THE DIGITALISATION MEGATREND

WHY SEAPORTS SHOULD PARTICIPATE

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The environment of seaports is very dynamic. Megatrends of today include:

1. Globalisation, distribution of work, changing trade patterns and structural changes in production driven by smart factories and increased customization, for example;
2. Demographic change, such as an ageing population and the impact on the labour market;
3. Rising levels of urbanisation, resulting in increasing problems at Port-City interfaces;
4. Sustainability, meaning the demand for environmentally, economically, and socially sustainable port operations.

These megatrends have an impact on society and economy. Seaports are faced with the challenge to cope with these megatrends. Amongst other effects, they demand completely new paradigms regarding the strategic orientation of seaports. As an example, increasing globalization has led to growth in transport volumes as well as port throughput volumes, resulting in bottlenecks and congested hinterland transport connections. Coping with these bottlenecks in a more efficient way requires the combined capacity use of all hinterland transport modes (road, rail, inland waterway) [1]. However, due to the competition between different actors in the transport sector means a system wide optimisation is often unrealistic.

Digitising complete supply chains and automating information exchange could form a solution to this problem [2]. In order to overcome current information exchange barriers research is currently being undertaken on the translation of the internet to the real-world. The result would be the Physical Internet, as we are beginning to see manifested through the Internet of Things, which would bring about a hyperconnected global logistics system including fully available and transparent intermodal transport services [2].

THE DIGITALIZATION MEGATREND

No development has influenced the evolution of industries more than advanced technological innovations. This can be observed when comparing the major achievements of the third industrial revolution (electronics and IT for a further automation of production) with the major achievements of the 2nd industrial revolution (mass production based on the division of labour and powered by electrical energy) [3]. Digitalisation will further continue and even accelerate this development. The digital universe (digital data created, replicated, consumed per year) is expected to double every two years and to grow by a factor of about 300 from 130 exabytes in 2005 to 40,000 exabytes in 2020 [4].

Digitalisation can also be understood as the technical infiltration of all social and economic sectors. It is transforming industrial processes all over the world.

INTERNET OF THINGS

A major innovation in the context of Digitalisation is the concept of the 'Internet of Things'. The main characteristics of Internet of Things Applications are:

1. Interconnectivity and data exchange among heterogeneous network elements, as well as with global network convergence and local or regional autonomy.
2. Intensive information processing, using uncertain sensory data, multisource and type data fusion, authorisation and privacy protection, interaction and adaptation.
3. Comprehensive intelligent services, including delivery, adapting software design, service adaptation and modelling. [5]

Major innovations related to the Internet of Things are RFID platforms, sensor networks, Cloud solutions, cyberphysical systems, and Machine-to-Machine systems. These innovative digital solutions do not just speed up or expand IT and production but also allow new ways to communicate, as well as new business models.

THE ECONOMIC IMPACT

In the context of the described challenges the implementation of innovative digital solutions could put ports into a better position to tackle today's major global challenges, increasing efficiency and/or reducing energy consumption. The economic principles for implementing digital solutions are more flexible operations, increased robustness towards interruption and errors, and an increased efficiency regarding the productivity and efficiency of resources. Further, Digitalisation enables a better handling of complexity [6].

DISRUPTIVE BUSINESS MODELS

Nevertheless, Digitalisation also has its risks, such as the threat posed to information security and privacy. The greatest risk may however result from not participating in this megatrend, with new market entrants replacing traditional players.

Disruptive business models could take over tasks and offer services that are traditionally offered by long-established actors from the maritime industry. Enabled by eCommerce, peer-to-peer platform solutions and the development towards a sharing economy, disruptions like these have already taken place in other market sectors. Disruptive business models go global early and rapidly to increase their value, to reduce revenue source risks, and to increase the size of the addressable market [7].

