MOVE FORWARD: STEP BY STEP TOWARDS A DIGITAL PORT.

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PortForward
Digital solutions by Port of Rotterdam

MOVING TOWARDS A GLOBAL NETWORK OF PORTS

Digitisation is a significant contemporary trend. All ports and maritime companies are aware of the need for change. The question is: how and where to start? This paper outlines a model for digital maturity that shows how we, as ports, need to develop and exchange data in order to keep up with digital developments around us.

Due to the arrival of the Internet of Things (IoT), artificial intelligence (AI) and big data, we are able to collect and process larger and larger volumes of information at increasingly lower costs. This provides a solid base for analysis, forecasting and real-time planning. Combining digital technologies offers opportunities to create more efficient processes in and between ports. The port call optimisation platform Pronto for example has reduced waiting times for vessels in the port of Rotterdam by 20%. Pronto collects data from various parties in the port, including terminals, the Port Manager, shipping companies and maritime service providers. Using artificial intelligence (AI), this data can be used as a basis on which to accurately determine ETAs & ETDs (Estimated Times of Arrival - Estimated Times of Departure). More Just-in-Time operations can be carried out because the port and logistics supply chain are more predictable.

The reduction of port time and improving the transparency of the available dock space means there is increased capacity, making the port more appealing to existing or potential clients. Consequently, shipping companies are able to work through their schedules with fewer vessels. Ships are able to adjust their speed making them more energy-efficient. The port does not need to invest as much in expensive physical infrastructure in order to continue growing. This makes the cost structure of a port call more attractive to clients, which in turn can lead to a port shift.

The expectation is that not all traditional ports will be able to survive this digital disruption. Other sectors have preceded us. Established brands have disappeared from the market in less than a decade. Just as with retail, the travel sector and the world of banking and insurance, digital platforms are set to dominate the supply chain in the logistics sector as well. For ports, the challenge is to determine their digital strategy so they can preserve and strengthen their competitive position in relation to more digital ports and other transport resources.

We believe in the development of a worldwide network of smart ports, which can exchange structured and digital information with each other and other logistics players. In our view, smart ports are connected ports. The Digital Maturity Model as described in this paper shows how ports gradually develop into smart ports. It provides practical guidelines for subdividing this challenge into smaller goals. The focus is on sharing data to make processes smarter and to add this value to the supply chain. This reduces waste and makes processes in ports more efficient.

Digital Maturity Model

The transition to becoming a digital port is difficult and complex. It needs to happen step by step to keep the process manageable and get the port community on board. Within our Digital Maturity Model, four 'maturity levels' have been defined. These indicate the digital development and what the following steps are.

