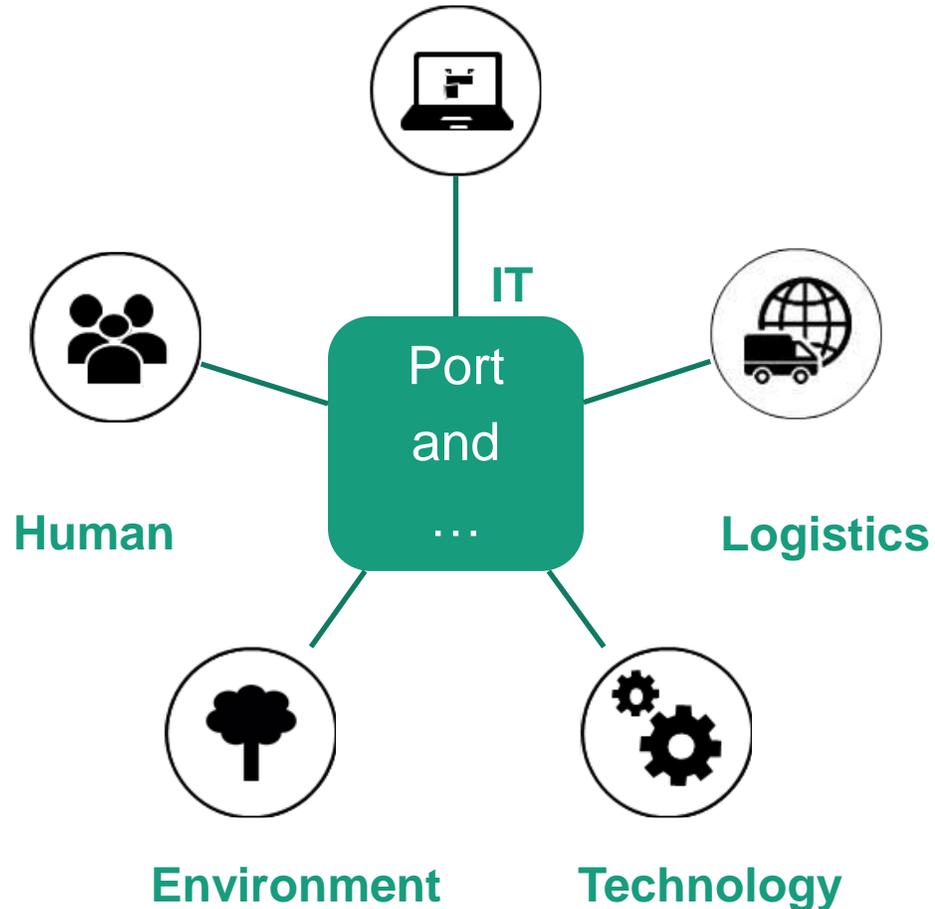
- Digitalization is often used for differentiation by ports.

- Common platforms seem not to be welcomed by the port authorities and operators while the port users would benefit from that.

- Are we really talking 4.0 when some desperately wait for 2.0 in the transport industry (e.g. single truck companies)?

- Are port authorities at all in a position to foster digitalization in their domain? Is that their business goal?

Thank you very much for your attention!

https://www.verlag.fraunhofer.de/
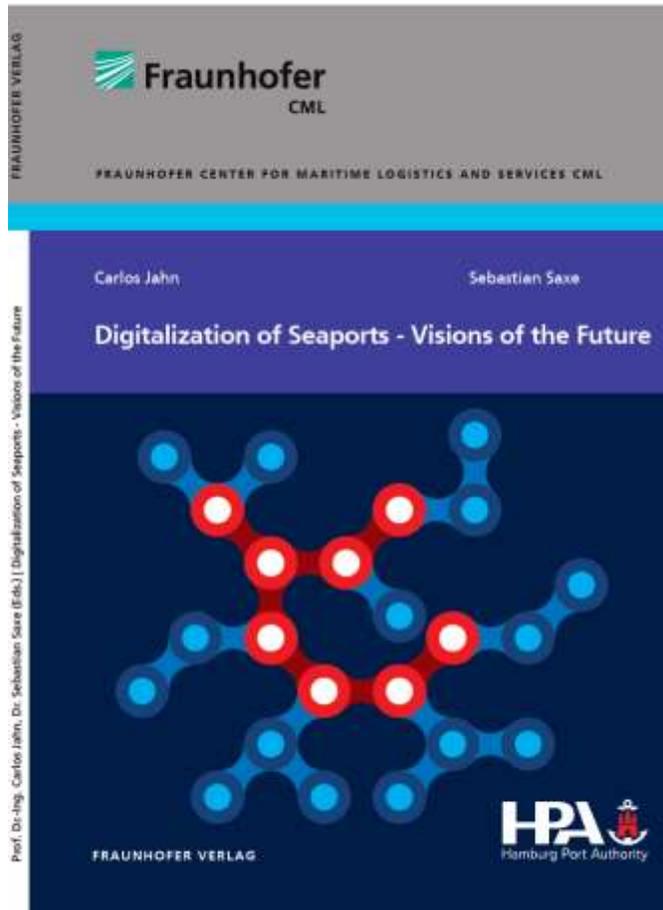
Julius Küchle / Ralf Fiedler

Fraunhofer-Center for Maritime Logistics and Services CML

Am Schwarzenberg-Campus 4, Gebäude D
D-21073 Hamburg
Tel: + 49 (0)40 428 78-4450

www.cml.fraunhofer.de