



**Study on Digitization and Disruptive Technologies
(Big Data, IoT, Blockchain, AI, etc.)
in Port Operation**

Final Report

August 2018

**Port Operations & Logistics Committee
IAPH**

Preface

We have been experiencing rapid transformation regarding application of information technology and disruptive technologies around port industry. Especially for the last few years, things have changed much more radically than we expected.

For example, application of Big Data and Internet of Things (IoT) will be a game changer in several industries. Major sectors such as retail, automobile, healthcare are investing on using massive data. For port & terminal industry, there are also many potential applications for use of these technologies. As an example, for container terminal operation, acquiring data from all machinery in the yard and optimize terminal operations by analyzing such data in real-time will be essential to maintaining terminal competitiveness in the near future.

Another important aspect is unhindered and secure transmission, communication, and sharing of maritime cargo data including B/L, insurance, stowage plan, trucking information, etc. Use of Blockchain technology may make it possible to share and transmit these sensitive data without being hacked.

The objectives of this study report is to research possible application of use of digitization and disruptive technologies such as Blockchain, Big Data and Internet of Things in port industry. I truly hope that this report will contribute to understanding these important issues, and that it will encourage those people who are not yet ready to truly embrace these disruptive technologies.

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1 Executive summary

Background of study

The shipping industry has been facing needs to deal with increasing vessel size and cargo volume. Ports and terminals are under pressure to implement and adopt innovative digital technologies. However, ports and terminals business environment are heavily interconnected with stakeholders such as shipping lines, terminals, port authorities, trucking companies, and so on. In order to fully benefit from these disruptive technologies, ports and terminals need to work together with all stakeholders and have overall supply chain perspective.

In this study, case studies of disruptive technologies related to maritime industry are identified and categorized into three groups, for supply chain stakeholders, for ships, for ports and terminals. It is also analyzed how these disruptive technologies will affect current port operations.

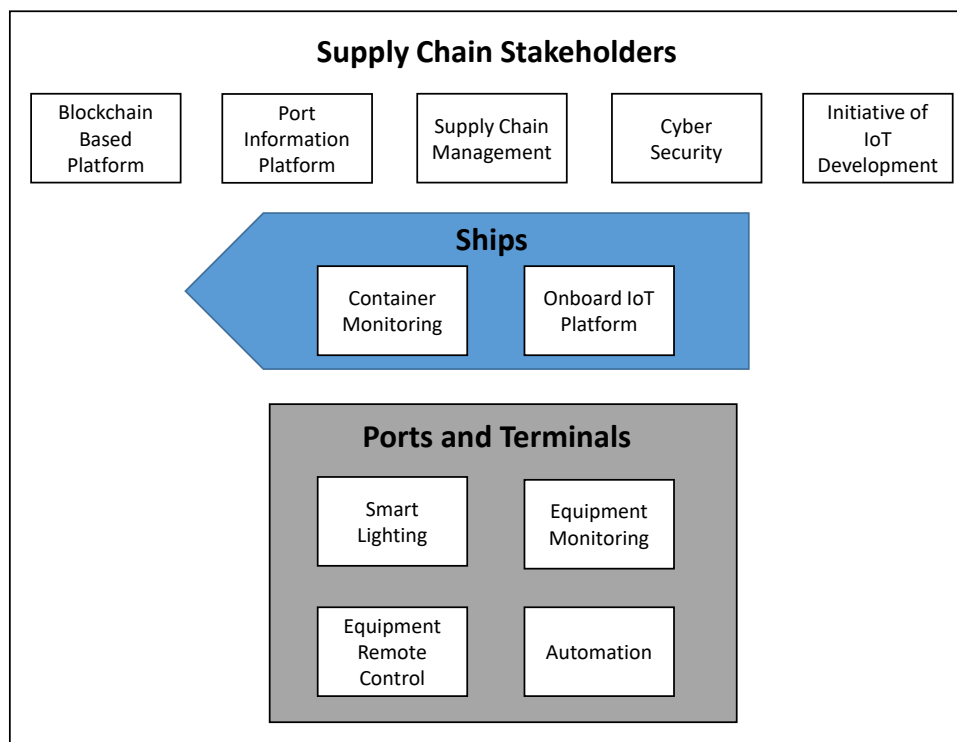


Fig. 1.1 Disruptive Technologies identified

Digitization and disruptive technologies for supply chain stakeholders

Blockchain based platform

In shipping trade, significant amount of paper documents are required to be exchanged. Physical inspection of documents is time consuming and adding cost on shipping transaction.

Blockchain technology has been originally used for digital currency such as Bitcoin, and recently several parties have been finding potential uses for maritime industries. A wide variety of documents exchange is considered possible to be digitized and several pilot projects by using blockchain-based application are

ongoing in recent years.

Maersk and IBM announced that they would provide more efficient and secure methods for conducting global trade using blockchain technology. Earnest & Young announced that it would plan to provide blockchain platform for marine insurance.

To realize such systems, there are hurdles such as building network over all concerned parties. However, when these blockchain-based information-exchange platform is in place, port operators will need to actively participate in discussion and adopt these technologies, in order to stay productive and competitive.

Port information platform

Ports have complicated network including terminals, port authorities, shipping lines, trucking companies, and so on. Port information platforms can make real time communication between the stakeholders and bring efficiency for whole supply chain.

To realize it, technologies are used including mobile network, cloud-based platform, cartographic information, and so on. In port information platforms, terminal operators can be one of the main information providers as well as active system users.

Digital information platforms are being implemented in several ports. Port of Hamburg has developed real-time connection to the port's various stakeholders and the port provides various types of information to the people who need it. Port of Rotterdam announced digitization initiatives to transform port's operational environment using IoT technologies.

Supply Chain Management

Over the whole supply chain process, containers travel from shipper to receiver by truck, ship, and rail transportation. Recent technologies enable users to track location of their containers anytime and this capability will bring container supply chain optimization. For logistics companies, it is becoming more and more important to provide better supply chain visibility to their customers.

NEC and DMIC established a company that provides logistic visualization service, enabling their customers to perform real-time searches of location of containers being transported by rail or road based on RFID and cloud-based technology.

Cyber Security

Digital technology has been more widely used in maritime sector for years now. As they are connected to the internet more frequently, this situation increases threat of cyber-attacks to the maritime sector. Port operations consist of complex systems that are connected to different stakeholders through the internet. Therefore, port operators should protect their systems against cyber-attacks.

In port of Los Angeles, Cyber Security Operations Centers was established to proactively monitor the computer environment to prevent a breach and to respond if a breach occurs. CSOC also collects cyber

security data that can be analyzed and shared with other agencies.

Initiatives on IoT development

Several projects that enhance development in maritime-related technology have been launched worldwide. Port authorities also support these initiatives and some of the outcomes may contribute to port operations.

Port Authority Singapore held Smart Port Challenge, a competition of proposal to tackle challenges facing the maritime industry. Shortlisted applicants were including IoT related proposal, and are eligible to apply for funding support from the port authority. The Municipality of Rotterdam and the Port of Rotterdam Authority launched the BlockLab, in which theoretical blockchain ideas are developed, tested and worked out into concrete opportunities in a real-world environment, together with consortia of developers and users.

Digitization and disruptive technologies for ships

Container Monitoring

Container remote monitoring can be possible through GSM (global system for mobile communications), GPS, and RFID technology. Data from containers including temperature, location can be monitored while on vessel or on shore.

For port operation, to have real-time information of all containers in the yard will greatly help operational efficiency. It will also eliminate human errors on manual regular inventory checking.

Maersk launched Remote Container Management system, which enables transmitting data of reefer container from fleet via satellites, such as temperature, location and power supply. The information is loaded onto the cloud and analyzed back in the central office.

Onboard IoT platform

Ship performance monitoring technology can contribute to ship's operational efficiency. Ship data such as voyage data and engine data are connected to data server and transferred to a data center on shore. The data can be used for application providers and equipment manufactures.

NYK and NTT consortium is developing onboard IoT platform that enables sharing detailed data, including operational condition and performance of ocean-going vessels between ship and shore.

Digitization and disruptive technologies for ports and terminals

Smart lighting

Smart lighting technology are now widely being applied in buildings, houses, streets. Intelligent lighting enables dynamic dimming and remote control

By implementing smart lighting in yards or roads, ports can reduce energy consumption for lighting and enhance safety for employees and visitors.

Port of Valencia installed prototype dynamic lighting system and it will cut energy consumption.

Equipment Monitoring

Sensors installed in container handling equipment can collect important performance data such as temperatures and vibration. The information can be sent to remote monitoring centers and are analyzed in real time. This solution allows users to forecast equipment failure and plan predicted maintenances.

Port operators may want to install such systems in order to be able to plan timely maintenance and keep equipment running efficiently.

For example, ZPMC established a centralized global monitoring center for their cranes, aiming to provide real-time monitoring and fault prediction based on acquired data.

Equipment Remote Control

Container handling equipment such as cranes can be operated from a remote control room, which is located in a remote place such as terminal office area. Remote operation system are now being realized in several container terminals.

Crane operators can work in a safe and ergonomic office environment and employee safety and satisfaction can be improved. In addition, one operator can operate different cranes at different times. As a result, operator idling time can be reduced and productivity can be increased.

Port operators may want to consider this solution to attract employees for providing safer and more attractive working environment.

Automation

Automated container terminals has been operational for many years now, even though level of automation varies from terminal to terminal. Some terminals only replace manual human operations such as reading container numbers at gates by automated optical character recognition system, and some terminals are heavily involved with full automation concept including robotizing container handling equipment.

It is expected that AI (Artificial Intelligence) will play a more important role in automated terminals. For example, AI will control quay cranes and yard cranes, and drive horizontal transportation such as automated guided vehicles (AGV).

Nowadays autonomous ship concept has been widely discussed and actual projects have been planned. Automated container terminal may need further development to accommodate autonomous ships in the port. Norwegian fertilizer conglomerate Yara has unveiled the plan of fully autonomous terminal for autonomous feeder vessel.

2 Introduction

2.1 Scope of work

Use of Big Data and Internet of Things (IoT) will be a game changer in many fields. Major sectors such as retail, automobile, healthcare are investing on using massive data. For port & terminal industry, there are many potential applications for use of these technologies. As an example, for container terminal operation, acquiring data from all machinery in the yard and optimize terminal operations by analyzing such data in real-time will be essential for maintaining terminal competitiveness in future.

The original objectives of this study is to research possible application of use of Big Data and Internet of Things in container terminal operation industry.

This study covers the following items:

1. to collect information about actual Big Data/IoT related port & container terminal projects
2. to collect information about available/future Big Data/IOT related technologies for cargo handling machinery, terminal operating system, port facilities, etc.
3. to analyze possible outcome of use Big Data/IoT technology in container terminal operation (improve productivity, reduce operation cost, reduce environmental load, improve operation safety, etc.)
4. to collect information about available/future Big Data/IOT related technologies for shipping lines in relation to port/terminal operations.
5. to provide a summary of the study with an insight gained by this information collection

After we began this research project, we have noticed that several new emerging technologies such as blockchain, Artificial Intelligence, and cargo information/sharing portal are being widely tested and adopted. Therefore, we decided to cover these technologies also.

3 Digitization and disruptive technologies for supply chain stakeholders

3.1 Blockchain based platform

In shipping trade, significant amount of paper documents are required to be exchanged. Physical inspection of documents is time-consuming and adding cost on shipping transaction.

Blockchain technology has been originally used for digital currency such as Bitcoin, and recently several parties have been finding potential uses for maritime industries. A wide variety of documents exchange is considered possible to be digitized and several pilot projects by using blockchain-based application are ongoing in recent years.

To realize such systems, there are hurdles such as building network over all the concerned parties. However when these blockchain-based information exchange platform is in place, port operators will need to actively participate in discussion and adopt these technologies in order to stay productive and competitive.

Table 3.1 list of blockchain related projects

Project name	Location	Main involved parties
Blockchain solution for safe, efficient container release pilot project	Antwerp (Belgium)	T-Mining, Port of Antwerp
Maersk and IBM to Form Joint Venture Applying Blockchain to Improve Global Trade and Digitize Supply Chains	Copenhagen (Denmark)	Maersk, IBM
Agility is First Forwarder to Work with Maersk IBM on Blockchain Solution	Baar (Switzerland)	Agility, Maersk, IBM
PIL, PSA, IBM Conclude Blockchain Trial from Chongqing to Singapore	Chongqing (China), Singapore	Pacific International Lines, PSA International, IBM Singapore
Pilot test of blockchain system for logistic industry	-	Marine Transport International, Agility Science
Plan to launch the first blockchain platform for marine insurance	-	Earnest & Young, Maersk, Microsoft, Guardtime, MS Amlin, XL Catlin, ACORD
Demonstration Test of Blockchain Technology in Cross-Border Trade Operations	-	Sumitomo Mitsui Financial Group, Sumitomo Mitsui Banking Corporation, The Japan Research Institute, Mitsui & Co, Mitsui O.S.K. Lines, Mitsui Sumitomo Insurance Company, IBM Japan
Assessment on Blockchain Technology Adopted in Shipping & Logistics	-	Hyundai Merchant Marine, Samsung SDS
Smart Bill of Lading		CargoX
Global Shipping Business Network		CMA CGM, Cosco, OOCL, Evergreen, Yang Ming, DP World, Hutchison Ports, PSA,

		Shanghai International Port, CargoSmart
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3.1.1 Blockchain solution for safe, efficient container release pilot project (Port of Antwerp)

Antwerp start-up T-Mining runs a pilot project that will make container handling in the port of Antwerp more efficient and secure using blockchain technology. By the new technology, container handling processes that involve several parties are securely digitized without any central middleman being involved. It is expected that the technology reduces the cost of interaction among parties involved and its operational risk. In addition, T-Mining works to introduce their solution in Singapore.

3.1.2 Blockchain to improve global trade (Maersk, IBM)

IBM and Maersk began collaboration in June 2016 to build new blockchain- and cloud-based technologies. Since then, multiple parties have participated in the blockchain platform including DuPont, Dow Chemical, Tetra Pak, Port Houston, Rotterdam Port Community System Portbase, Customs Administration of the Netherlands and U.S. Customs and Border Protection.

The joint venture will now enable IBM and Maersk to commercialize and scale their solutions to a broader group of global corporations. Many companies including General Motors and Procter and Gamble express their interest in the new platform. In addition, additional customs and government authorities, including Singapore Customs and Peruvian Customs, will explore collaborating with the platform to facilitate trade flows and enhance supply chain security.

The global terminal operators APM Terminals and PSA International will use the platform to enrich port collaboration and improve terminal planning.

3.1.3 Blockchain Solution (Agility, Maersk, IBM)

Agility has agreed to identify events associated with individual shipments and to share and receive information about them via the distributed-ledger blockchain technology developed by IBM and Maersk. Agility is a leading global logistics provider and it is the first freight forwarder to collaborate on a Maersk-IBM solution to provide more efficient and secure methods for conducting global trade by using blockchain technology to manage and track container shipments.

3.1.4 Blockchain Trial from Chongqing to Singapore (Singaporean consortium)

Shipping company Pacific International Lines (PIL), port group PSA International (PSA) and technology company IBM Singapore (IBM) have completed a blockchain-based supply chain platform trial.

The companies worked on a proof of concept (POC) exercise, built on IBM Blockchain Platform, applying and then testing the platform to track and trace cargo movement from Chongqing to Singapore via the Southern Transport Corridor. As the POC has successfully been completed, they will involve more participants from the different nodes of the distribution network that forms the supply chain logistics ecosystem for the next stage.

3.1.5 Blockchain system for logistic industry (MTI, Agility Science)

Marine Transport International announces a successful pilot project of blockchain technology, validated by the University of Copenhagen & BLOC.

August 2017, MTI, in conjunction with Agility Sciences, released a paper detailing the deployment of their Container Streams system in a supply chain environment. The results of the pilot project have been verified by scientists at the University of Copenhagen and maritime technology experts at Blockchain Labs for Open Collaboration (BLOC).

3.1.6 The first blockchain platform for marine insurance (EY, Maersk, Microsoft)

Ernst & Young announced that it plans to launch the first blockchain platform for marine insurance, alongside Microsoft, A.P Moller-Maersk and others. The distributed ledger will be used to capture information about shipments, risk and liability, and to help firms comply with insurance regulations.