Examples include mobility sharing platforms like Uber or accommodation sharing platforms like Airbnb. Alibaba and Facebook are additional examples for successful disruptive business models. Uber offers passenger transportation without owning a fleet of vehicles, but instead uses private cars; Airbnb facilitates the provision of accommodation without holding property; Alibaba facilitates the

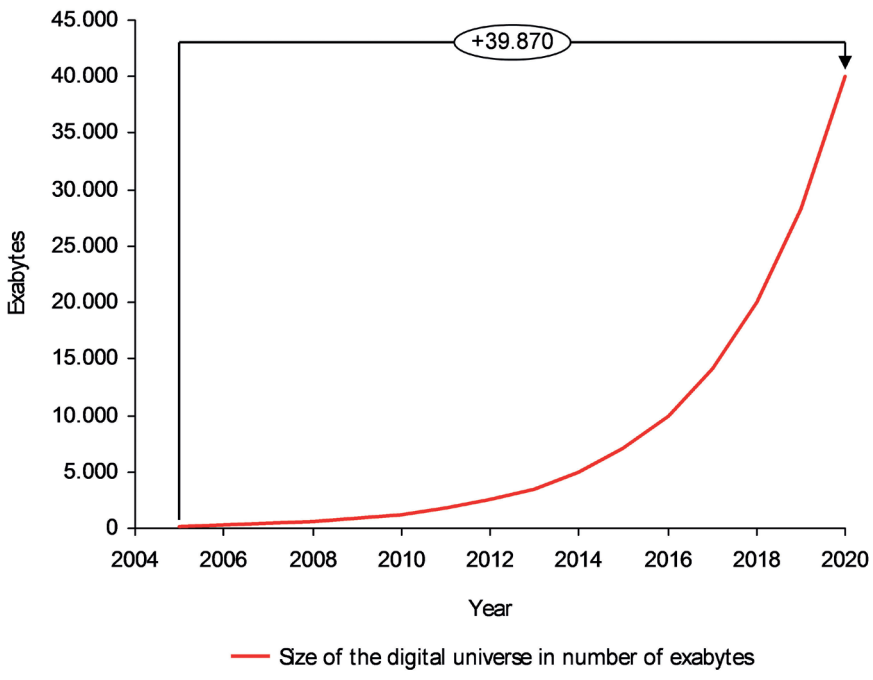

Figure 1: Increasing size of the digital universe; authors based on [4]

sale of goods without holding inventory; and Facebook is arguably the largest media channel, yet it does not hire journalists [8][9].

LESSONS LEARNED

Lessons can be learnt from these successful disruptive business models and applied to the Digitalisation of the maritime sector, especially regarding the underlying logic of peer-to-peer platforms or implemented innovations like blockchain technology, for example [10][11].

Driven by the need for a more efficient maritime supply chain peer-to-peer platforms could be implemented to share information related to the maritime supply chain. This could contribute to the elimination of inefficiencies. These inefficiencies include, on the one hand, links between seaports and their respective hinterlands, and on the other hand, maritime links between partnering seaports. Further, by sharing information in real-time inefficiencies within individual seaports could also be eliminated [12].

Other examples of inefficiencies include avoidable peaks in seaports which cause congestion at terminal gates, within the port area, and on the hinterland connections, blocked berths, as well as an inefficient utilisation of port terminal superstructures. By sharing information on vessel departures or delays seaports can better forecast the expected times of arrivals (ETAs) or departures (ETDs) of vessels, thus enabling a better utilisation of superstructures on port terminals and a better management of hinterland transportation [13]. Research is already being conducted on this topic. As an example, Fraunhofer CML is currently involved in a research project that aims at developing an algorithm for forecasting ETAs in seaports based on vessel traffic service (VTS) data, metocean data, and tide data [13]. Other research activities focus on reducing the risk of accidents by exchanging information between vessels coming close to each other, for example. This could also lead to an elimination of inefficiencies resulting from unnecessary evasive manoeuvres [14].

If ports or other stakeholders in the maritime industry do not implement such platform solutions for real-time information exchange, alternative actors will do it instead. Thus, the danger of disruptive business models also exists for the maritime industry.

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ABOUT THE ORGANISATION

The Fraunhofer Center for Maritime Logistics and Services CML develops and optimizes processes and systems along the maritime supply chain. Within practically oriented research projects CML supports public and private sector clients of port operations as well as from the logistics services industry and from the shipping business.

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