



SMART PORTS AS LIGHTHOUSE NODES OF SUPPLY CHAIN NETWORKS

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Ports of the world are crucial nodes in supply chain networks as they manage shipments of goods. Contemporary developments for the ports of tomorrow focus on establishing advanced capabilities for efficient physical handling of goods, not necessarily involving sea transports, as well as looking for opportunities to provide innovative digital services. The latter helps the port to also become an information provider to the participants in supply chain networks as the port develops knowledge about when goods arrive or pass through the port. Such information feeds allow for status and conditions signals, identifying potential risks ahead of the goods, optimising supply chain

buffer zones, generating real-time advice on route options to reach the point of destination in full and on time. The smart port is one source (out of many) for aggregated information serving as the basis for coarse-grained situational awareness enabling well-informed decisions on the transportation of goods of commercial and humanitarian concern. Beyond the role as intelligence provider, lighthouse ports are providing insights to their customers assisting them to make the best moves along the chain.

THE SMART PORT CONCEPT REVISITED

Throughout history, ports have always played an important role as strategic nodes in inter-

national trade and supply chain networks. With the arrival of the Fourth Industrial Revolution and Maritime Informatics, ports now have also the opportunity to establish themselves as logistics information exchange hubs of the digital era serving their local and regional supply chain ecosystem. This idea is grounded in the concept of the smart port.

It is essential to conceive a port as a node of the self-organising ecosystem of goods transports, with some lighthouse ports that are influencing other ports in their developments and decision-making and tightly connect with land and air transports. This all together brings attention to the idea that a smart port is integrated in the ecosystem



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which it is part of and feeds its direct and indirect clients with essential information.

Smart ports’ new revenue-generating and cost-saving information services enable carriers, shippers, and other players to significantly improve their operational predictability, efficiency, visibility, and capacity utilisation. Connectivity and increasingly complete port data sets raise situational awareness to reduce inefficiencies, inventories, cash requirements and risks, while descriptive, predictive and prescriptive analytics power timely and fact-based decision making to swiftly and precisely react to disruptions to avoid delays and damage.

Digitally connected cargo handling, combined appointment and notification systems for sea-borne and intermodal traffic as well as container identification and connectivity, improve safety, smoothen operations and increase capacity utilisation as well as its visibility in the supply chain. Productivity gains resulting from a more integrated transportation process equals better resource usage, facilitating the shift to cleaner modes of transportation, and an eco-friendlier operation. Solutions like motion-sensitive lighting systems within terminals and on port roads help reduce energy consumption, and air quality sensors enabling inspectors to receive real-time sulphur dioxide emissions reports from vessels entering or leaving a port support environmental and regulatory compliance monitoring and enforcement efforts.

Port security is enhanced through technologies that enable entrance authorisation, video surveillance and analytics, behaviour analysis and biometric authentication solutions. Customs clearance processes are optimised and accelerated through digital single windows, electronic data exchanges across national borders facilitated by emerging platforms. As a by-

catch of customs clearance, the detailed cargo descriptions of customs manifests can be assessed by advanced analytics systems to reduce the risk of severe damage due to undeclared or mis-declared dangerous goods. All these development trends are surfaced within the new emerging field of maritime informatics.

ENHANCED SITUATIONAL AWARENESS

Data – provided by systems and sensors, distributed through networks, and cleaned and analysed by powerful algorithms – informs about inventories and goods in transit and its conditions. The result is situational awareness about goods, shipments, equipment assets and infrastructure. Situational awareness can be simply defined as “knowing what is going on around us”, or – more technically – as “the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future”.

Enhanced situational awareness is in high demand, especially needed in times of turbulence or dynamic circumstances requiring quick and proper reaction. Across the full spectrum of activities in the movement of goods from origin to destination, situational awareness is gluing the actors in the self-organising ecosystem of shipping together. At its core sits digitisation which contributes to enhanced predictability. Once digitised, an industry gains greater insight into its presence and future and can more swiftly and flexibly respond to rapidly changing environments, and quickly establish new collaborative ventures. Tomorrow’s data feeds would also inform about the conditions of the port and ecosystem infrastructure providing foundations for predictive maintenance and repair of logistics and port assets.