The blockchain solution was built on Microsoft's cloud platform, Microsoft Azure. The blockchain solution is set to be implemented from January 2018 onwards.

3.1.7 Blockchain Technology in Cross-Border Trade Operations (Japan Consortium)

Sumitomo Mitsui Financial Group, Sumitomo Mitsui Banking Corporation, The Japan Research Institute, Mitsui & Co., Mitsui O.S.K. Lines, Mitsui Sumitomo Insurance Company and IBM Japan have agreed to start a demonstration test in December 2017 to verify the applicability of blockchain technology as a way to streamline and upgrade cross-border trade operations.

In the demonstration test, participating companies input information of real trade transactions using a blockchain-based application, by which a wide variety of documents, including trade agreements and logistics/insurance documents are digitized, recorded and shared among participants. By comparing against current operations, the test is intended to verify the effectiveness of blockchain technology for enhancing security and reducing the time required to settle cross-border trade transactions and discrepancies among related documents, thus reducing administrative costs.

3.1.8 Blockchain Technology Adopted in Shipping & Logistics (HMM, Samsung)

Hyundai Merchant Marine (HMM) with Samsung SDS and other members of shipping and logistics blockchain consortium have conducted a blockchain-technology-integrated pilot voyage and internal assessment for past seven months. HMM has begun its blockchain-integrated pilot voyage from August and has successfully completed its first pilot voyage from Korea to China (Busan to Qingdao) with reefer containers, followed by more pilot voyages in India, Middle East, and Europe.

It is expected that the blockchain technology reduce a massive amount of paperwork such as feeding booking information and Bill of Lading, thus will improve work efficiency. Also with the integrated Internet of Things (IoT) technology, cargo status (such as location, temperature, humidity, etc.) will be shared among HMM and the related parties on a real-time basis, which will clarify any legal disputes that may occur during the transportation of the cargo.

3.1.9 Smart Bill of Lading (CargoX)

CargoX is developing the world's first blockchain Bill of Lading (B/L). They will create an open system based on Ethereum and encrypted permanent decentralized data storage, which will enable the creation and exchange of B/L documents.

Their blockchain-based Smart B/L will work in a similar way as tokens. Users (shippers, carriers, forwarders and importers) will be able to create, transfer and claim ownership of the B/L, and thereby the cargo that is the subject of the B/L.

3.1.10 Global Shipping Business Network

Five shipping lines and four terminal operators are to form a consortium to develop a Global Shipping Business Network (GSBN), which will be a blockchain-enabled platform that will help digitize the industry, set standards and transform documentation flows.

The participants comprise Ocean Alliance members CMA CGM, Cosco/ OOCL, Evergreen and interestingly THE alliance partner Yang Ming, as well as DP World, Hutchison Ports, PSA and Shanghai International Port Group. The technology company is CargoSmart.

3.2 Port information platform

Ports have complicated network including terminals, port authorities, shipping lines, trucking companies, and so on. Port information platforms can make real-time communication between the stakeholders and bring efficiency for whole supply chain.

To realize it, technologies are used including mobile network, cloud-based platform, cartographic information, and so on. In port information platforms, terminal operators can be one of the main information providers as well as active system users.

3.2.1 SmartPort Logistics (Port of Hamburg)

The Hamburg Port Authority (HPA) has been working with big companies like SAP on a series of 20 projects collectively called smartPort Logistics since several years ago.

In this project, The SAP HANA Cloud Platform was used to enable a real-time connection to the port's various stakeholders through a mobile business cloud. Based on the analysis of data collected via the platform, HPA provides various types of schedules, tasks, and insights to the people who need it via their mobile devices. With the assistance of information provided by the platform, they have predictive and preventive operation and maintenance capabilities. In addition, they use the smartPort application for vessel traffic services. Furthermore, they obtain data of traffic on roads and parking lots and the data is used to realize more efficient and safe trucking.

3.2.2 5G mobile network (Port of Hamburg)

Hamburg Port Authority (HPA), German telecommunications company Deutsche Telekom and communication and technology giant Nokia have launched a testbed that stretches across some 8,000 hectares of port area. Port of Hamburg's testbed is set up to experiment 5G applications in an industrial environment. It will play an important role in new application scenarios created by the Internet of Things (IoT) and Industry 4.0.

3.2.3 Maritime shipping data platform pilot (Port of Los Angeles)

After an initial pilot project to keep cargo-flow efficiency by a digital solution, the Port of Los Angeles and GE Transportation are expanding the program to include all container terminals and shipping lines at the Port.

3.2.4 PortMaps (Port of Rotterdam)

The Authority of Port of Rotterdam provides a complete, current and clear online map. This map is automatically updated on a daily basis with the most recent information and clarifies all relevant

topographical and nautical information regarding the port so that all users see the same map, which is always updated.

3.2.5 Digitalization of port's operational environment (Port of Rotterdam)

The Port of Rotterdam Authority and IBM announced their collaboration on a multi-year digitization initiative to transform the port's operational environment using Internet of Things (IoT) technologies through the cloud system to benefit the port and those who use it.

The initiative will also prepare the Port of Rotterdam's entire 42-kilometre site to host connected ships in the future. It begins with the development of a centralized dashboard application that will collect and process real-time water (hydro), weather (meteo) sensor data and communications data, analyzed through the IBM IoT platform.

The Port of Rotterdam can use the information to make decisions that reduce wait times, determine optimal times for ships to dock, load and unload, and enable more ships into the available space. Cisco and Axians are also involved in the project.

3.2.6 Smart port (Port of Durban)

T-Systems has successfully secured the first phase of an innovative Smart Ports initiative with the South African Transnet National Port Authority. The deal aims at increasing the port throughput and decreasing congestion at the Port of Durban using different types of drone, tracking and sensor technology.

These technologies are integrated with systems that allow for real-time monitoring and availability of information through dashboards powered by SAP HANA. T-Systems is the prime contractor and delivers the SAP HANA and Business Intelligence (BI) components. The drones and telematics technology are delivered by LOTS Projects, and the wireless communication network is provided by Huawei.

3.2.7 Cloud-based platform (XVELA)

XVELA provides a transformative, cloud-based collaboration platform and network for ocean carriers and terminal operators.

XVELA's cloud-based platform allows terminal operators and ocean carriers to collaborate in real-time on vessel stowage activities to simplify and synchronize stowage planning and execution processes. Shared, comprehensive stowage planning information and collaboration tools facilitate

clear carrier-terminal communication to optimize stowage efficiency, maximize terminal productivity and minimize port stays.



Fig. 3.1 Cloud base collaboration platform (source: XVELA)

<https://www.xvela.com/index.html>

3.3 Supply Chain Management

Over the whole supply chain process, containers travel from shipper to receiver by truck, ship, and rail transportation. Recent technologies enable users to track location of their containers anytime and this capability will bring container supply chain optimization. For logistics companies, it is becoming more and more important to provide better supply chain visibility to their customers.

3.3.1 Logistics Visualization Service (India)

NEC Corporation and the DMIC Trust have established a joint venture company, DMICDC Logistics Data Services Limited, for providing logistics visualization services in India. The new company will provide shippers and transport operators with logistics visualization services, enabling them to perform real-time searches based on accurate positional information, showing the location of containers being transported by rail or road between Delhi and Mumbai.

To provide these services, the new company will affix RFID tags to shipping containers being loaded and unloaded at ports in Mumbai. Positional information obtained by RFID reader/writers will then be gathered in real time via a cloud-based logistics visualization system. There are plans to link up the logistics visualization system with rail transit management systems, port management systems and other existing systems in the future.

3.4 Cyber Security

Digital technology has been more widely used in maritime sector for years now. As they are connected to

the internet more frequently, this situation increases threat of cyber-attacks to the maritime sector. Port operations consist of complex systems that are connected to different stakeholders through the internet. Therefore, port operators should protect their systems against cyber-attacks.

3.4.1 Cyber Security Operations Center (Port of Los Angeles)

The port of Los Angeles has been operating Cyber Security Operations Center (CSOC) in 2014. The CSOC includes advanced hardware and software that is used to proactively monitor the computer environment to prevent a breach and be able to quickly detect and respond if a breach does occur.

The CSOC is also the technical nerve center, which collects cyber security data that can be analyzed and shared with other agencies. It collaborates with City of LA, USCG, FBI, USSS, DHS, and AAPA.

The CSOC is certified with ISO 27001, Information Security Management System since 2015. There is dedicated cyber security team, including qualified employees with cyber security industry certifications.



Fig. 3.2 Cyber Security Operations Center (Source: Port of Los Angeles)

3.5 Initiative on IoT development

Several projects that enhance development in maritime-related technology via IoT have been launched worldwide. Port authorities also support these initiatives and some of outcomes may contribute to port operations.

3.5.1 Smart Port Challenge (Singapore)

The Smart Port Challenge, a competition of proposal to tackle challenges facing the maritime industry was organized by the Maritime and Port Authority of Singapore (MPA).

MPA received 81 proposals, from which the final 12 were eventually shortlisted. The top winner of Demo Day was Gleematic, which used automation to help ships meet regulatory clearance. It won S\$5,000 in cash. The second-prize winner was T-Mining, which aimed to increase visibility of the maritime logistic supply chain data from ships, cargo and containers to improve efficiency of global operations. Third was XjeraLabs, which looked at ensuring the safety of port users in an automated and heavily industrial environment.

All 12 start-ups are eligible to apply for funding support of up to S\$50,000 to develop fully functional solutions with opportunities to test-bed their product with MPA's industry partners.

3.5.2 Blockchain technology field lab (Rotterdam)

BlockLab is an initiative of the Port of Rotterdam Authority and the Municipality of Rotterdam, who will also be financing the project. In addition, the lab is supported by the regional development corporation InnovationQuarter.

They launched a field lab for the development of concrete applications and solutions based on blockchain technology.

The BlockLab will be starting with a core team of five, who work from the Cambridge Innovation Center in Rotterdam. In the field lab, theoretical blockchain ideas are developed, tested and worked out into concrete opportunities in a real-world environment, together with consortia of developers and users. In addition, the lab will serve as a knowledge center for the regional private sector. The team will be working together with Rotterdam University of Applied Sciences to develop a curriculum intended to marshal the influx of talented new blockchain researchers.

4 Digitization and disruptive technology for ships

4.1 Container Monitoring

Container remote monitoring can be possible through GSM (global system for mobile communications), GPS, and RFID technology. Data from containers including temperature, location can be monitored while on vessel or on shore.

For port operation, to have real-time information of all containers in the yard will greatly help operational efficiency. It will also eliminate human errors on manual regular inventory checking.

4.1.1 Remote Container Management (Maersk, Ericsson)

Maersk Line has developed global IoT solutions with Ericsson. In 2012, they teamed up to install real-time monitoring across its fleet with Ericsson's mobile and satellite communication technology. Since then, the collaboration has gone beyond information about vessel operation, fuel consumption and electric conditions.

For example, they launched The Remote Container Management (RCM) in 2015. It allows Maersk's fleet with refrigerated containers to transmit vital statistics via satellite, such as temperature, location and power supply. This information is loaded onto the cloud and analyzed back in the central office. The system is used to solve the problems that Maersk faces with refrigerated shipments on a daily basis.

4.2 Onboard IoT platform

Ship performance monitoring technology can contribute to ship operational efficiency. Ship data such as voyage data, engine data are connected to data server and transferred to a data center on shore. The data can be used for application providers and equipment manufactures.

4.2.1 Onboard IoT Platform (NYK Group)

Nippon Yusen Kabushiki Kaisha (NYK), MTI Co. Ltd., Nippon Telegraph and Telephone Corporation (NTT), and NTT DATA Corporation have successfully conducted a proof-of-concept experiment for a next-generation onboard IoT platform. The four companies began collaboration to make use of NTT computing technology to develop a next-generation onboard IoT platform. Ship Information Management System (SIMS) is expanded to a new system that would enable the remote distribution and management of onboard applications from land offices.

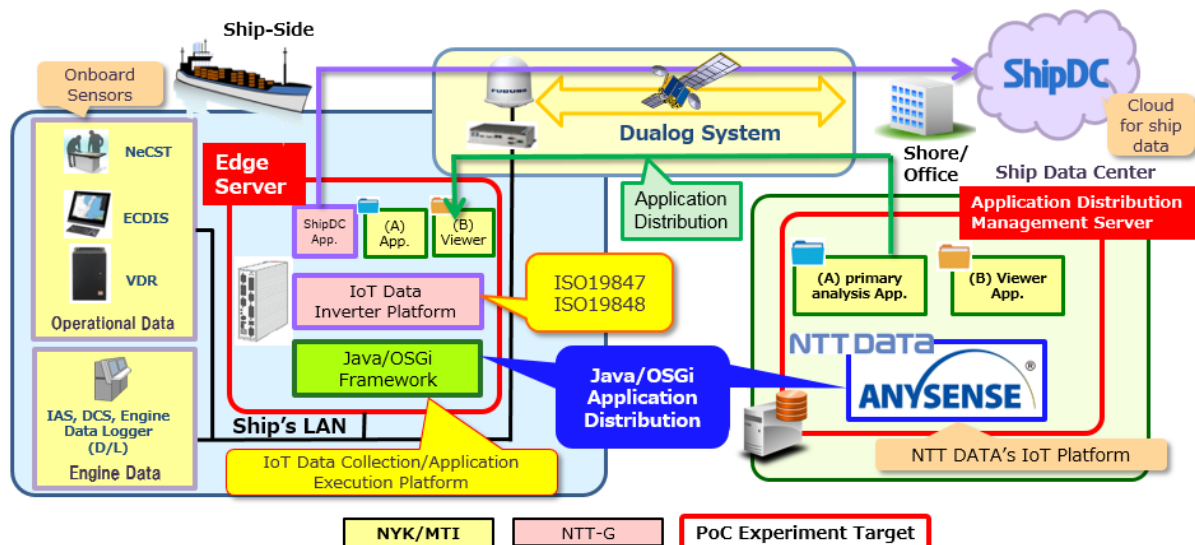


Fig. 4.1 Onboard IoT Platform (Source: NYK)

5 Digitization and disruptive technology for ports and terminals

5.1 Smart lighting

Smart lighting technology are now widely being applied in buildings, houses, streets. Intelligent lighting enable dynamic dimming and remote control.

By implementing smart lighting in yards or roads, ports can reduce energy consumption for lighting and enhance safety for employees and visitors.

5.1.1 Dynamic real-time lighting (Valencia)

In the European SEA TERMINALS project, spearheaded by the Valenciaport Foundation and with the participation of the Port Authority of Valencia, Noatum and Ingeniería de Aplicaciones Energéticas SLU (EDAE), a Dynamic Lighting System that allows container port terminals to better manage and reduce energy consumption of lighting in an intelligent and efficient way was developed. The system, which will be tested at the Noatum Container Terminal Valencia from September to November, will mean savings of up to 8 times the current energy consumption at the terminal for the estimated period.

The Dynamic Lighting System includes LED luminaires and a software that manages the lighting needs and can reduce the lighting levels by a third as long as there are no operational activities going on in the areas overseen by the lighting towers. In addition, the system automatically adapts the lighting conditions during the hours of daybreak and dusk so that there are no abrupt changes to the lighting levels at container port terminals.



Fig. 5.1 Dynamic Lighting System (Source: Valenciaport Foundation)

5.1.2 Intelligent street lighting (Port of Moerdijk, Netherlands)

The Port of Moerdijk in southern Netherlands is installing smart street lighting controls across 2600 hectares of land in an attempt to slash energy consumption and maintenance costs.

The Port will equip 1100 new LED street lights with motion sensors and management software from Amsterdam-based Tvilight. Dutch company Dynniq will oversee the rollout and the LED light installation. Dynniq is a technology firm that specializes in managing infrastructure, traffic, and energy systems.

A Tvilight spokesperson said that the new smart street lighting system should slash the lighting electricity bill by up to 80% — in large measure by dynamic dimming — compared to the existing fluorescent lights, which do not benefit from smart controls. Tvilight's CitySense sensors and CityManager software will also help cut maintenance costs by as much as 50%, through preventative maintenance, the spokesperson said.

5.2 Equipment Monitoring

Sensors installed in container handling equipment can collect important performance data such as temperatures and vibration. The information can be sent to remote monitoring centers and are analyzed in real time. This solution allows users to forecast equipment failure.