Level 1: Digitisation of individual parties in the port
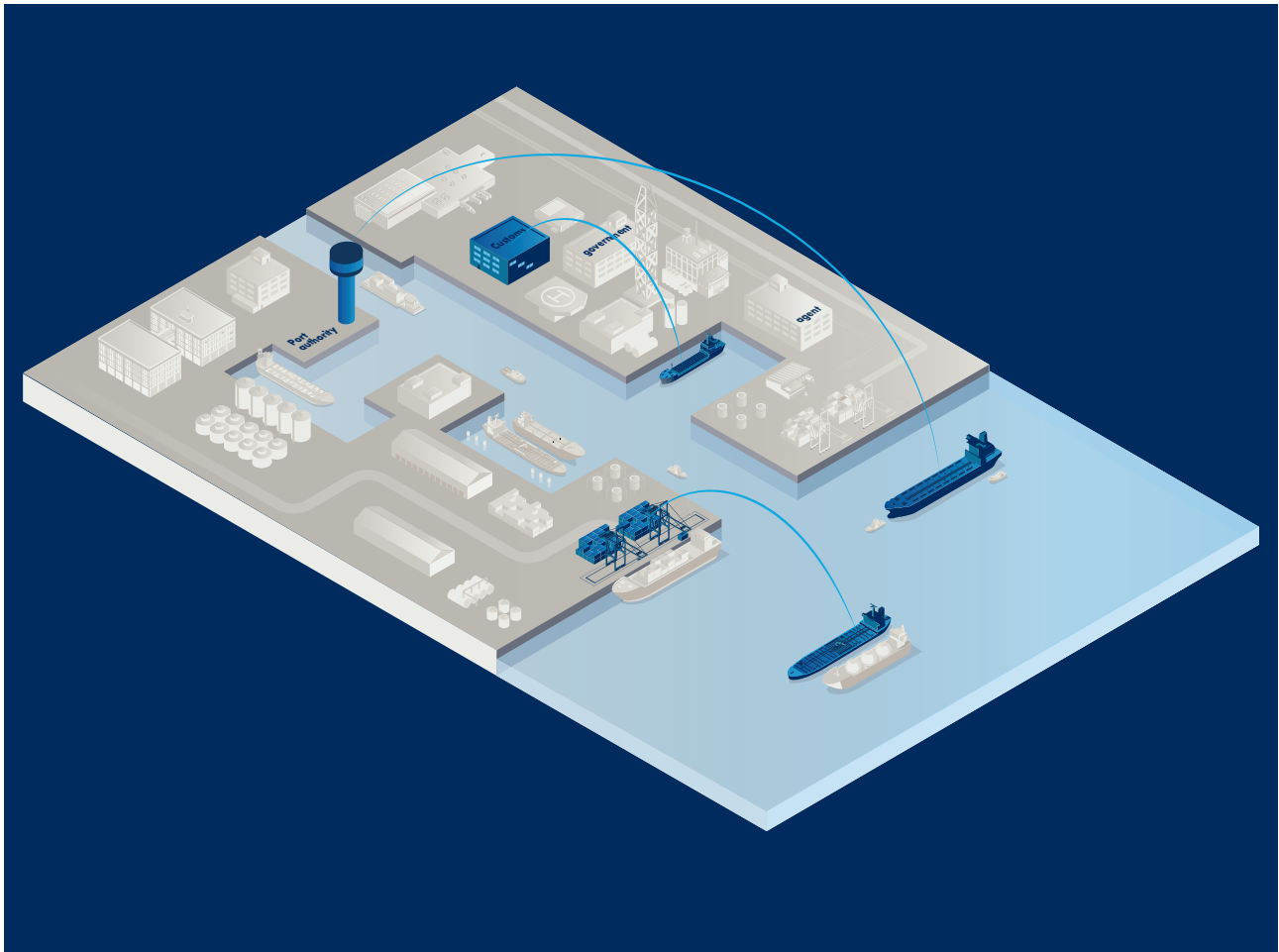
Many different parties operate at a port. For instance, there's the Port Authority, nautical service providers and terminals. By digitising their processes, they can all work more efficiently. Every organisation does this for itself and largely keeps the development under their own control.

In order to do so, port companies implement what is known as a Port Management System (PMS). This supports the administrative and financial processing of calls and facilitates the digitisation of the departure and arrival of ships, dock planning and cargo handling.

Another option could be to combine data science with, for instance, AIS technology on board ships and sensors in the port. This can result in more efficient asset management. The Port of Rotterdam achieves savings of 5 to 10% in dredging costs by bundling the routes sailed with information on silt deposits in the port basins. Sensor technology, big data and

artificial intelligence all make this possible. Good for the environment and for reducing costs.

Automating the individual parties in the port enables data collection. This can be used to make the port run more cost-effectively, more safely and more sustainably. The implementation of the PMS in Rotterdam has shortened the turnaround time for ships by 30 minutes[1]. Assuming a vessel costs €10,000 per hour, this means around €150 million in annual savings for the whole port of Rotterdam. The reduction of the number of incidents results in savings of €7 million per year. Port staff can be deployed more efficiently: annual savings of €2 million. For instance, we are seeing that despite the expansion of Maasvlakte 2, the staff levels of the Harbour Master's Division have shrunk. As a result, the PMS in the port of Rotterdam generates a total annual saving of approximately €160 million[1].