DATA SHARING IS ON THE RISE

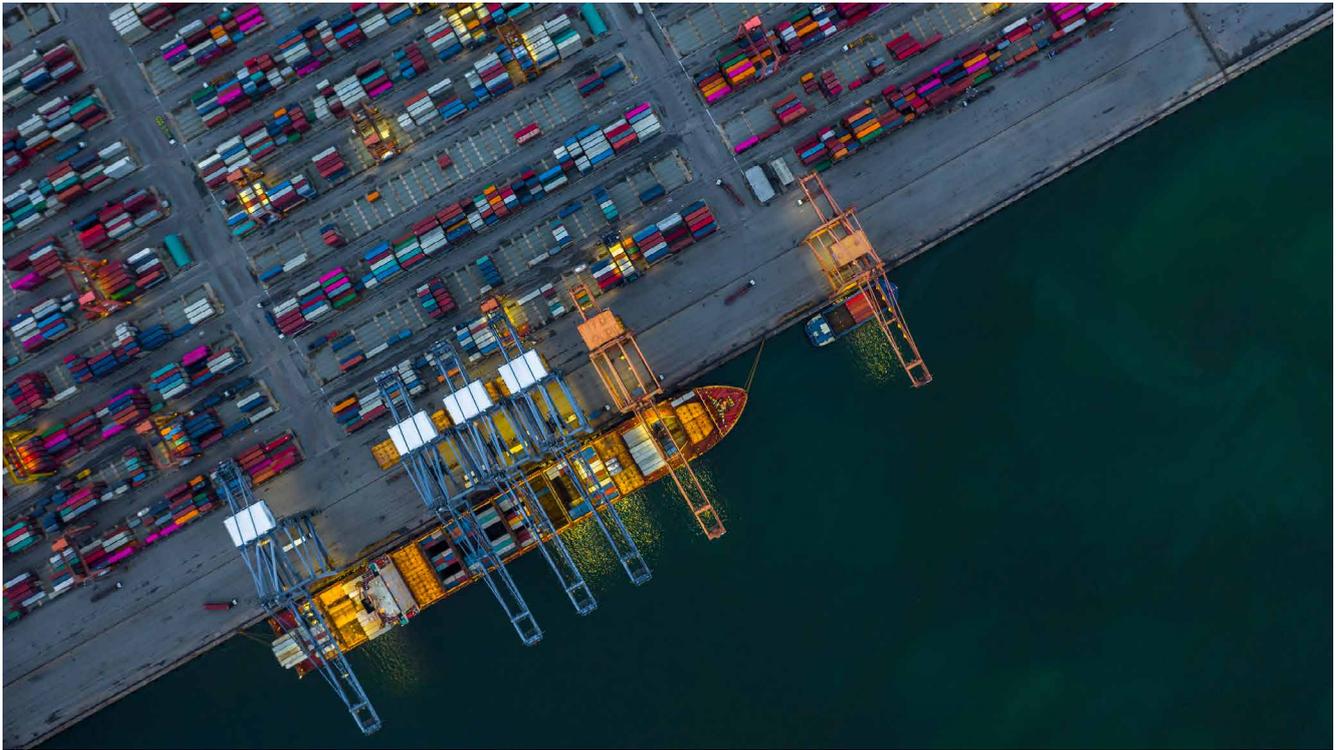
The European Commission forecasts exponential growth of data streams. Substantial investments today are being made in digital technologies allowing for more digital data streams in supply chains. Logistic Service Providers (LSP), carriers, intermodal operators (air, sea, ground), port authorities and terminal operators, regulatory bodies, and Beneficial Cargo Owners (BCO) are all working on this topic for each of their benefits.

Each actor in a port needs to contribute to and access up-to-date situational awareness to achieve a collective and mutually beneficial level of operation efficiency and traffic safety. Numerous initiatives are now building upon the emerging principles of digital collaboration, standardised data sharing, and the use of internet of things (IoT) devices and systems. Their purpose is to improve the speed and predictability of operations by applying just-in-time thinking and door-to-door visibility of the trip execution empowered by digital data sharing.