Port operators may want to install such systems in order to be able to plan timely maintenance and keep equipment running efficiently.

5.2.1 Equipment Monitoring (Port of Cartagena)

The Port of Cartagena introduced Cisco and IBM solution to capturing data of their equipment in real-time so that they immediately act on the data to keep the port continuously operational.

The solution allows them to forecast equipment failures and keep their machines running effectively by ensuring they get ahead of equipment degradation with needed maintenance.

5.2.2 Equipment Monitoring (CHS engineering)

CHS Engineering Services Ltd is currently monitoring the performance of quay cranes at DP World's London Gateway terminal on the River Thames. This involves fixing one of the company's mobile-phone sized Foundations Connect Hubs to the crane and connecting that to a power supply. An array of sensors is then attached to this device, which monitors three variables: temperature, vibration and humidity. Using a SIM card embedded within the hub, information is sent directly to the Foundations Connect cloud platform. This is analyzed in real time and the results made available live to the client online and via SMS, Email and status dashboards.

CHS Engineering Services Ltd is considering that they provide the results of data analysis to help customers plan maintenance strategies and decide to minimize operational downtime. In addition, how much redundancy equipment needs can be determined using the system and it would be helpful for manufacturers to cut the cost due to too much redundancy.

5.2.3 Global Remote Monitoring (ZPMC)

Equipment manufacturer ZPMC established Global Remote Monitoring Center to monitor ZPMC's cranes and heavy-duty machinery. It aims to provide real-time monitoring of equipment, fault prediction and preventive maintenance based on big data, and real-time remote support services for global users.

The establishment of the center is to take advantage of the Internet of things, big data, cloud service and other technologies to provide remote centralized monitoring and remote technical support for their products. Thus, they can learn preventable diagnosis and maintenance technologies, and realize intelligent equipment-platform service.



Fig. 5.2 ZPMC Global Remote Monitoring Center (Source:ZPMC)

<https://www.zpmc.com/news.php?act=yw&page=172>

5.2.4 Equipment Performance Management (Kalmar)

Kalmar, provider of cargo handling solutions to port, launched optimization tool. Kalmar Insight is a cloud-based software service that combines data from equipment fleet, Terminal Operating System (TOS) and the terminal's Maintenance Management System (MMS). The solution aggregates the data from these sources and displays the most relevant information on a single user interface with simple dashboards.

Using the same data, the tool provides dashboards for four different user groups; Operation Management, Maintenance Management, Health and Safety Officers, and Senior Management.

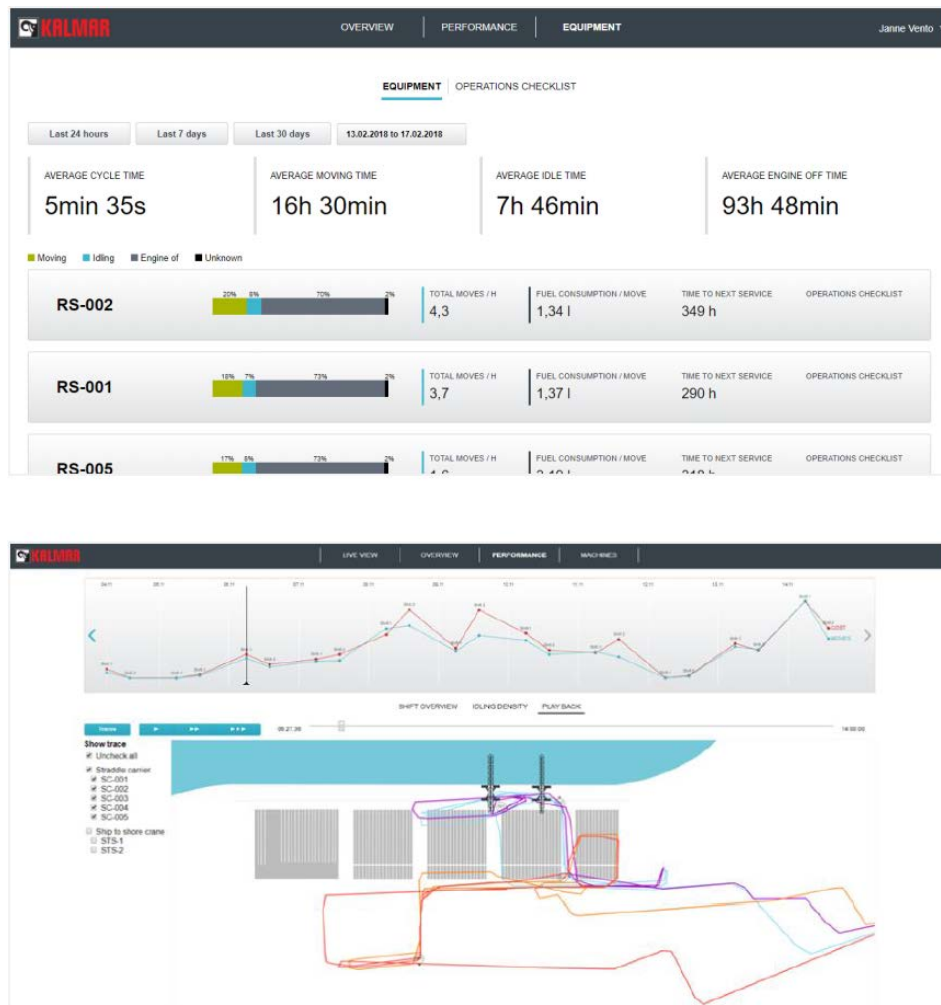


Fig. 5.3 Kalmar Insight (Source: Kalmar)

5.3 Equipment Remote Control

Container handling equipment such as cranes can be operated from a remote control room, which is located in the terminal office area. Remote operation system has been developed by several system providers such as SIEMENS, ABB, KONECRANE and so on.

Crane operators can work in a safe and ergonomic office environment, and employee safety and satisfaction can be improved. In addition, one operator can operate different cranes at different times. As a result, operator idling time can be reduced and productivity can be increased.

Port operators may want to consider this solution to attract employees for providing safer and more attractive working environment.



Fig. 5.4 Equipment Remote Control (Source: SIEMENS)

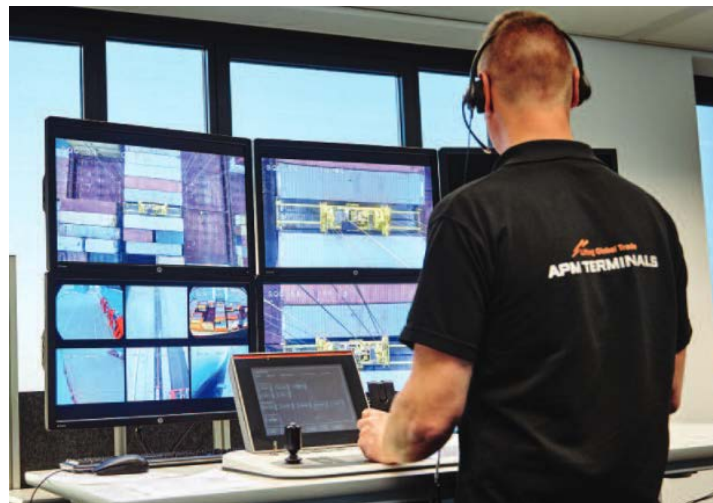


Fig. 5.5 Equipment Remote Control (Source: ABB)



Fig. 5.6 Equipment Remote Control (Source: KONECRANE)

5.4 Automation

Automated container terminals have been implemented for many years now, even though level of automation varies from terminal to terminal. Some terminals only replace manual human operations such as reading container numbers at gates by automated optical character recognition system, and some terminals are heavily involved with full automation concept including robotizing container handling equipment.

It is expected that AI (Artificial Intelligence) will play a more important role in automated terminals. For example, AI may control quay cranes and yard cranes, and drive horizontal transportation such as automated guided vehicles (AGV).

Nowadays autonomous ship concept has been widely discussed and actual projects have been planned. Automated container terminal may need further development to accommodate autonomous ships in the port.

5.4.1 Autonomous feeder vessel and automated container yard (Yara)

Yara, Norwegian fertilizer conglomerate, have unveiled the plan of fully autonomous terminal for Yara's Porsgrunn facility in Norway.

In 2017, Yara announced to implement an autonomous feeder vessel, YARA BRIKLAND, to transport fertilizer by containers from Yara's Porsgrunn facility via inland waterways to the deep-sea port of Lavrik and Brevik. The journey will be about 31 nautical miles.

Port operations at Porsgrunn would also be fully automated and it has selected Kalmar to provide that technology.



Fig. 5.7 Path between Porsgrunn (Herøya) and Brevik (Source:Yara International)

The quayside concept is a widespan RMG handling the vessel, a stack, and the straddle interchange: a small-scale system better suited to the volume expected to be carried (approximately 20,000 containers per year).

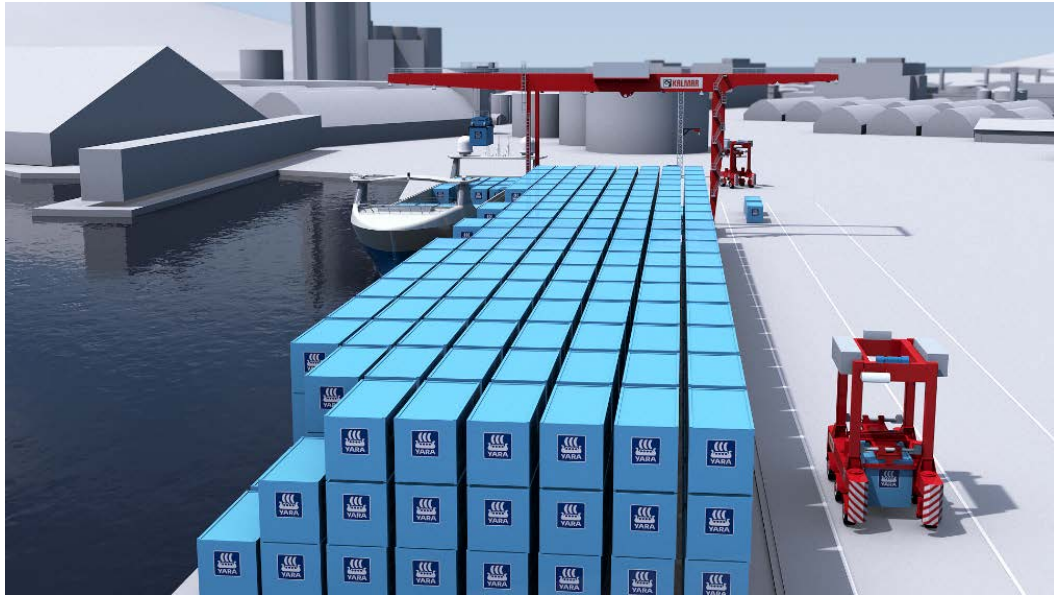


Fig. 5.8 Image of Porsgrunn facility (Source: Yara International)

<https://www.worldcargonews.com/news/fully-digital-autonomous-terminal-for-yara--59746>

6 Analysis of possible effects and influences of digitization and disruptive technologies on port operation

In the previous chapters, case studies of disruptive technologies related to maritime industry were identified and categorized into three groups, for supply chain stakeholders, for ships, for ports and terminals. In this chapter, it is also analyzed how these disruptive technologies will affect current port operations.

Digitization and disruptive technologies for supply chain stakeholder

(3.1) Blockchain based platform

In shipping trade, significant amount of paper documents are required to be exchanged. Physical inspection of documents is time consuming and adding cost on shipping transaction. A wide variety of documents exchange can be digitized and several pilot projects by using blockchain-based application are ongoing in recent years.

To realize such systems, there are hurdles such as building a network over all concerned parties. However, when these blockchain-based information exchange platform is in place, port operators will need to actively participate in discussion and adopt these technologies, in order to stay productive and competitive.

(3.2) Port information platform

Ports have a very complicated network including terminals, port authorities, shipping lines, trucking companies, and so on. Port information platforms can make real-time communication between the stakeholders and bring efficiency for whole supply chain. To realize it, technologies should be used including mobile network, cloud-based platform, cartographic information, and so on.

In port information platforms, terminal operators can be one of the main information providers as well as active system users.

(3.3) Supply Chain Management

Over the whole supply chain process, containers travel from shipper to receiver by truck, ship, and rail transportation. Recent technologies enable users to track location of their containers anytime and this capability will bring container supply chain optimization.

In such supply chain management system, ports will act as an important information gateway for ocean and landside connections.

(3.4) Cyber Security

Digital technology has been more widely used in maritime sector for years now. As they are connected to the internet more frequently, this situation increases threat of cyber-attacks to the maritime sector.

Port operations consist of complex systems that are connected to different stakeholders through the internet. Therefore, port operators should protect their systems against cyber-attacks.

(3.5) Initiative on IoT development

Several projects that enhance development in maritime related technology have been launched worldwide. Port authorities also support these initiatives and some of outcomes may contribute to port operations.

Digitization and disruptive technologies for ships

(4.1) Container Monitoring

Container remote monitoring can be possible through GSM (global system for mobile communications), GPS, and RFID technology. Data from containers including temperature and location can be monitored while on vessel or on shore.

For port operation, to have real-time information of all containers in the yard will greatly help operational efficiency. It will also eliminate human errors on manual regular inventory checking.

(4.2) Onboard IoT platform

Ship performance monitoring technology can contribute to ship operations efficiency. Ship data such as voyage data and engine data are connected to data server and transferred to a data center on shore. The data can be used for application providers and equipment manufactures.

Digitization and disruptive technologies for ports and terminals

(5.1) Smart lighting

Smart lighting technology are now widely being applied in buildings, houses, streets. Intelligent lighting enable dynamic dimming and remote control

By implementing smart lighting in yards or streets, ports can reduce energy consumption for lighting and enhance safety for employees and visitors.

(5.2) Equipment Monitoring

Sensors installed in container handling equipment can collect important performance data such as temperatures and vibration. The information can be sent to remote monitoring centers and are analyzed in real time. This solution allows users to forecast equipment failure.

For port operators, installing such system will enable them to plan maintenance on demand and keep equipment running efficiently.

(5.3) Equipment Remote Control

Container handling equipment such as cranes can be operated from a remote control room, which is located in a remote place such as terminal office area. Remote operation system are now being realized in several container terminals.

Crane operators can work in a safe and ergonomic office environment and employee safety and satisfaction can be improved. In addition, one operator can operate different cranes at different times. As a result, operator idling time can be reduced and productivity can be increased.

For port operators, this solution will attract employees for providing safer and more attractive working environment.

(5.4) Automation

Automated container terminals have been implemented for many years now, even though level of automation varies from terminal to terminal. Some terminals only replace manual human operations such as reading container numbers at gates by automated optical character recognition system, and some terminals are heavily involved with full automation concept including robotizing container handling equipment.

For ports, which will face labor shortage in the future, automation solution will be the way to consider. However, in order to achieve full or semi-automated operation, it will take much effort and a lot of time to reach the operational performance level originally intended.

Overall conclusion

Several consortiums are now developing different cargo information exchange platforms such as IBM-Maersk blockchain-based one and many others. For supply-chain management system such as visualization and digitization, maritime related companies and IT companies are forming consortiums and developing different systems. From the end-user perspective, it is not desirable to be forced to use different information platforms. Having said that, it is as well not favorable that a specific business group monopolizes such important services. It will a challenge that how this conflicting issue will be solved.

For maritime and port industries, number of disruptive technologies are available. They need to implement these technologies to stay operationally efficient and environmentally friendly in current and future business circumstances. Having said that, comparing to other industries, not so many disruptive technologies projects have been implemented yet in the maritime and port sectors. There may be several reasons for this slow progress, but one of the reasons may be the shortage of ICT specialists in the industries. In order to keep up with the cutting-edge technologies, the maritime and port sectors will need to hire more ICT specialists from outside of their sectors.

Another concern is, comparing to other industries, the maritime and port sectors are relatively conservative

for changing its operational practice. There are more examples that companies from different sectors start providing disruptive services, such as Google's development of self-driving car and, Rakuten's (E-commerce conglomerate) announcement of research of unmanned cargo ships. If there is no self-reformation, the maritime and port industry will find more game-changers from other industries in their own turf.