Level 2: Integrated systems in a port community
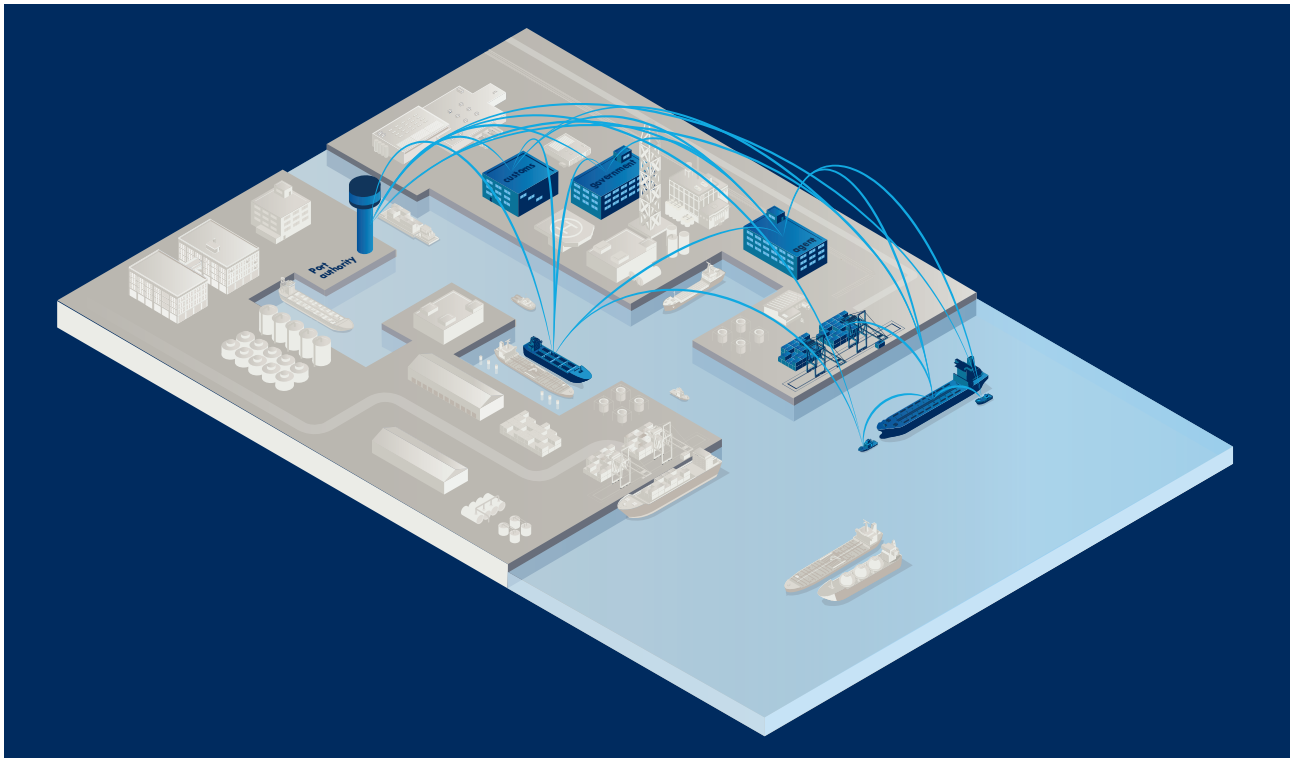
The digitisation of individual processes heralds the digital exchange of information within the port community. This leads to reliable, efficient and paperless data flows. Thanks to current technology, this can also be done securely.

Given that the number of players in a port can grow rapidly, the bilateral linking of systems can be inefficient. It is better to link all individual systems to one central platform, enabling the port to operate as a single entity. Securing the links is of crucial importance. For this reason, the systems in the port of Rotterdam have been developed using the principles of security by design. Due to the fact that besides technology, human activity also determines the level of data security, cyber security and cyber resilience need to be properly aligned to one another.

A Port Community System (PCS) forms a neutral, reliable basis for the digital exchange of information within the port community. This applies both to business-to-government (B2G) communication and to communication between companies (B2B). Data ownership and control of who may use which data need to be arranged in such a way that it is always clear who which data belongs to and who it may be shared with. This may not get in the way of exchanging new data. A port authority can play a neutral part in this and so offer added value to the port community.

We have identified three levels:
- Mandatory notifications to the authorities (B2G): e.g. IMOFAL and Customs
- General communications between companies (B2B): e.g. about ETA, ATA, ATD
- Specific communications between companies (B2B): informing each other about changed schedules, pooling of cargo etc.

ETA/ATA, ETD/ATD, and gate-in and gate-out times. Whereas traditional Port Community Systems focused on administrative data, nowadays the exchange of event data is becoming increasingly important. People can use it to be better able to predict how the logistics process will evolve. The exchange of event data and adding "brain" function make a PCS more and more valuable.