SMART PORT SYSTEMS

A system of records, combined with relevant internal and external data, can be used in a system of inquiry, such as data analytics, to discover hidden patterns and generate knowledge to enable more efficient use of a port’s capacity. The information produced by a system of inquiry helps to position a port in a modern transportation system. The port’s system will become a microservices data oriented layer invoking different services via standard Application Programming Interfaces (APIs) and exposing a rich set of services to the whole ecosystem, while abiding by global cybersecurity and data sovereignty laws.

Ports can provide insights to freight forwarders and other transport capacity and services buyers to guide cargo over the best



available transport modes and efficient routes. Data on the progress to downstream ports allow them to optimally plan and deploy resources. This is especially important in short-sea shipping, enabling optimised capacity utilisation and achieving shorter, reliable transit times. Port data, data sharing governance, big data intelligence and smart port systems are key characteristics of the port of the future. Through increased digitisation efforts during the recent years, leading ports have embarked on the journey from the transshipment hub to also include capabilities of an information hub.

THE CONCEPTION OF A LIGHTHOUSE PORT

Lighthouse ports are digital pioneers. They investigate every operational and

managerial process and area with regard to digitisation. They experiment not only in the digital comfort zone but overcome the fear to fail in order to learn and place themselves ahead of the pack by going beyond the current viable models and operational levels and develop and test completely new ways of operating, positioning themselves as the leaders in the digitisation race.

The interest of the shipper and carriers do not stop at the yard gate and the quay wall. Lighthouse ports are holistically focused, trained and active enabler of supply chain network performance through supporting digital infrastructure, providing digital services and sharing data to help them and the entire system

optimise processes, improve capacity utilisation and avoid disruption through visibility and analytics. They are trusted environments by which carriers, shippers, port communities, customs, and governments, financial, and other actors can securely access the data they need. They set the example, drive innovation through hackathons and support others in their digitisation efforts.

A lighthouse port thus guides other participants in the ecosystem on different decision levels, such as in strategic decisions on investments or more operational real-time decisions to make for transport coordinators and cargo owners for re-planning transport routes and flows. The capabilities of the lighthouse port, as a model for oth-

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ers and having capabilities to inform others outside their own domain, is also one of the drivers for responding to the goals of reducing greenhouse gasses (GHG) resulting from the maritime supply chain being put high on the global agenda.

SMART PORTS AS LIGHTHOUSES IN A NETWORKED WORLD

Improving customer experience

Smart ports function as a probe for deriving status information about shipments and goods, help to optimise buffers, contribute to data pools for optimal routing and is one of many information sources for coarse-grained situational awareness enabling decisions for business, humanitarian and societal concern. Customer relationship management (CRM) systems help to pull all data together and consult customers on their best moves.

Reducing inefficiencies and inventories

Visibility providers like TradeLens, Traxens, Roambee, EVERYTHNG, Scantrust and Fourkites work towards realising the complete end-to-end dataset. Port community systems (PCS) and other platforms and tools, like those provided by startups, connect to other systems and the various stakeholders ranging from shipping lines to customs to road, rail and logistics providers easing the burden of coordination and collaboration. Visibility reduces inventories and frees cash that may be better deployed to drive digitisation efforts and projects.

Mitigating supply chain disruptions

Decision-making is not an isolated process. For ports, they need to be collective and collaborative to mitigate risk propagation when disruptions occur. By sharing information between all relevant stakeholders, a more complete picture can be quickly reached which is of utmost importance in extraordinary situations, like accidents or disasters that cause emergencies and major disruptions.

CONCLUDING REMARKS

Recent trade wars and the COVID-19 pandemic have demonstrated the brittleness of a highly interconnected economy. In turbulent times, responsiveness favours survival through agility and resilience. Agile organisations can quickly decide and redeploy their critical capital and competencies to meet emerging societal needs, such as swiftly delivering bulk healthcare supplies to dozens of countries when needed. Resilient organisations can recover quickly from disruption.

Smart ports, empowered by maritime informatics, with their networks, data, their analytics, platforms and worldwide connectivity are fulcrums of coordination,

supplying the broad range of actors involved in a voyage and port visit with data in near real-time, helping them organise the numerous activities and connectivity to other means of transport. They are architects, drivers of change and vital physical and digital nodes in the next generation supply chain networks. They are important lighthouse-node players in the act of balancing capital productivity and energy efficiency.

FOOTNOTES

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