Appendix (Literature Research)

Information collection about Big data/IoT related projects were carried out through the Internet and literature research. These projects were classified into the following categories and further explained.

1. Blockchain Based Platform

- Blockchain solution for safe, efficient container release pilot project (Port of Antwerp)
- Blockchain to improve global trade (Maersk, IBM)
- Blockchain Solution (Agility, Maersk, IBM)
- Blockchain Trial from Chongqing to Singapore (Singapore)
- Blockchain system for logistic industry (MTI, Agility Science)
- The first blockchain platform for marine insurance (EY, Maersk, Microsoft)
- Blockchain Technology in Cross-Border Trade Operations (Japan Consortium)
- Blockchain Technology Adopted in Shipping & Logistics (HMM, Samsung)
- Smart Bill of Lading (CargoX)
- Global Shipping Business Network

2. Port Information Platform

- SmartPort Logistics (Port of Hamburg)
- 5G mobile network (Port of Hamburg)
- Maritime shipping data platform pilot (Port of Los Angeles)
- PortMaps (Port of Rotterdam)
- Digitalization of port's operational environment (Port of Rotterdam)
- Smart port (Port of Durban)

3. Supply Chain Management

- Logistics Visualization Service (India)

4. Initiative on IoT development

- Smart Port Challenge (Singapore)
- Blockchain technology field lab (Rotterdam)

5. Container Monitoring

- Remote Container Management (Maersk, Ericsson)

6. Onboard IoT platform

- Onboard IoT Platform (NYK Group)

7. Smart Lighting

- Dynamic real-time lighting (Valencia)
- Intelligent street lighting (Port of Moerdijk, Netherland)

8. Equipment Monitoring

- Equipment Monitoring (Port of Cartagena)
- Equipment Monitoring (CHS engineering)

1 Blockchain Based Platform

1.1 Blockchain solution for safe, efficient container release pilot project (Port of Antwerp)

Project Name	Blockchain solution for safe, efficient container release pilot project
Underlying Technology	Blockchain
Location	Antwerp (Belgium)
Information Released	June 2017
Involved Parties	T-Mining, Port of Antwerp
Article	
Antwerp start-up T-Mining develops Blockchain solution for safe, efficient container release	
<p>28 Jun 2017 T-Mining is currently working on a pilot project that will make container handling in the port of Antwerp more efficient and secure. Using blockchain technology, processes that involve several parties – carriers, terminals, forwarders, hauliers, drivers, shippers etc. – are securely digitized without any central middleman being involved.</p> <p>Just getting a container from point A to point B frequently involves more than 30 different parties, with an average of 200 interactions between them. Given that many of these interactions are carried out by e-mail, phone and even (still, nowadays) by fax, paperwork accounts for up to half of the cost of container transport.</p> <p><i>“We aim to do something about this,”</i> says Nico Wauters, CEO of T-Mining. This Antwerp start-up has developed a solution for a recognized problem in the port. When a container arrives in the port, it is collected from the terminal by a truck driver or shipper. To ensure that the right person picks up the right container a PIN code is used. However, the PIN code is transmitted via a number of parties, which of course is not without risk. Somebody with bad intentions can simply copy the PIN code, which naturally can cause great problems.</p> <p><i>“We have developed a very secure solution for this,”</i> explains Nico Wauters. <i>“Currently, when we want to transfer a valuable object we generally make use of a trusted intermediary to carry out the transfer. For instance, when you want to sell a house the notary not only carries out all the paperwork but also ensures that the money lands safely in your bank account while the buyer receives full title to the property, without any unpleasant surprises for either party. But this intermediary naturally does not work for free, and furthermore the additional step causes extra delay.”</i></p> <p>The blockchain solution overcomes these issues, permitting safer and faster transfer of valuable objects, fully digitally and without a middleman. <i>“With our blockchain platform the right truck driver is given clearance to collect a particular container, without any possibility of the process being intercepted. Furthermore our blockchain platform uses a distributed network, so that the transaction can go ahead only if there is consensus among all participating parties, thus excluding any attempts at fraud or undesired manipulations.”</i></p> <p>A pilot project is currently running in the port of Antwerp with a limited number of parties. <i>“We want to test</i></p>	

whether it all works smoothly in practice,” says Nico Wauters. “Together with PSA, MSC, a forwarder and a transporter, we ensure secure handling of the first containers on our blockchain platform. Thanks to the City of Antwerp we even have an office in Singapore where we are working hard to introduce our solution there too. Our ambition is to serve the first paying customers by the end of this year,” Nico Wauters concludes.

Reference
Port of Antwerp http://www.portofantwerp.com/en/news/antwerp-start-t-mining-develops-blockchain-solution-safe-efficient-container-release

1.2 Blockchain to improve global trade (Maersk, IBM)

Project Name	Maersk and IBM to Form Joint Venture Applying Blockchain to Improve Global Trade and Digitize Supply Chains
Underlying Technology	Blockchain, Cloud based open source, Artificial Intelligence (AI)
Location	Copenhagen (Denmark)
Information Released	January 2018
Involved Parties	Maersk, IBM
Article	
<p>COPENHAGEN, DENMARK and ARMONK, NY – 16 January 2018:</p> <p>A.P. Moller – Maersk (MAERSKb.CO) and IBM (NYSE: IBM) today announced their intent to establish a joint venture to provide more efficient and secure methods for conducting global trade using blockchain technology.</p> <p>The aim of the new company will be to offer a jointly developed global trade digitization platform built on open standards and designed for use by the entire global shipping ecosystem. It will address the need to provide more transparency and simplicity in the movement of goods across borders and trading zones.</p> <p>The cost and size of the world’s trading ecosystems continues to grow in complexity. More than \$4 trillion in goods are shipped each year, and more than 80 percent of the goods consumers use daily are carried by the ocean shipping industry. The maximum cost of the required trade documentation to process and administer many of these goods is estimated to reach one-fifth of the actual physical transportation costs. According to The World Economic Forum, by reducing barriers within the international supply chain, global trade could increase by nearly 15 percent, boosting economies and creating jobs.</p> <p>The attributes of blockchain technology are ideally suited to large networks of disparate partners. A distributed ledger technology, blockchain establishes a shared, immutable record of all the transactions that take place within a network and then enables permissioned parties’ access to trusted data in real time. By applying the technology to digitize global trade processes, a new form of command and consent can be introduced into the flow of information, empowering multiple trading partners to collaborate and establishing a single shared view of a transaction without compromising details, privacy or confidentiality.</p> <p>Maersk, a global leader in container logistics, and IBM, a leading provider of blockchain, supply chain visibility and interoperability solutions for the enterprise, will use blockchain technology to power the new platform, as well as employ other cloud-based open source technologies including artificial intelligence (AI), IoT and analytics, delivered via IBM Services, in order to help companies move and track goods digitally across international borders. Manufacturers, shipping lines, freight forwarders, port and terminal operators and customs authorities can all benefit from these new technologies –and ultimately consumers.</p> <p>“This new company marks a milestone in our strategic efforts to drive the digitization of global trade. The potential from offering a neutral, open digital platform for safe and easy ways of exchanging information is</p>	

huge, and all players across the supply chain stand to benefit,” said Vincent Clerc, chief commercial officer at Maersk and future chairperson of the board of the new joint venture. “By joining our knowledge of trade with IBM’s capabilities in blockchain and enterprise technology, we are confident this new company can make a real difference in shaping the future of global trade.”

IBM's blockchain platform is enabling hundreds of clients and thousands of developers to build and scale active networks across complex use cases, including cross border payments, supply chains, and digital identification.

"The major advances IBM has made in blockchain have shown that the technology can foster new business models and play an important role in how the world works by building smarter businesses," said Bridget van Kralingen, senior vice president, IBM Global Industries, Solutions and Blockchain. "Our joint venture with Maersk means we can now speed adoption of this exciting technology with the millions of organizations who play vital roles in one of the most complex and important networks in the world, the global supply chain. We believe blockchain will now emerge in this market as the leading way companies seize new untapped economic opportunities.”

IBM and Maersk began a collaboration in June 2016 to build new blockchain- and cloud-based technologies. Since then, multiple parties have piloted the platform including DuPont, Dow Chemical, Tetra Pak, Port Houston, Rotterdam Port Community System Portbase, Customs Administration of the Netherlands, and U.S. Customs and Border Protection.

The joint venture will now enable IBM and Maersk to commercialize and scale their solutions to a broader group of global corporations, many of whom have already expressed interest in the capabilities and are exploring ways to use the new platform, including: General Motors and Procter and Gamble to streamline the complex supply chains they operate; and freight forwarder and logistic company, Agility Logistics, to provide improved customer services including customs clearance brokerage.

Additional customs and government authorities, including Singapore Customs and Peruvian Customs, will explore collaborating with the platform to facilitate trade flows and enhance supply chain security. The global terminal operators APM Terminals and PSA International will use the platform to enrich port collaboration and improve terminal planning. With support from Guangdong Inspection and Quarantine Bureau by connecting to its Global Quality Traceability System for import and export goods, the platform can also link users to important trade corridors in and out of China.

To address the specific needs of the industry, Maersk and IBM are establishing an advisory board of industry experts to help further shape the platform and services, provide guidance and feedback on important industry factors, and drive open standards.

Maersk and IBM have named Michael J. White, former president of Maersk Line in North America, as CEO of the new company. He commented, “Today, a vast amount of resources are wasted due to inefficient and error-prone manual processes. The pilots confirmed our expectations that, across the industry, there is considerable

demand for efficiency gains and opportunities coming from streamlining and standardizing information flows using digital solutions. Our ambition is to apply these learnings to establish a fully open platform whereby all players in the global supply chain can participate and extract significant value. We look forward to further expanding our ecosystem of partners as we progress toward a global solution.”

The new company initially plans to commercialize two core capabilities aimed at digitizing the global supply chain from end-to-end:

- A shipping information pipeline will provide end-to-end supply chain visibility to enable all actors involved in managing a supply chain to securely and seamlessly exchange information about shipment events in real time.
- Paperless Trade will digitize and automate paperwork filings by enabling end-users to securely submit, validate and approve documents across organizational boundaries, ultimately helping to reduce the time and cost for clearance and cargo movement. Blockchain-based smart contracts ensure all required approvals are in place, helping speed up approvals and reducing mistakes.

Upon regulatory clearance, solutions from the joint venture are expected to become available within six months.

The new company will be headquartered in the New York metropolitan area.

The platform is built on IBM Blockchain technology, which is provided through the IBM Cloud and powered by Hyperledger Fabric 1.0, a blockchain framework and one of the Hyperledger projects hosted by the Linux Foundation.

Reference

Maersk

<https://www.maersk.com/press/press-release-archive/maersk-and-ibm-to-form-joint-venture>

IBM Blockchain Blog

<https://www.ibm.com/blogs/blockchain/2018/01/digitizing-global-trade-maersk-ibm/>

1.3 Blockchain Solution (Agility, Maersk, IBM)

Project Name	Agility is First Forwarder to Work with Maersk IBM on Blockchain Solution
Underlying Technology	Blockchain
Location	Baar (Switzerland)
Information Released	February 2018
Involved Parties	Agility, Maersk, IBM
Article	
<p>Agility is First Forwarder to Work with Maersk IBM on Blockchain Solution</p> <p><i>Logistics provider teams up to transform global, cross-border supply chain</i></p> <p>BAAR, Switzerland – Feb. 6, 2018 – Agility, a leading global logistics provider, is the first freight forwarder to collaborate on a Maersk-IBM solution to provide more efficient and secure methods for conducting global trade by using blockchain technology to manage and track container shipments.</p> <p>Agility has agreed to identify events associated with individual shipments and to share and receive information about them via the distributed ledger blockchain technology developed by IBM and Maersk.</p> <p>Agility’s goal is to reduce costs and increase shipping efficiency by integrating information about shipments onto a secure platform accessible to shippers, carriers, freight forwarders and others in the supply chain.</p> <p>“Blockchain technology is going to make shipping cheaper, safer and more reliable. As early adopters, companies like Agility can help Maersk and IBM understand the needs of shippers and develop standards that will make trade more efficient,” said Essa Al-Saleh, CEO of Agility Global Integrated Logistics. “We can help customers understand how to use blockchain to improve shipment visibility, eliminate paperwork, reduce errors, and shorten transit and clearance times.”</p> <p>Blockchain is a secure, immutable and tamper-resistant ledger that can be used to track shipments, documentation and payment transactions. Its digital infrastructure can connect parties in the supply chain, giving them access to information and real-time visibility based on their level of permission.</p> <p>Documentation and administration are estimated to be one-fifth of the \$1.8 trillion spent annually to move goods across borders. In addition to showing the location of containers in transit, blockchain can show the status of customs documents, bills of lading and other documentation. It can improve workflow, cut processing costs and enhance visibility by integrating shipping processes and partners.</p> <p>Customs and border authorities can use the technology to improve the information available for risk analysis, leading to increased safety and security as well as greater efficiency in border inspection clearance.</p> <p>“For Agility, it’s important to be involved early in blockchain and to work with forward-thinking companies like Maersk and IBM,” Al-Saleh said. “Together, we have a lot to learn and share in order to bring the benefits</p>	

of this technology to shippers and consumers as quickly as possible.”

About Agility

Agility brings efficiency to supply chains in some of the globe’s most challenging environments, offering unmatched personal service, a global footprint and customized capabilities in developed and developing economies alike. Agility is one of the world’s leading providers of integrated logistics. It is a publicly traded company with \$4 billion in revenue and more than 22,000 employees in over 500 offices across 100 countries. Agility’s core commercial business, Global Integrated Logistics (GIL), provides supply chain solutions to meet traditional and complex customer needs. GIL offers air, ocean and road freight forwarding, warehousing, distribution, and specialized services in project logistics, fairs and events, and chemicals. Agility’s Infrastructure group of companies manages industrial real estate and offers logistics-related services, including e-government customs optimization and consulting, waste management and recycling, aviation and ground-handling services, support to governments and ministries of defense, remote infrastructure and life support.

Reference

Agility

<https://www.agility.com/en/2018/02/agility-first-forwarder-work-maersk-ibm-blockchain-solution/>

1.4 Blockchain Trial from Chongqing to Singapore (Singapore)

Project Name	PIL, PSA, IBM Conclude Blockchain Trial from Chongqing to Singapore
Underlying Technology	Blockchain
Location	Chongqing (China), Singapore
Information Released	February 2018
Involved Parties	Pacific International Lines (PIL), PSA International, IBM Singapore
Article	
<p>PIL, PSA, IBM Conclude Blockchain Trial from Chongqing to Singapore</p> <p>Shipping company Pacific International Lines (PIL), port group PSA International (PSA) and technology company IBM Singapore (IBM) have completed a blockchain-based supply chain platform trial.</p> <p>As informed, the companies worked on a proof of concept (POC) exercise, built on IBM Blockchain Platform, applying and then testing the platform to track and trace cargo movement from Chongqing to Singapore via the Southern Transport Corridor.</p> <p>The exercise follows a memorandum of understanding (MOU) signed in August 2017 with an aim to collaborate on blockchain-based supply chain business network innovations.</p> <p>The partners believe that there is now sufficient evidence to show that the concept can be taken to the next stage. The scope of the POC will be widened and the partners are eager to engage more participants from the different nodes of the distribution network that form the supply chain logistics ecosystem, PIL said in a statement.</p> <p><i>“We are highly committed to this idea because we as a company believe the wider application of blockchain across the global logistics and shipping businesses will lead to much greater operating efficiencies, security and transparency. It is the future for our industry,”</i> Teo Siong Seng, Managing Director of PIL, commented.</p> <p><i>“PSA’s collaboration alongside our partners and relevant stakeholders in this blockchain trial demonstrates our efforts to enhance physical and digital connectivity, as well as to improve efficiencies along the global supply chain. Ultimately, we hope to create value for our customers along the Southern Trade Corridor – a key route in the Belt and Road initiative,”</i> Roger Tan, Regional CEO Northeast Asia of PSA, pointed out.</p>	
Reference	
<p>World Maritime News</p> <p>https://worldmaritimeneews.com/archives/245431/pil-psa-ibm-conclude-blockchain-trial-from-chongqing-to-singapore/</p>	

1.5 Blockchain system for logistic industry (MTI, Agility Science)

Project Name	Pilot test of blockchain system for logistic industry
Underlying Technology	Blockchain
Location	-
Information Released	August 2017
Involved Parties	Marine Transport International (MTI), Agility Science
Article	
<p>Blockchain System Successfully Deployed to Revolutionize the Logistics Industry</p> <p>Marine Transport International announces a successful pilot of blockchain technology, validated by the University of Copenhagen & BLOC</p> <p>LONDON, August 30, 2017 /PRNewswire/ -</p> <p>A successful pilot program delivered by logistics technology company Marine Transport International (MTI) demonstrates that the logistics industry will see improved connectivity, efficiency and security thanks to blockchain. MTI, in conjunction with Agility Sciences, have today released a whitepaper detailing the deployment of their Container Streams system in a supply chain environment. The results of the pilot have been verified by scientists at the University of Copenhagen and maritime technology leads at Blockchain Labs for Open Collaboration (BLOC).</p> <p>The project, which has connected supplier, shipper, load point, customs and terminal on a shared blockchain ledger, has far-reaching consequences for the logistics industry as it seeks new ways to improve security and profitability. All parties involved in the supply chain benefit from automated data flows as the system allows complete interoperability of data sources, even including legacy systems.</p> <p>Jody Cleworth, CEO of Marine Transport International, comments: "The results of this successful pilot demonstrate the strengths of blockchain technology when deployed to link the various actors in the supply chain. We are confident that firms throughout the logistics industry will see a broad spectrum of benefits stemming from blockchain deployment.</p> <p>"The blockchain has proven to be an excellent way of connecting the different parties involved in any supply chain environment due to the transparency and security-by-design of the technology. In recent months, the shipping industry has fallen victim to industrial-scale cyberattacks, which have left large shipping lines, such as Maersk, paralyzed and unable to serve clients.</p> <p>"A blockchain-enabled supply chain is highly resilient to cyberattack - a copy of the essential shipping data is stored on each node on a decentralized network, meaning that even if one node is compromised, the data is safe nevertheless.</p> <p>"The business case for connecting supply chains using blockchain is very strong. As the interface is easily</p>	

adaptable to existing systems there is a very low barrier to entry. Any type of supply chain business, be it marine-, air-, or land-based, can take advantage of such a system - the cost savings that we envisage are as high as 90%, as a result of substantially streamlined processes."