The annual added value of the PCA PortBase in the port of Rotterdam amounted to 245 million euros[2]. Savings include 30 million euros by reducing the number of phone calls, 100 million euros by reducing email traffic, and 10 million euros by reducing the volume of road freight mileage.

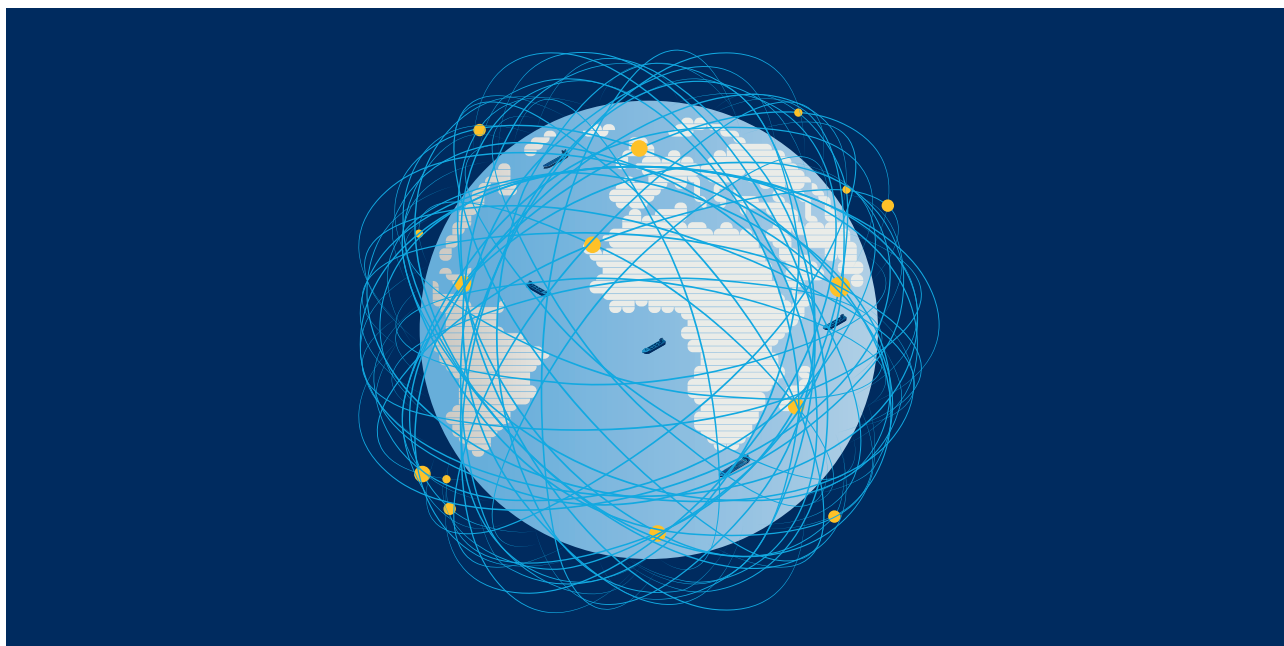# Level 3: Logistics chain integrated with hinterland