Karim Jabbar, from the Department of Computer Science at the University of Copenhagen, added, "This pilot demonstrates the great potential for distributed ledger technologies to be used in improving supply chain processes. The Container Streams system is unique in the fact that it does not require the complete replacement of existing systems - instead, MTI's solution allows complete interoperability with existing legacy infrastructure. The logistics industry as a whole can expect better visibility, connectivity and cost savings as a result of distributed ledger adoption."

Deanna MacDonald, CEO of Blockchain Labs for Open Collaboration says, "We have documented the first phase of this use case, its implications for the maritime industry and the resulting development of a turn-key application ecosystem for global supply chain logistics. However, the future potential of this ecosystem platform will rest upon collaboration from the different actors in these supply chains in order to clearly identify the problems and co-create applications that solve for the collective challenges they are facing today."

Marine Transport International

At MTI, we specialize in moving cargo around the world by bringing technology and logistics together. We keep our customers in control through our high performing, low cost software products. With offices in New York and the U.K., we have access to over 30 years of technology and logistics experience, ensuring our clients get the best products available in the market, whilst making cost savings in their supply chain along the way.

Our vision is to significantly reduce additional cost associated with general freight forwarders and provide fair, market related prices, giving customers control of rates, operations and documentation at the click of a button.

Reference

PR Newswire

<https://www.prnewswire.com/news-releases/blockchain-system-successfully-deployed-to-revolutionise-the-logistics-industry-642213333.html>

1.6 The first blockchain platform for marine insurance (EY, Maersk, Microsoft)

Project Name	Plan to launch the first blockchain platform for marine insurance
Underlying Technology	Blockchain
Location	-
Information Released	September 2017
Involved Parties	Earnest & Young, Maersk, Microsoft, Guardtime, MS Amlin, XL Catlin, ACORD
Article	
<p>EY teams with Microsoft, Maersk to use blockchain for marine insurance</p> <p>Accounting giant EY said Wednesday that it plans to launch the first blockchain platform for marine insurance, alongside Microsoft, A.P Moller-Maersk and others.</p> <p>The distributed ledger will be used to capture information about shipments, risk and liability, and to help firms comply with insurance regulations.</p> <p>It will also ensure transparency across an interconnected network of clients, brokers, insurers and other third parties.</p> <p>EY explained that its decision to secure marine insurance data with blockchain was due to a "complete inefficiency" in the sector.</p> <p>"The reason we chose marine (insurance) as the starting point for this sort of market is mainly because of its complete inefficiency," Shaun Crawford, global insurance leader at EY, told CNBC via phone earlier this week ahead of the announcement.</p> <p>Crawford said the industry was "over capacity" and that there was "a lot of cost to it."</p> <p>He added, "It's facing high administrative burdens of managing and writing claims with a lot of paperwork. All contracts are signed multiple times. They go from ship to ship, port to port, through quite a journey."</p> <p>Distributed ledgers are groupings of data shared across multiple locations without the need for central administrators and other middlemen.</p> <p>The original blockchain was built to serve as the distributed ledger for bitcoin transactions. However, various blockchain experts believe the technology can provide transparency for a multitude of different industries, not just the financial services.</p> <p>"We're not talking about a new currency here, we're not talking about money. We're talking about data aggregation," EY's Crawford added.</p> <p>Maersk said the blockchain platform would enable the shipping giant to maintain a smoother relationship with</p>	

the insurance market.

IBM deploys blockchain technology to provide enterprise solutions to food safety: IBM's Brigid McDermott "It is a priority for us to leverage technology to streamline and automate our interaction with the insurance market," Lars Henneberg, head of risk and insurance at Maersk said in a statement Wednesday.

"Insurance transactions are currently far too tedious and frictional. The distance between risk and capital is simply too far. Blockchain technology has the potential to facilitate the desired development that is long overdue."

Blockchain could benefit wider insurance industry

Marine insurance has traditionally relied on physical contracts being shipped to and from one port to another, in order to be eventually signed, according to EY.

The global research firm has worked closely with software security company Guardtime to develop the blockchain platform.

Guardtime said it expects to roll out blockchain to the wider insurance industry after its initial marine insurance deployment.

"Initially, we focused on marine insurance as it is well-suited to a blockchain solution as it has a complex international ecosystem, with multiple parties, multiple jurisdictions, high transaction volumes and significant levels of reconciliation," Guardtime CEO Mike Gault told CNBC in an emailed note prior to the announcement.

"But down the line we expect it to be rolled out across other areas of insurance markets — as there are clearly shared benefits and attributes. In fact, blockchain can be applied to any commercial or specialty line of business with high-value assets."

Blockchain built on Microsoft Azure

The blockchain solution was built on Microsoft's cloud platform, Microsoft Azure.

Cloud technology allows firms to store data and software via the internet rather than locally on a hard drive.

A proof of concept for EY's digital ledger was completed in March.

"When we built the proof of concept, we built a prototype on Azure to make sure the whole thing worked and is secure, and now what we're doing is building it," EY's Crawford noted.

"We provide that cloud service which we believe is one of the strongest ones on the market, and that's why we chose Microsoft to work with."

Guardtime said Microsoft's cloud offered a secure network on which to build the blockchain.

"For any new system to be implemented it needs to be built using the right model, one that is robust, scalable

and can co-exist with existing IT infrastructure or systems," Guardtime's Gault said.

"That's what Azure and the cloud technology enables us to do, without comprising performance or flexibility, which is why it was so important to partner with Microsoft."

Mark Russinovich, chief technology officer at Microsoft Azure, said that blockchain had the potential to be "transformational."

"Microsoft believes blockchain is a transformational technology with the ability to significantly reduce the friction of doing business, especially streamlining business processes shared across multiple organizations," he said.

He added, "Marine insurance is a prime example of a complex business process that can be optimized with blockchain."

Insurers MS Amlin and XL Catlin also collaborated with EY on the project, as well as insurance industry body ACORD (Association for Cooperative Operations Research and Development).

The blockchain solution is set to be implemented from January 2018 onwards.

The race to create large distributed ledger network has become increasingly competitive.

IBM for instance announced it would partner with food giants like Nestle and Unilever in August, and use blockchain technology to trace the movements of food to avoid tackle contamination faster.

EY told CNBC that its decision to make the announcement ahead of time was due to a host of other players making similar moves.

Reference

CNBC

<https://www.cnbc.com/2017/09/05/ey-microsoft-maersk-blockchain-for-marine-insurance.html>

1.7 Blockchain Technology in Cross-Border Trade Operations (Japan Consortium)

Project Name	Demonstration Test of Blockchain Technology in Cross-Border Trade Operations
Underlying Technology	Blockchain
Location	-
Information Released	December 2017
Involved Parties	Sumitomo Mitsui Financial Group, Sumitomo Mitsui Banking Corporation, The Japan Research Institute, Mitsui & Co, Mitsui O.S.K. Lines, Mitsui Sumitomo Insurance Company, IBM Japan
Article	
<p>TOKYO, December 12, 2017 - Sumitomo Mitsui Financial Group ("SMFG", President and group CEO: Takeshi Kunibe), Sumitomo Mitsui Banking Corporation ("SMBC", President and CEO: Makoto Takashima), The Japan Research Institute, Limited ("JRI", President and CEO: Masahiro Fuchizaki), Mitsui & Co., Ltd. ("Mitsui & Co.", President and Chief Executive Officer: Tatsuo Yasunaga), Mitsui O.S.K. Lines, Ltd. ("MOL", President and CEO: Junichiro Ikeda), Mitsui Sumitomo Insurance Company, Limited ("MSI", President: Noriyuki Hara) and IBM Japan, Ltd. (President: Elly Keinan) have agreed to start a demonstration test in December 2017 to verify the applicability of blockchain technology as a way to streamline and upgrade cross-border trade operations.</p> <p>In the demonstration test, participating companies input information of real trade transactions using a blockchain-based application, by which a wide variety of documents, including trade agreements and logistics/insurance documents are digitized, recorded and shared among participants. By comparing against current operations, the test is intended to verify the effectiveness of blockchain technology for enhancing security and reducing the time required to settle cross-border trade transactions, discrepancies among related documents and administrative costs. Further, looking to commercialization, the technology will be evaluated for its viability in cross-border trade business operations.</p> <p>SMFG, SMBC, and JRI aim to use new information technologies proactively, thereby adapting to an increasingly fast-changing environment, and ultimately to become a more competitive and innovative financial group and continuously upgrade the quality of customer service. The demonstration test was planned with Silicon Valley Rep. Office, which conducts research on new technologies based on the PoC SMBC announced in February 2017. Through the application of blockchain technology to the safekeeping of legal information, SMFG is committed to adding value and offering innovative new financial products and services.</p> <p>Mitsui & Co. provides trading services, offering safe and optimized delivery of goods and services desired by customers worldwide. In the demonstration test, the company aims to combine the experience and expertise gained from its long-standing global trading business with the cutting-edge blockchain technology, and achieve better productivity in trade transactions and gain new business opportunities.</p> <p>MOL group is a leading global marine transportation operator. As a provider of integrated transportation</p>	

services, the group, meeting diverse needs for transportation, has earned a global reputation for safety. MOL is expected to offer related expertise to the demonstration test, and aims to become the corporate group that customers think of first when they choose a logistics business partner, by drawing upon ICT technologies to enhance its services.

MSI's business offers safety and security to resolve various social challenges. The company, through this trade platform, aims to provide services developed using advanced technologies, such as blockchain and IoT.

Seeking to develop various business applications that meet the business sector's demand for high-level security, IBM participates in Hyperledger, an open source collaborative effort created to advance cross-industry blockchain technologies hosted by The Linux Foundation. The demonstration test will use Hyperledger Fabric, a blockchain framework and one of the Hyperledger projects.

Reference

Mitsui O.S.K line

<http://www.mol.co.jp/en/pr/2017/17090.html>

1.8 Blockchain Technology Adopted in Shipping & Logistics (HMM, Samsung)

Project Name	Assessment on Blockchain Technology Adopted in Shipping & Logistics
Underlying Technology	Blockchain
Location	-
Information Released	December 2017
Involved Parties	Hyundai Merchant Marine, Samsung SDS
Article	
<p>HMM Completes Assessment on Blockchain Technology Adopted in Shipping & Logistics</p> <ul style="list-style-type: none"> - Conducted its Pilot Voyage since August - Aims to be one of the pioneers of the Fourth Industrial Revolution within the industry <p>Hyundai Merchant Marine has announced that it has completed its analysis of Blockchain Technology adopted in shipping and logistics that began in August.</p> <p>HMM, with Samsung SDS and other members of shipping and logistics blockchain consortium, have conducted the blockchain technology integrated pilot voyage and internal assessment for past seven months.</p> <p>Samsung SDS commented, “The blockchain technology adopted in shipping and logistics industry has prevented alteration and forgery of import/export documents and it also minimized the issuance of paper documents, simplifying the document issuance process.”</p> <p>HMM has begun its blockchain integrated pilot voyage from August and has successfully completed its first pilot voyage from Korea to China (Busan to Qingdao) with reefer containers, followed by more pilot voyages in India, Middle East, and Europe.</p> <p>HMM, through this blockchain consortium, has acquired the transparency of shipping transactions by delivering import/export related documents to all related parties (shipper-carrier-customs-bank) at once and also by preventing any alteration or forgery of import/export documents through public-key cryptography. This is expected to reduce a massive amount of paperwork – such as inputting booking information and Bill of Lading – hence will improve work efficiency.</p> <p>Also with the integrated Internet of Things (IoT) technology, cargo status (such as location, temperature, humidity, etc.) will be shared among HMM and the related parties live on time, of which will clarify any legal dispute that may occur during the transportation of the cargo.</p> <p>HMM plans to specify the plan for adopting blockchain technology in shipping based on the assessment result of the shipping and logistics blockchain consortium. It also plans to request to various research organizations and the government bodies for further legal revision and support for adopting the blockchain technology into shipping and logistics.</p>	

HMM official commented, “we are reviewing various ways to improve our service and its quality through adopting IT technologies” and that “by adopting the high-end IT technologies such as blockchain and IoT in shipping and logistics, we will become one of the pioneers in shipping and logistics.

Reference

Hyundai Merchant Marine

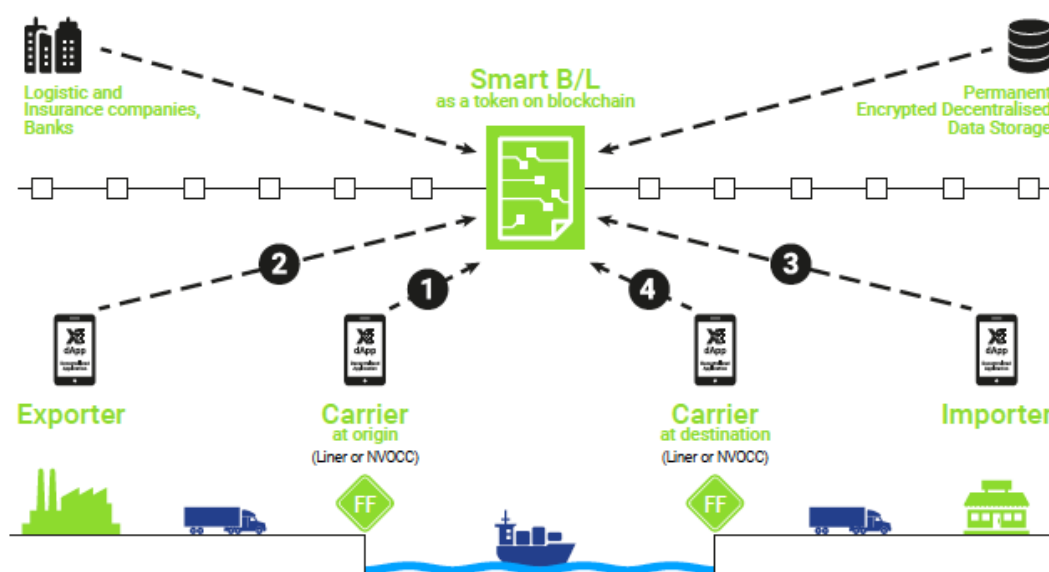
https://www.hmm21.com/cms/company/engn/introduce/prcenter/news/1203283_7540.jsp

1.9 Smart Bill of Lading (CargoX)

Project Name	Smart Bill of Lading
Underlying Technology	Blockchain
Location	-
Information Released	January 2018
Involved Parties	CargoX
Article	

As the logistics industry, the backbone of all global trade, still relies on one of the oldest methods for issuing a proof of ownership (the Bill of Lading, B/L), this can cause numerous problems, including: delays in delivery, the high cost of re-claiming the goods when the B/L is lost, stolen or damaged, and also the time-consuming processing of the documentation.

That is why CargoX is about to revolutionize the industry. We are developing the world's first blockchain Bill of Lading. We will create an open system based on Ethereum and encrypted permanent decentralized data storage, which will enable the creation and exchange of Bill of Lading documents.



The diagram above illustrates the workflow between different parties in the CargoX system.

Our blockchain-based Smart B/L will work in a similar way to tokens. Users (shippers, carriers, forwarders, importers) will be able to create, transfer and claim ownership of the B/L, and thereby the cargo that is the subject of the B/L.

The process will be simple, smooth, safe and secure, but also cheaper and much, much faster than it is today with technology with roots in the Roman times!

A simple and secure process

1. At the origin, the carrier uses our dApp (distributed application) to create a blockchain-assisted Smart B/L with the exporter's address and sends it as a token to the exporter.
2. After receiving the money for the goods from the importer, the exporter transfers ownership of the Smart B/L to the importer using our dApp.
3. The importer can claim ownership of the goods at the destination port by presenting the Smart B/L token to the carrier or **designated release agent** at the destination using our dApp.
4. At the destination, the carrier releases the goods to the importer once the importer proves ownership of the Smart B/L token.

All global-trade-sensitive information will be hidden from public view and only shown to the importer, the exporter and the issuer of the Smart B/L **and to the designated release agent at destination**; special care will be given to properly secure all information about multiple business interactions between the same peers.

What is needed for Smart B/L to thrive

To build the ecosystem and drive the market, the CargoX will create tools, initial rules and protocols to ease and incentivize the interactions between partners, to boost network growth and facilitate creation and exchange of Smart B/L by actively developing the following elements:

- **A governing body** comprised of industry leaders that will be responsible for the adoption of the standard in the industry and legislature.
- **CargoX B/L eXchange protocol (B/L X)** for exchange of Bill of Lading (B/L) documents.
- **CXO token** will serve as a protocol utility token, allow decentralized transfer of digital ownership claim and facilitate a payment method for logistics services.
- **Smart B/L dApp** is a web-based decentralized application allowing customers to interact with a Smart B/L digital document.
- **Smart L/C dApp** will allow deposit of money in accordance with smart contract and will be released when the buyer receives the goods. Banks and current L/C procedure such as escrows and payment intermediaries will become obsolete.
- **Smart Booking Module**—integrated at external shipping platforms (such as 45HC.com, etc.)

Gains

Revolutionary gains will be achieved through speeding up the process, as it will take minutes or at most hours, not days, to deliver the document in a safe and secure way.

There will be no intermediaries involved, and the document will be stored in a distributed and publicly

confirmed way, yet it will be encrypted so that its contents will only be available to the issuer and the recipient.

Reference

Medium.com/cargox

<https://medium.com/cargoxio/how-cargox-will-revolutionise-bill-of-lading-tech-e6cab367be9f>

1.10 Global Shipping Business Network

Project Name	Global Shipping Business Network
Underlying Technology	Blockchain
Location	-
Information Released	November 2018
Involved Parties	CMA CGM, Cosco, OOCL, Evergreen, Yang Ming, DP World, Hutchison Ports, PSA, Shanghai International Port, CargoSmart
Article	
<p>Yesterday's announcement that five shipping lines and four terminal operators are to form a consortium to develop a Global Shipping Business Network (GSBN) has raised more questions than it answered.</p> <p>GSBN will be a blockchain-enabled platform that will help digitize the industry, set standards and transform documentation flows, the companies said.</p> <p>The participants comprise Ocean Alliance members CMA CGM, Cosco/ OOCL, Evergreen and interestingly THE alliance partner Yang Ming as well as DP World, Hutchison Ports, PSA and Shanghai International Port. The tech company is CargoSmart.</p> <p>The announcement immediately drew comparison with the Maersk/IBM effort, TradeLens, which has been criticized for alienating much-needed potential partners because of Maersk's heavy involvement.</p> <p>One port source on Twitter noted yesterday, "Can't help thinking that any line's proprietary blockchain solution is going to struggle with universal, or even widespread, acceptance."</p> <p>Stefan Kukman, CEO of blockchain specialist CargoX, said: "Of course we are glad to see distributed ledger technology gather interest in the market, and for companies to rely on it. However, seeing such initiatives, numerous questions arise. This obviously is not an independent platform, as it is created by the consortium of powerful runner-ups to the Maersk/IBM duo.</p> <p>"How will private data be handled? What processes will be covered in the platform? Will it be open to other services, such as the CargoX Smart B/L(TM), for example? Will it have vendor lock-in by default, or will it enable companies to take out their private data and process it in their own way?"</p> <p>He added, "If they are going to develop from scratch, such processes can take a long time, especially if specific private interests of the consortium members will need to be catered to."</p> <p>While CargoSmart failed to respond to The Loadstar, the press release confirmed that the platform would connect to other consortium networks.</p> <p>It also said it would develop a "digital baseline for standards – an industry-wide common, trusted and expansive</p>	

digital model provides a foundation for highly collaborative initiatives and market intelligence”.

However, further details are yet unclear. One fear is that with various consortia looking to develop industry standards, they may not end up being industry-wide.

At the Global Liner Shipping Conference in March, Peter Wolf, general manager Germany for CMA CGM, a member of the new platform, said the only realistic way forward was a digital solution in which five to seven of the biggest lines jointly developed a platform.

Moreover, Hapag-Lloyd chief Rolf Habben Jansen, which as part of THE Alliance has yet to join a digital platform, said at the conference that although the Maersk/ IBM platform could be good, it had to be industry-wide.

“This is the weakness we’re currently seeing in many of these initiatives, as each individual project claims to offer an industry platform that they themselves control. This is self-contradictory.”

Mr. Kukman warned, “This is about the digitalization of the industry as a whole. Service and solution providers who do not open their data models, processes, and data transaction technology to other participants in the market, might do more damage than good for the whole industry, and blockchain technology specifically.

“We hope the consortium will develop in the right direction, as everybody can benefit from that. Just imagine, big systems, such as CargoSmart, TradeLens and CargoX being interconnectable, to offer smooth collaboration.”

With THE Alliance member, Yang Ming involved in the new platform, one shipping observer noted, “This will add to chatter on the pressure for Evergreen to take Yang Ming under its wing.”

Reference

The Loadstar

<https://theloadstar.co.uk/shipping-lines-terminals-unveil-digital-global-shipping-business-network/>

2 Port Information Platform

2.1 SmartPort Logistics (Port of Hamburg)

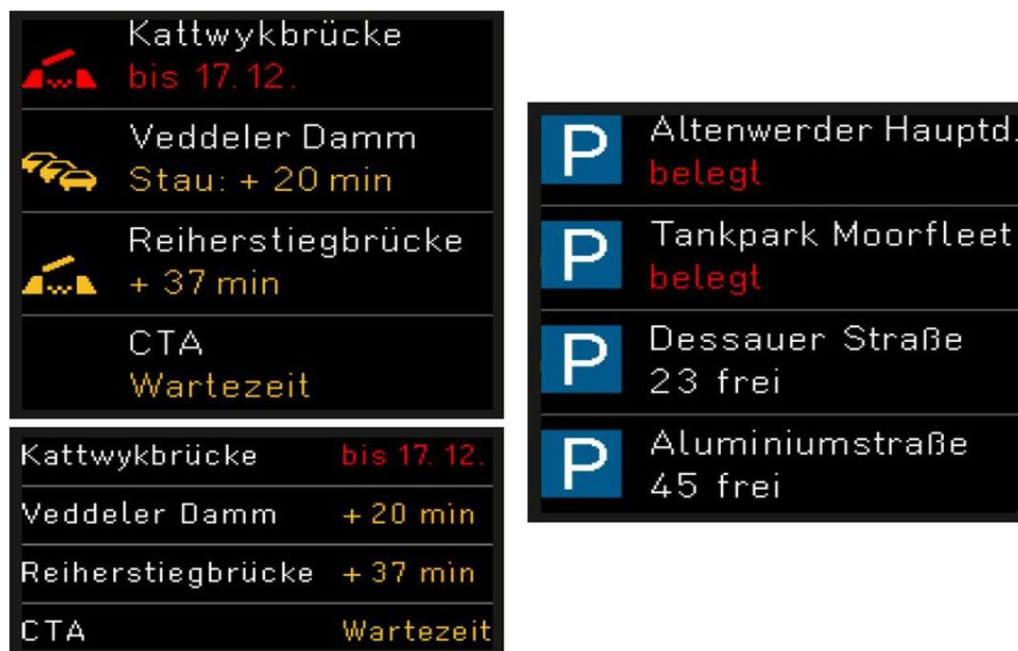
Project Name	SmartPort Logistics
Underlying Technology	Information Cloud Platform, mobile cloud
Location	Hamburg, Germany
Information Released	April 2016
Involved Parties	Hamburg Port Authority, SAP
Article	
<p>The Hamburg Port Authority (HPA) has engaged in the most impressive Internet of Things (IoT) project that the logistics industry has seen. Moreover, their work is not yet done.</p> <p>Sascha Westermann, the Head of ITS and Intermodal Traffic Management, spoke at SAPinsider on March 21st about HPA's progress to date and future plans.</p> <p>The Port of Hamburg is the second busiest container port in Europe, and is a key trade lane connecting Eastern Europe to Germany and the rest of the world. The HPA is in charge of providing efficient infrastructure in the port area: managing the real estate; making sure quay walls, bridges, wharves and other waterfront structures are maintained, maintaining 140 kilometers of roads and 130 bridges within the port area, and managing the traffic – across ocean, barge, rail, and truck – into and out of the port. Other parts of the infrastructure, like the 4 big container terminals, are managed by industrial companies.</p> <p>Over 9 million twenty-foot equivalent units (TEUs) are transported through the port every year, and this is forecast to double by 2025. However, the Hamburg Port is located in an urban area and they cannot increase the size of the port to handle increased traffic. To handle shipments efficiently, the HPA must operate smarter. Better traffic management also helps to minimize pollution. The port and city are impacted by up to 40,000 truck trips daily and no one wants those trucks spending a high amount of time idling.</p> <p>To help keep traffic flowing smoothly, the HPA worked with big companies like SAP on a series of 20 projects collectively called smartPort Logistics. This work began five years ago. The SAP HANA Cloud Platform was used to enable a real-time connection to the port's various stakeholders through a mobile business cloud. Those stakeholders include the HPA itself, shippers, trucking, rail, and ocean carriers, customs authorities, terminals, contract warehouses, parking providers, and other businesses across the port. Data for people, processes and things are then consolidated and analyzed using the SAP HANA Cloud Platform. The process data is based on an extended supply chain view that begins with a shipment from another port and can extend to inbound truck drivers hundreds of kilometers outside of Hamburg. Based on the analysis, HPA provides various types of schedules, tasks, and insights to the people who need it via their mobile devices.</p> <p>Under the banner of smartPort logistics, they have predictive and preventive maintenance capabilities. Mr. Westermann gave the example of a movable raise bridge that had a malfunction of a push button that raised and</p>	

lowered the bridge. A maintenance technician got an emergency alert, was able to use his mobile tablet to search for the part in the SAP maintenance application and requisition it, and was then able to drive to the site and replace the part before any of the port's customers even knew there was a problem. In some cases, maintenance can be based on sensor information. The Port Authority has sensors on their most intensely used rail switches, for example, and is experimenting with sensors that measure the structural strain and tension of a bridge.

Another smartPort application is known as the Port Monitor and is used for vessel traffic services (VTS). VTS is a marine traffic monitoring system similar to air traffic control for aircraft. VTS makes use of digital maps combined with AIS data on the positions of vessels, and data on sea levels, berths, whether bridges are closed or open, and where construction is occurring.

Just as there is a control room for managing waterborne traffic, there are control rooms used to manage traffic on the railways, and roads, as well as for managing the movable infrastructure. About 300 traffic sensors and 270 kilometers of fiber optics feed data into these control rooms. Eventually these separate control rooms will be merged into one virtual control room to increase synergies.

The road traffic control room also pulls various streams of data to predict travel time into terminals and suggests alternative routes when traffic is heavy. In addition to traffic sensors, data sources include the schedule for bridges being raised and lowered, the situation at the container terminals, and other sources as well. Truckers can view this data on their telematics devices.



Telematics Screen Shots

Trucks are not allowed to enter the container terminals unless they have an appointment for a slot. If they will be late for their appointment, they must see if they can get a new slot or whether they must exit the port and wait until a new slot can be booked. Once entering the yard, very often a truck will be directed to a marshalling area to park bumper to bumper until traffic eases. This prevents idling. Smart parking capabilities direct trucks

to lots with available space.

Smart traffic lights make sure a platoon of trucks get an extended green light through an intersection, while the smaller number of trucks on the cross street must wait. If pedestrians are crossing an intersection when the light is red, a safety-warning message is sent to the vehicle to let them know of the danger associated with trying to beat the light. HPA is experimenting with functionality that will automatically increase street lighting if pedestrians or cyclists are present; and video streams that help to predict potential traffic accidents, for example, if a vehicle is stopped even though there is no traffic jam.

In concluding the presentation, Mr. Westermann made a variety of points. Slot management is key to increasing efficiencies and reducing pollution, but it even works better with the ability to pull the wide variety of data sources together. These data sources have included information from competing stakeholders, and role-based visibility had to be constructed in a way that preserved privacy and competitive information while providing useful information to all stakeholders. Much work went into creating a simple user interface, but there have still been issues associated with getting truck drivers and other stakeholders to efficiently use the information that is available. Finally, the worse the traffic conditions, the higher the value this system provides.

Is this really the logistics industry's most impressive IoT project? Probably. It is certainly the most holistic use of data sources fed to a single platform for the purpose of increasing logistics efficiencies that ARC has ever come across.

Reference

Forbes/logistics&transportation

<https://www.forbes.com/sites/stevebanker/2016/04/01/the-hamburg-port-authoritys-impressive-iot-project/2/#539b407a647c>

Hamburg Port Authority

<https://www.hamburg-port-authority.de/en/hpa-360/smartport/>

2.2 5G mobile network (Port of Hamburg)

Project Name	Port of Hamburg Becomes a 5G Testing Ground
Underlying Technology	5G mobile networks
Location	Hamburg
Information Released	February 2018
Involved Parties	Hamburg Port Authority, Deutsche Telekom, Nokia
Article	
<p>Europe's third-largest container port has become the testing ground for 5G, the next generation mobile standard that is set to transform communications.</p> <p>After six months of preparation, Hamburg Port Authority (HPA), German telecommunications company Deutsche Telekom and communication and technology giant Nokia have launched a testbed that stretches across some 8,000 hectares of port area.</p> <p>The project has installed a base station, a central hub that allows connection to a network, on Hamburg's 150-metre-tall television tower.</p> <p>Port of Hamburg's testbed is set up to test 5G applications in an industrial environment.</p> <p>5G combines terrestrial and mobile networks to support a wide range of use cases that all have different speed, latency, security and capacity requirements.</p> <p>It will play an important role in new application scenarios created by the Internet of Things (IoT) and Industry 4.0, but telecommunications networks for industrial applications must be ultra-reliable and highly secure as well as support multiple use cases.</p> <p>Jens Meier, CEO of the HPA, said: "5G offers a level of security, reliability and speed that current mobile networks are unable to match. It provides the HPA with a wholly new set of application options.</p> <p>"The testbed allows us to study the future technology and co-shape the standard, which will not only benefit the port but the entire city of Hamburg."</p> <p>The application needs of the Port of Hamburg are diverse and the requirements on networks are particularly high as they co-ordinate applications such as port traffic lights and in the collection and processing of real time environmental data.</p> <p>Hamburg's 5G trial network divides into virtual networks — so-called network slices — customized to meet specific port application needs as each slice delivers greater network flexibility and supports the port's numerous and varied use cases.</p> <p>The Port of Hamburg will be the first location in Germany to test a network with several slices under real life</p>	

industrial conditions and will form part of the two-year 5G MoNArch research project.