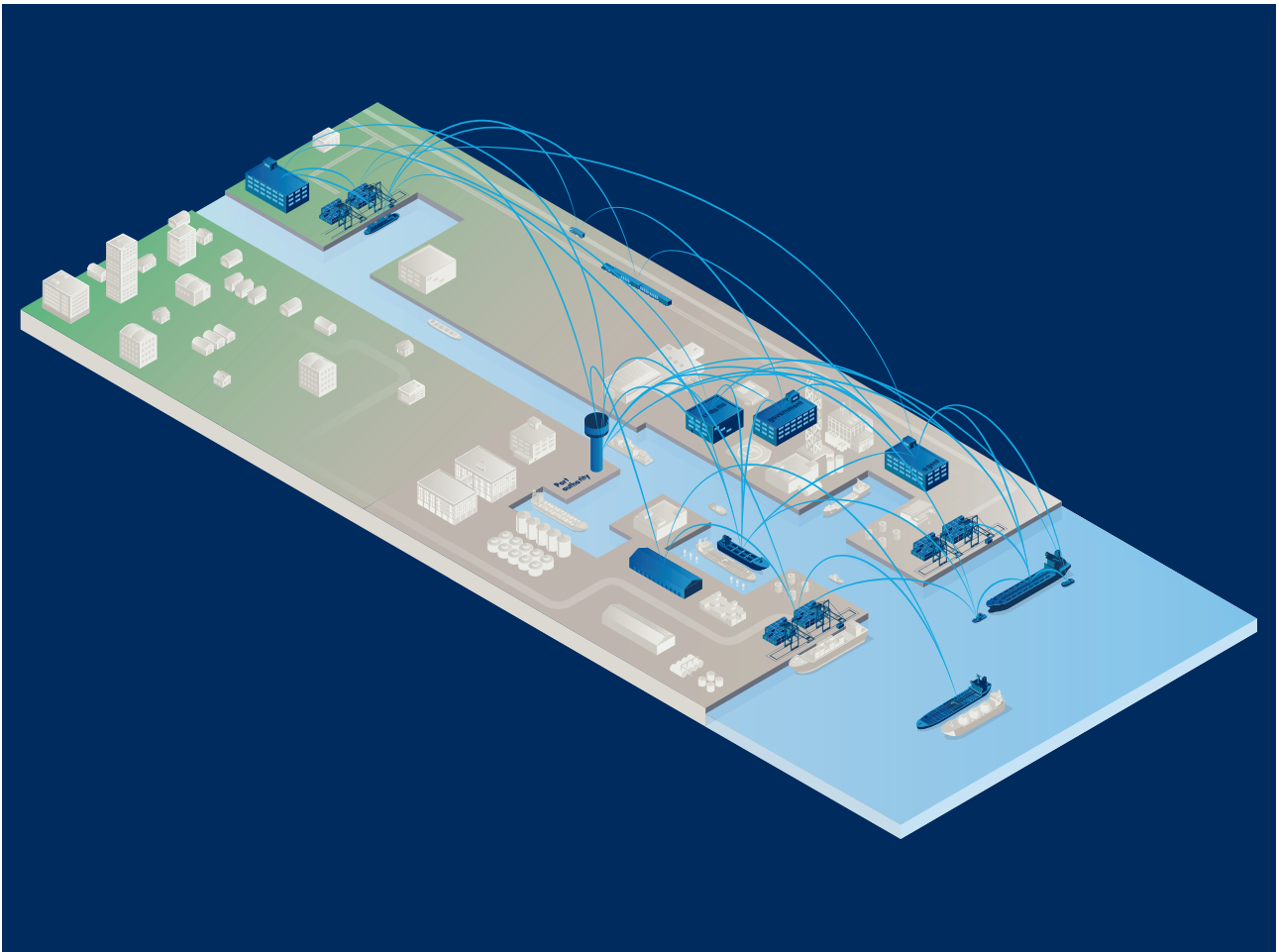
At this level, hinterland players are also involved in the digital communications within the port community. Information from the PCS about, say, ETA/ATA and ETD/ATD are shared with inland terminals, empty depots, carriers etc. Consequently, parties in the hinterland have a real-time insight into cargo and ship visits, which makes better planning possible.