This aims to put 5G mobile network architecture into practice by deploying 5G network slicing in real life test environments to help review and improve existing concepts.

While the testbed in Hamburg is primarily used to trial the integration of 5G into traffic and infrastructure management systems, the second testbed of the project in Turin focuses on multi-media applications.

As a 5G Infrastructure Public Private Partnership (5G-PPP) Phase II project, 5G MoNArch is co-funded by Horizon 2020, the European Union's Framework Programme for Research and Innovation.

Peter Merz, Head of End-to-End Mobile Network Solutions of Nokia Bell Labs, stated: "The 5G trial programme in the Port of Hamburg opens the door to a whole new world of business applications that have the potential to change a lot of sectors.

"The aim is to considerably speed up industrial processes and make them more flexible.

"We will test all that in Hamburg under real life conditions for the first time. The importance of the project simply cannot be overstated."

Reference

Port Technology

https://www.porttechnology.org/news/port_of_hamburg_becomes_5g_testing_ground

2.3 Maritime shipping data platform pilot (Port of Los Angeles)

Project Name	Maritime shipping data platform pilot
Underlying Technology	Information Integration
Location	Los Angeles, USA
Information Released	August 2017
Involved Parties	Port of Los Angeles, GE transportation
Article	
<p>PORT OF LOS ANGELES AND GE TRANSPORTATION BUILD ON EARLY SUCCESS OF PILOT WITH COMMERCIAL AGREEMENTS WORTH UP TO \$12 MILLION</p> <p>Teams scale digital pilot, adding terminals and shipping lines throughout Port to help goods move more efficiently through America's largest container port</p> <p>LOS ANGELES, Aug. 21, 2017 - (NYSE:GE) - Less than a year since launching a first-of-its kind digital solution to keep cargo flowing efficiently through America's largest container port, the Port of Los Angeles and GE Transportation are expanding the program to include all container terminals and shipping lines at the Port.</p> <p>Because of the pilot's success, the Port of Los Angeles and GE Transportation have agreed to new commercial agreements worth up to nearly \$12 million and extended their relationship for at least five years. The agreements, subject to review by the Los Angeles City Council, will be far reaching, supporting approximately nine million TEUs (20-foot shipping containers), more than 15,000 truck providers and thousands of cargo importers.</p> <p>"With our container volumes at record highs, the GE digital shipping solution is critical to our future success," said Gene Seroke, executive director of the Port of Los Angeles. "The GE portal is an investment in the long-term growth of the Port of Los Angeles and tells our stakeholders and customers that we take seriously our responsibility to find new ways to drive efficiencies and optimization. We believe this project will not only move the needle but could be a game changer."</p> <p>Based on the initial pilot results, the Port of Los Angeles anticipates efficiency gains of between eight and 12 percent as the enhanced solution is rolled out across the Port.</p> <p>To inform the next phase of the collaboration, the Port of Los Angeles and GE Transportation surveyed users involved in the initial pilot. Results were overwhelmingly positive with most respondents agreeing the data in the portal is easy to understand and easy to access.</p> <p>"This project has been a home run," said John Ochs, senior director at APM Terminals, the site of the pilot project. "The Port of Los Angeles has transformed data into information that can be utilized by stakeholders to optimize their goods movement processes."</p> <p>"The Port of Los Angeles and GE Transportation have become the global leaders on trying to digitize the supply</p>	

chain and bring efficiencies to the maritime industry,” said Weston LaBar, executive director of the Harbor Trucking Association. “A trucking dispatcher may visit up to 40 websites a day just to coordinate cargo movement into the port complex. Having a single portal, a single reference point, will create new levels of efficiency that we’ve been seeking for a long time.”

The survey also uncovered areas for improvement. For example, users said they would like to see more terminals and shipping lines integrated into the solution, which is reflected in the new commercial agreement. Additional areas for progression include improving the level of detail users can access about each shipment, and increasing their access to shipment data across the supply chain.

“The initial results of the pilot are resonating with partners and providing an opportunity for us to collaborate on expanding the work. It’s a major step toward exploring how a system like this could be developed and implemented for other ports in the U.S. and abroad,” said Jamie Miller, president and CEO at GE Transportation. “This is a game changing effort for business, the economy, investors and consumers.”

About GE Transportation

At GE Transportation, we are in the business of realizing potential. We are a global technology leader and supplier of equipment, services and solutions to the rail, mining, marine, stationary power and drilling industries. Our innovations help customers deliver goods and services with greater speed and savings using our advanced manufacturing techniques and connected machines. Our digital solutions , which provide data-driven insights to improve efficiency, utilize Predix – GE’s cloud-based operating system for the Industrial Internet. Established more than a century ago, GE Transportation is a division of the General Electric Company that began as a pioneer in passenger and freight locomotives. That innovative spirit still drives GE Transportation today and is strengthened by our ability to serve customers more holistically through the GE Store – a global exchange of knowledge, technology and tools across all GE businesses that ultimately provides better outcomes for customers. GE Transportation is headquartered in Chicago, IL, and employs approximately 10,000 employees worldwide.

About the Port of Los Angeles

The Port of Los Angeles, America’s Port® and the premier gateway for international commerce, is located in San Pedro Bay, 25 miles south of downtown Los Angeles. This thriving seaport not only sustains its competitive edge with record-setting cargo operations, but is also known for groundbreaking environmental initiatives, progressive security measures, and diverse recreational and educational facilities. The Port of Los Angeles encompasses 7,500 acres of land and water along 43 miles of waterfront. It features 27 passenger and cargo terminals, including automobile, breakbulk, container, dry and liquid bulk, multi-use, and warehouse facilities that handle billions of dollars’ worth of cargo each year.

Reference
Port of Los Angeles https://www.portoflosangeles.org/newsroom/2017_releases/news_082117_GE_POLA_Transportation.asp

2.4 PortMaps (Port of Rotterdam)

Project Name	PortMaps
Underlying Technology	Geographic Information System
Location	Rotterdam, Netherlands
Information Released	December 2015
Involved Parties	Port of Rotterdam
Article	
<p>Now online: the completely revamped Harbor Master Port Map</p> <p>From the Maasvlakte to beyond the Erasmus Bridge, it is incredibly busy every day. Apart from anything else, around 30,000 sea-going and 110,000 inland vessels a year have to find their way through all the winding waterways. An up-to-date port map is therefore not only essential for the vessels, but also for all the different parties in the port, if operations are to run efficiently. From now on, the Port Authority - with the brand new PortMaps system - has available a complete, current and clear online map of the port.</p> <p>Always on hand</p> <p>The interactive Harbor Master Port Map provides a clear overview of terminals, jetties, dolphins, berths and water depths, among other things. This map is supplemented daily with the most recent information and clarifies all relevant topographical and nautical information about the port. This is a great improvement on the guides, for example: the physical maps that used to be sent out and were more or less obsolete by the time the envelope was sealed. From now on, you can click and scroll easily through the map online and everyone always has the most recent information on hand.</p> <p>Updated automatically</p> <p>As manager and director of the port, it is extremely important for the Port of Rotterdam Authority that all users use the same port map, which is always up to date. With PortMaps, the Port Authority is putting into use a modern information system for storing, calculating and making visible geographic data. The Harbor Master Port Map will be updated automatically every day and is linked internally with systems such as ArcGIS, SAP and Sharepoint.</p> <p>Administrative task</p> <p>It took the necessary effort to bring all existing information together in one system; not surprisingly, it took the Port Authority a good eighteen months. Thanks to this major innovation drive, the Port Authority has managed to compile a port map that is ready for the future. From now on, there will always be one place where you can easily see where you need to be in the port.</p>	
Reference	
<p>Port of Rotterdam</p> <p>https://www.portofrotterdam.com/en/news-and-press-releases/now-online-the-completely-revamped-harbour-master-port-map</p>	

2.5 Digitalization of port's operational environment (Port of Rotterdam)

Project Name	Digitalization of port's operational environment
Underlying Technology	Information Cloud Platform, Sensors
Location	Rotterdam, Netherlands
Information Released	January 2018
Involved Parties	Port of Rotterdam, IBM, CISCO, Axians
Article	
<p>Port of Rotterdam teams with IBM Internet of Things to digitize operations</p> <p>The Port of Rotterdam Authority and IBM today announced their collaboration on a multi-year digitization initiative to transform the port's operational environment using Internet of Things (IoT) technologies in the cloud to benefit the port and those who use it. The initiative will also prepare the Port of Rotterdam's entire 42-kilometre site to host connected ships in the future. It begins with the development of a centralized dashboard application that will collect and process real-time water (hydro), weather (meteo) sensor data and communications data, analyzed through the IBM IoT platform. This will enable a new wave of safer and more efficient traffic management at the port.</p> <p>"Here in Rotterdam, we are taking action to become the smartest port in the world," says Paul Smits, chief financial officer of the Port of Rotterdam Authority. "Speed and efficiency is essential to our business, and requires us to use all of the data available to us. Thanks to real-time information about infrastructure, water, air, etc., we can enormously improve the service we provide to everyone who uses the port, and prepare to embrace the connected, autonomous shipping of the future."</p> <p>As the largest port in Europe, the Port of Rotterdam handles over 461 million tons of cargo and more than 140,000 vessels annually. Previously the port relied on traditional radio and radar communication between captains, pilots, terminal operators, tugboats and more to make key decision on port operations. Now, as the Port of Rotterdam begins its digital transformation, sensors are being installed across 42-kilometers of land and sea - spanning from the City of Rotterdam into the North Sea - along the Port's quay walls, mooring posts and roads. These sensors will gather multiple data streams including water (hydro) and weather (meteo) data about tides and currents, temperature, wind speed and direction, water levels, berth availability and visibility.</p> <p>This data will be analyzed by IBM's cloud-based IoT technologies and turned into information that the Port of Rotterdam can use to make decisions that reduce wait times, determine optimal times for ships to dock, load and unload, and enable more ships into the available space. For example, the Port of Rotterdam will now be able to predict the best time based on water level, to have a ship arrive and depart Rotterdam, ensuring that the maximum amount of cargo is loaded onboard.</p> <p>With the new initiative, Port of Rotterdam operators will also be able to view the operations of all the different parties at the same time, making that process more efficient. In fact, shipping companies and the port stand to</p>	

save up to one hour in berthing time, which can amount to about \$80,000 US dollars in savings.

The Port of Rotterdam's digital transformation project is enabled by IBM's cloud-based IoT technologies and will see the Port of Rotterdam and IBM are working together long-term to uncover other innovative applications of IoT and artificial intelligence. Cisco and Axians are also involved in the project.

Reference

Port of Rotterdam

<https://www.portofrotterdam.com/en/news-and-press-releases/port-of-rotterdam-teams-with-ibm-internet-of-things-to-digitize-operations>

2.6 Smart port (Port of Durban)

Project Name	Smart port
Underlying Technology	Information Cloud Platform, Drones, LTE (4G) network, Sensors
Location	Durban, South Africa
Information Released	March 2017
Involved Parties	Transnet National Port Authority, T-Systems, Huawei
Article	
<p>Drones and LTE: Port of Durban goes "smart"</p> <p>Mar 9, 2017</p> <p>T-Systems has successfully secured the first phase of an innovative Smart Ports initiative with the South African Transnet National Port Authority. The deal aims at increasing the port throughput and decreasing congestion at the Port of Durban using different types of drone, tracking and sensor technology.</p> <p>Smart port and smart city: T-Systems is digitizing the port of Durban</p> <p>The Port of Durban is South Africa's premier multi-cargo port and is counted among the busiest ports in Africa. Handling over 80 million tons of cargo per annum, the port struggles with several challenges including growing container turnover, leading to port congestions and long waiting hours for vehicles entering the port area. Ristha Joga, ICT manager Transnet: "We were looking for an automated overview on all operations in the port. T-Systems – together with its partners – was offering a solution that would bring all data into one single control center."</p> <p>The port solution entails the deployment of LTE networks and telematic solutions such as drone, tracking and sensor technology to improve the overall operations. These technologies are integrated with systems that allow for real time monitoring and availability of information through dashboards powered by SAP HANA, thus simplifying decision making. T-Systems is the Prime Contractor and is delivering the SAP HANA and Business Intelligence (BI) components. The drones and telematics technology is delivered by LOTS Projects and the Wireless communication network infrastructure is provided by Huawei.</p> <p>Use case convinces customer</p> <p>The signing of the deal was preceded by a Proof of Concept (PoC) phase, which laid the basis for winning Transnet's trust to improve port efficiencies. Ronald Salis, Deal Executive T-Systems: "The goal of the PoC was to develop an Operations Control Nerve Centre that allows the customer to streamline its operations and embed real-time data analytics into its business processes. It also enables the port to manage and allocate port resources through the real-time integration and alignment of port events and activities." The PoC was conducted in two phases. Phase one focused on testing the network connectivity and data integration of all in-scope interfaces and technologies into an on-premise SAP HANA Database. In phase two, the team developed the BI data analytics, customer interfaces or digital applications to ensure real time monitoring and intelligent reporting of the port's operations. During the three months period, 18 different use cases were tested on several types of</p>	

drones, tracking and sensor technologies to guarantee that the LTE wireless network is performing well.

Innovative drone technology to facilitate communication

The deployment of drones will also enable the port to automate several functions such as monitoring the port area, locating and inspect the buoys' position or walls of the port or the hull of ships in the harbor. Drones may also facilitate the communication between the port and the ships and even support the captains in bringing their ships safely into the harbor.

The upcoming seven months will now show whether the Smart Port project might serve as a blueprint for other ports around the world. A successful delivery of the first project phase will pave the way for subsequent rollouts to other ports and will involve additional use cases.

Reference

T Systems

<https://www.t-systems.com/de/en/about-t-systems/company/newsroom/news/news/smart-port-city-590512>

3 Supply Chain Management

3.1 Logistics Visualization Service (India)

Project Name	Joint venture to provide logistics visualization service
Underlying Technology	RFID, Information Cloud Platform
Location	India
Information Released	April 2016
Involved Parties	DMIC Trust, NEC
Article	
<p>NEC and DMIC Trust establish joint venture to provide logistics visualization services in India</p> <p>Tokyo, Japan - April 27, 2016 - NEC Corporation (NEC; TSE: 6701) and the DMIC Trust have established a joint venture company, DMICDC Logistics Data Services Limited, for providing logistics visualization services in India. NEC and DMIC Trust will each hold 50% of the joint venture's total capital of approximately 80 million Indian Rupees (INR).</p> <p>This is the first commercial project to originate from the Smart Community initiatives of the Delhi Mumbai Industrial Corridor, which is being promoted jointly by the Indian and Japanese governments. Since 2010, the Japanese Ministry of Economy, Trade and Industry (METI) has played a key role in helping NEC and DMIC Trust to establish this new company.</p> <p>The new company will provide shippers and transport operators with logistics visualization services, enabling them to perform real-time searches based on accurate positional information, showing the location of containers being transported by rail or road between Delhi and Mumbai. This will make significant contributions to shortening shipping lead times, reducing inventory levels and improving the accuracy of production plans.</p> <p>To provide these services, the new company will affix RFID tags to shipping containers being loaded and unloaded at ports in Mumbai. It will also install RFID reader/writers at locations such as port entrances and exits, toll plazas on the expressway between Delhi and Mumbai, and inland container depots where customs inspections are carried out and cargo reloaded. Positional information obtained by RFID reader/writers will then be gathered in real time via a cloud-based logistics visualization system. There are plans to link up the logistics visualization system with rail transit management systems, port management systems and other existing systems in the future, in order to gather information such as freight train running times and container management status at the port.</p> <p>"Development of logistics infrastructure in India is struggling to keep pace with the country's rapid economic growth, causing issues such as longer shipping lead times and delays, and difficulties checking progress with goods in transit," said Hiroshi Hashimoto, General Manager, Transportation and Logistics Solutions Division, NEC Corporation. "We are aiming to establish advanced logistics infrastructure in India through this new company, in order to contribute to the country's economic development and to the Indian government's key</p>	

economic policy 'Make in India'."