Tools for supply chain visibility, network planning and tracking and tracing make the chain more transparent, so shippers are better able to guide their cargo over the available transport modes and transhipment hubs. They can select the most efficient route for their cargo and have insight into the expected transit time. If they wish, they can contact carriers and/or transhipment hubs in the logistics chain. With tracking and tracing, all logistics chain players have insight into the status and location of cargo batches. This can be based on the transport mode (vessel, lorry or train) as well as at the individual container level through the sharing of information on gate processes. Congestion in the port or the hinterland can be signalled and prevented, resulting in the quicker handling of cargo without additional investments in infrastructure.

For ports and their hinterland, the digital sharing of information yields competitive advantages: shorter transit times, reliable hinterland transport and lower costs. For potential clients, this can be what prompts them to consider a port shift. In addition, ports and hinterland players can get to know each other's needs and the needs of their clients, which reinforces their joint clout. However, digital communications with the hinterland chain will only run smoothly if clear standards and definitions related to the contractual agreements between chain parties are set.

Level 4: Connected ports in the global logistics chain

At this level, the communications between a port and its hinterland are expanded to other ports around the world, and these in turn are digitally linked to their own hinterland. This way, an integrated door-to-door digital logistics chain is created on a global scale, making optimum use of different transport modes.

Since sea-going vessels call at several ports, delays at one port can affect the available capacity at the next one. Or otherwise the ship has to increase its speeds with an increase of emissions. This is mainly the case if the ports are close to one another. By informing each other in good time of sailing routes and any divergence from their schedule, ports are able to make optimum use of their capacity and achieve shorter, reliable transit times. Being able to respond in real-time to changes in the schedule means fewer delays, Just-in-Time operations and a seamless cargo flow from the production plant to the customer.

There are benefits to be had for all players along the logistics chain. Shippers and shipping companies are able to plan with greater accuracy and follow their cargo/ships in real time. Warehouses can maintain their stocks with small margins. Ports and terminals can forecast the ETAs and ETDs of ships more and more accurately and use their dock space and resources more effectively. This is not a luxury, given that currently around 30% of sea-going vessels still arrive more than 24 hours too late[3].

The environment also benefits. The fulfilment of contract agreements by bulk carriers often leads to unnecessary emissions and high costs because the ships arrive at the port at the time arranged only to find themselves anchored outside the port because they are not yet allowed in. The fulfilment of contract arrangements on the basis of real-time information offers the opportunity of sailing more slowly, and therefore greener. Ships reach the port just in time and at the moment there is space available.

The linking of technologies (e.g. AI, IoT and AIS) means everyone can access all the information they need about sea-going vessels: location, cargo, crew data, port calls, speed, etc. A new era is dawning in shipping; one in which virtually the entire logistics process will become transparent and predictable. We are convinced that this will result in a considerable improvement in global port calls. Initial estimates from several international shipping companies anticipate a potential saving of between 25 and 150 billion euros across the maritime industry[4]. Studies have shown that the emissions in international shipping could fall by 35% due to Just-in-Time shipping[5].

Working towards this, the highest level of digital maturity is a challenge for everyone involved. For example, ports will have to enter into talks about sharing information with their rivals. In addition, global standards will have to be developed in order to make it possible to follow the logistics process from manufacture to the finished product on the shelf. The first steps towards this goal have already been taken with the development of the function definitions for nautical port information by the Port Call Optimisation Task Force (Shell, Maersk, MSC, CMA-CGM and the ports of Algeciras, Busan, Gothenburg, Houston, Rotterdam, Singapore and Ningbo Zhoushan), in collaboration with the International Harbour Masters' Association, United Kingdom Hydrographic Office and GS1. Now we are taking the next step from functional definitions to data definitions. Put simply: functional definitions ensure that people in the maritime industry understand each other. Data definitions enable machines to communicate with each other.

Technology as an enabler

In our opinion, connectivity is the driving force behind the establishment of a global logistics network. We see technology as an enabler that will integrate and optimise the logistics chain. For example, the IoT is growing at an unprecedented rate. Sensors on quays and roads, and at gates and in port basins are able to generate greater and greater volumes of information on, for instance, the water temperature, tides, wind speeds, currents and the availability of berths and docks. The analysis of this data using geographic information systems (GIS) provides insight into a port's status and lays the foundations for, say, autonomous sailing in future. Port of Rotterdam and IBM are working together long-term to uncover innovative applications of IoT and artificial intelligence.

Blockchain technology in the logistics chains can organise freight flows much more efficiently. For example, in the Rotterdam Blocklab, a pilot has been launched with ABN AMRO and Samsung SDS. At the moment, payments, administration and the physical transportation of containers are still virtually entirely separate circuits. This results in delays and inefficiency as many parties are involved and everything is organised using paper documents. For instance, an average 28 parties are involved in container transport from China to Rotterdam. The transportation, monitoring and financing of freight and services should be just as easy as ordering a book online.

Conclusion

Based on the digital maturity model, ports can grow step by step into smart ports. Although innovative technology plays a key role, it is not an objective in and of itself. The focus is on sharing data. The level at which this happens will have an impact on the digital maturity of a port, and on the associated benefits.

With the aid of a model, ports will be able to determine the point they have reached in their digital transformation and what the next steps will be. The higher a port's digital maturity level, the more the port will benefit from digitisation.

Ports are working towards a global network of smart ports. Achieving this will demand the courage and willingness to cooperate, trust one another and be transparent. Even competitors will have to share information to give the end customer more insight into a world of sea freight where there is still little transparency at the moment.

Do you want to exchange your views and ideas about digitisation and connected ports? Feel free to come and talk to us. Only together will ports be able to work towards Just-in-Time operations and facilitate a seamless flow of cargo.

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