"This project will enable quicker decision making that improves competitiveness of logistics and manufacturing industries in India, and also will provide better governance and complete transparent and visible management for performance evaluation of ports, inland container depots and truckers," said Alkesh Sharma, Chief Executive Officer and Managing Director, DMICDC (*) and Chief Executive Officer, DMIC Trust.

The new company will utilize NEC's "Logistics Visualization System" to develop and operate the necessary platforms to provide the logistics visualization services.

NEC's Logistics Visualization System belongs to the lineup of NEC Global Enterprise Solutions, NEC's portfolio of continually upgraded and expanded solutions and services offered globally to enterprise customers in retail, distribution, manufacturing and other fields. NEC plans to build on experience and expertise from its initiatives in India to provide a range of solutions and services designed to help develop more advanced logistics infrastructure in the future, focusing particularly on Asian countries.

(*) DMICDC: Delhi Mumbai Industrial Corridor Development Corporation Limited

Reference

NEC

https://www.nec.com/en/press/201604/global_20160427_01.html

4 Initiative on IoT development

4.1 Smart Port Challenge (Singapore)

Project Name	Smart Port Challenge
Underlying Technology	Blockchain, Digitization, Augmented reality, etc.
Location	Singapore
Information Released	September 2017
Involved Parties	Maritime and Port Authority of Singapore
Article	
Shortlisted start-ups pitch ideas at Smart Port Challenge Demo Day	
<p>SINGAPORE - A total of 12 start-ups pitched proposals to tackle challenges facing the maritime industry at the Smart Port Challenge Demo Day on Thursday (Sept 28).</p> <p>Some included technologies such as augmented and virtual reality to simulate safe and realistic training in a port environment for quay crane operations and container lashings.</p> <p>One proposal had an intelligent chatbot with learning capability to enhance customer service for ferry customers. Another harnessed the use of blockchain to digitize shipping documents in the sea transport logistics supply chain.</p> <p>These basic workable prototypes can be further developed beyond the event, said MPA in a statement.</p> <p>The Smart Port Challenge, organized by the Maritime and Port Authority of Singapore (MPA), was launched in June this year.</p> <p>In all, the initiative received 81 proposals, from which the final 12 were eventually shortlisted.</p> <p>The top winner of Demo Day was Gleematic, which used automation to help ships meet regulatory clearance. It won S\$5,000 in cash.</p> <p>The second-prize winner was T-Mining, which aimed to increase visibility of the maritime logistic supply chain data from ships, cargo and containers to improve efficiency of global operations.</p> <p>Third was XjeraLabs, which looked at ensuring the safety of port users in an automated and heavily industrial environment.</p> <p>All 12 start-ups are eligible to apply for funding support of up to S\$50,000 to develop fully functional solutions with opportunities to test-bed their product with MPA's industry partners.</p> <p>They can also look forward to funding support from other venture capitalists or apply for MPA's Maritime Innovation and Technology fund to further their research and development of the project.</p>	

"The various prototypes demonstrate how we can leverage novel technologies for practical applications in the industry, helping to improve productivity, streamline operations, and save costs. Through such platforms, we hope to attract more start-ups to the maritime sector in future runs," said MPA chief executive Andrew Tan.

He added that MPA would also be exploring potential collaboration with other accelerator programs to boost efforts to promote innovation in the maritime sector.

Reference

The Straits Times

<http://www.straitstimes.com/business/shortlisted-start-ups-pitch-ideas-at-smart-port-challenge-demo-day>

4.2 Blockchain technology field lab (Rotterdam)

Project Name	BlockLab
Underlying Technology	Blockchain
Location	Rotterdam, Netherlands
Information Released	September 2017
Involved Parties	Municipality of Rotterdam, Port of Rotterdam
Article	
<p>Port Authority and Municipality of Rotterdam launch blockchain technology field lab</p> <p>The Municipality of Rotterdam and the Port of Rotterdam Authority are jointly launching a field lab today for the development of concrete applications and solutions based on blockchain technology. The new applied research lab has been christened 'BlockLab'.</p> <p>BlockLab is an initiative of the Port of Rotterdam Authority and the Municipality of Rotterdam, who will also be financing the project. In addition, the lab is supported by the regional development corporation InnovationQuarter. The field lab will be jointly opened by Port Authority President and CEO Allard Castelein, Rotterdam's Deputy Mayor for Economic Affairs Maarten Struijvenberg and the Director of Innovation Quarter, Rinke Zonneveld. During the event, the partners will not only be presenting the lab's team and ambitions, but also the first practical applications of its research, which were developed during the start-up phase.</p> <p>Transactions without an intermediary</p> <p>Blockchain is seen as one of the most crucial fields of innovation today. The basic idea behind the technology is that users can conduct transactions without involving a third party. Data technology guarantees the necessary checks and balances and ensures that the transaction is processed automatically. This makes it possible to structure large-scale networks, chains and markets far more efficiently than before – without the need for a dominant, regulating party. The technology can be used by companies, individuals and even machines. For example, blockchain is the underlying technology for the cryptocurrency bitcoin.</p> <p>Next economy</p> <p>"There's this huge buzz about 'blockchain', but actually, there aren't that many fully functional applications," says Struijvenberg. "We'll be changing this with BlockLab. This is important, because we need real innovations to launch the next economy. And blockchain can help us realize them."</p> <p>Energy transition</p> <p>For example, blockchain allows users to set up a finely meshed decentralized power network, in which companies can trade residual heat and city dwellers can trade electricity. This gives new impetus to the energy transition in the port and the city.</p> <p>Cargo flows</p>	

“This alone makes it very interesting to us,” adds Castelein. “But I’m also thinking of the numerous applications that can be realized within logistics chains thanks to blockchain, allowing us to organize cargo flows more efficiently. This step is seamlessly in line with our ‘smartest port’ ambitions.”

Port logistics stock financing

One of the first concrete projects to be presented during the official opening is a blockchain application for stock financing in the port logistics sector, which was developed in partnership with Exact and ABN AMRO. In addition, it will be announced which innovation partners have been awarded funding for the development of blockchain applications for the energy sector.

Team and implementation

The BlockLab will be starting with a core team of five, who work from the Cambridge Innovation Center in Rotterdam. In the field lab, theoretical blockchain ideas are developed, tested and worked out into concrete opportunities in a real-world environment, together with consortia of developers and users. In addition, the lab will serve as a knowledge centre for the regional private sector. The team will be working together with Rotterdam University of Applied Sciences to develop a curriculum intended to marshal the influx of talented new blockchain researchers.

Reference

Port of Rotterdam

<https://www.portofrotterdam.com/en/news-and-press-releases/port-authority-and-municipality-of-rotterdam-launch-blockchain-technology>

5 Container Monitoring

5.1 Remote Container Management (Maersk, Ericsson)

Project Name	Remote Container Management
Underlying Technology	GPS, 3G, GSM (Global System for Mobile)
Location	-
Information Released	November 2016
Involved Parties	Maersk, Ericsson
Article	
Maersk and Ericsson collaborate for IoT success story	
Maersk Line, the world’s largest shipping company, has developed global IoT solutions with Ericsson that are making waves in the ocean cargo transport industry.	
Maersk Line’s shipping containers are a common sight in ports around the world; the company operates in 343	

ports across 121 countries. Back in 2012, the Danish giant teamed up with Ericsson to install real-time monitoring across its fleet with Ericsson's mobile and satellite communication technology. Since then, the collaboration has gone beyond information about vessel operation, fuel consumption and electric conditions.

IoT is keeping Maersk cool

Maersk has around 300,000 refrigerated containers transporting fresh produce that needs to be kept chilled or frozen throughout its journey. Clearly, this is a logistical challenge of significant proportions, with many ships operating far out to sea and isolated from technical support in the event of a power failure.

Ericsson's technology has allowed Maersk's fleet of 'reefers' to transmit vital statistics via satellite, such as temperature, location and power supply. This information is loaded onto the cloud and analyzed back in the central office.

The Remote Container Management (RCM) system relies on three components: a GPS unit to track the ship's whereabouts, a 3G SIM card capable of operating at high temperatures, and a GSM antenna.

IoT improving safety, efficiency and cargo care

Speaking exclusively to Internet of Business today, head of RCM at Maersk Line, Catja H. Rasmussen, outlined the ways that the Internet of Things (IoT) is helping to solve the problems Maersk faces with refrigerated shipments on a daily basis.

"Since we launched RCM in 2015 we have generated significant operational savings, matured our internal processes and gained operational experience in handling the data," she said.

As well as offering real-time information as issues develop, the collaboration with Ericsson has also led to increased safety for port staff, as containers now require less manual inspection.

"Before RCM, all containers would go through extensive and costly pre-trip inspections (PTI) prior to release for export. These inspections would be performed whether actually required or not. We are now using the data made available through RCM to constantly analyze the running condition of the reefer and compare this with the expected condition."

"At the end of each trip, RCM indicates the condition of the reefer – determining the type of inspection required prior to release for the next customer. If the reefer is running as expected, we now perform a quick visual inspection prior to release. Currently close to 60 percent of reefers only require visual inspection after a trip. This means reduced costs, faster turn times, better resource utilization and reduced CO2 emissions."

However, getting to this point has not been easy. "Installing RCM devices on more than 270,000 reefers in constant motion around the world (installments are done during port stays – every year Maersk Line makes 46,000 port calls in 343 ports in 121 countries) is no easy task," says Rasmussen. "Neither is structuring and operationalizing the huge amount of data they generate. We have a 5-year journey behind us. It provided a great

deal of experience that we can leverage to build superior products.”

New opportunities emerging from Maersk’s IoT system

Rasmussen also points to the notion that RCM technology can be used to actively spot trends and catch faults before they happen, offering more than reactive support.

If we analyze the RCM data and combine with other in-house data, new opportunities emerge – e.g. preventative maintenance; preventative claim handling; and helping our customers avoid cargo damage,” she said. “A good example is a pilot we did, using the RCM technology to monitor the set point temperature of our reefers. If these temperatures deviate from the predefined thresholds in the system, we can determine from knowing the given commodity inside the extent of the problem and what action is required to avoid damage to the cargo from correcting the set points.”

“A good example is a pilot we did, using the RCM technology to monitor the set point temperature of our reefers. If these temperatures deviate from the predefined thresholds in the system, we can determine from knowing the given commodity inside the extent of the problem and what action is required to avoid damage to the cargo from correcting the set points.”

“Over 15 weeks, we were able to intervene in 180 instances. So, for 180 reefers we have been able to remotely change the set points to avoid what would likely have been a claim at a later stage.”

A reefer container can hold vast amounts of produce – around 100,000 bananas according to Rasmussen. That’s a lot of potential for moldy fruit

Reference

Internet of business

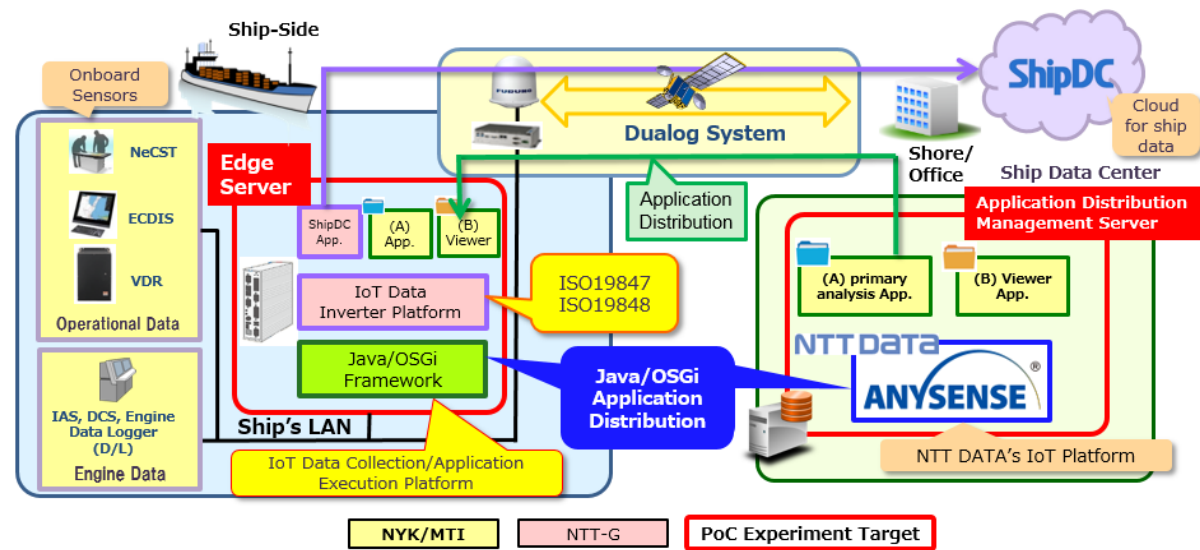
<https://internetofbusiness.com/maersk-ericsson-iot-success/>

6 Onboard IoT platform

6.1 Onboard IoT Platform (NYK Group)

Project Name	Onboard IoT platform
Underlying Technology	Ship Information Management System,
Location	Japan
Information Released	February 2018
Involved Parties	NYK, MTI, NTT
Article	
<p>Joint Test of Next Generation Onboard IoT Platform Conducted</p> <p>Nippon Yusen Kabushiki Kaisha (NYK), MTI Co. Ltd., Nippon Telegraph and Telephone Corporation (NTT), and NTT DATA Corporation have successfully conducted a proof-of-concept experiment for a next-generation onboard IoT platform. The test was held aboard Hidaka, a domestic coastal vessel owned and operated by Kinkai Yusen Kaisha Ltd. of NYK Group.</p> <p>The NYK Group (NYK and MTI) previously developed a ship information management system (SIMS) that enables the gathering, monitoring, and sharing of detailed data between ship and shore, with the aim to promote safe, efficient operations. The data includes information on the operational condition and performance of oceangoing vessels.</p> <p>From last September, the four companies began a collaboration to make use of NTT edge-computing technology to develop a next-generation onboard IoT platform by adding to SIMS a new system that would enable the remote distribution and management of onboard applications from land offices. This experiment was conducted using NTT DATA's ANYSENSE IoT platform and the communication company's expertise developing infrastructure that makes use of IoT solutions.</p> <p>This platform is also compliant with onboard IoT international standardization being devised by the Japan Ship Machinery and Equipment Association. In addition, the gathered data can be utilized not only on board but also from an IoT open platform ShipDC, a ship data center established by Nippon Kaiji Kyokai (Class NK).</p> <p>The four companies performing this test will next conduct a proof-of-concept experiment on an oceangoing vessel operated by the NYK Group, and continue to create innovation in the maritime industry to improve safety and the efficiency of vessel operations, and promote environmental initiatives and global competitiveness.</p> <p>*ANYSENSE</p> <p>An IoT platform service of NTT DATA with the further developing IoT technology for mainly social infrastructure.</p>	

-Image of Next Platform Onboard



Reference

NYK

http://www.nyk.com/english/news/2018/1190020_1687.html

7 Smart Lighting

7.1 Dynamic real-time lighting (Valencia)

Project Name	Dynamic real-time lighting system for port terminals
Underlying Technology	Dynamic lighting
Location	Valencia, Spain
Information Released	July 2015
Involved Parties	Noatum Container Terminal
Article	
<p>The SEA TERMINALS project designs a dynamic real-time lighting system for port terminals</p> <ul style="list-style-type: none"> ● The pilot, which was developed by engineering company Ingeniería de Aplicaciones Energeticas SLU, will be tested at the Noatum Container Terminal Valencia from September to November ● Estimated energy savings forecasted for this period is 8 times the current consumption levels at Noatum Container Terminal Valencia <p>30 July 2015. In the European SEA TERMINALS project, spearheaded by the Valenciaport Foundation and with the participation of the Port Authority of Valencia, Noatum and Ingeniería de Aplicaciones Energéticas SLU (EDAE), the latter developed a Dynamic Lighting System that allows container port terminals to better manage and reduce energy consumption of lighting in an intelligent and efficient way. The system, which will be tested at the Noatum Container Terminal Valencia from September to November, will mean savings of up to 8 times the current energy consumption at the terminal for the estimated period.</p> <p>The Dynamic Lighting System includes LED luminaires and a software that manages the lighting needs and can reduce the lighting levels by a third as long as there are no operational activities going on in the areas overseen by the lighting towers. In addition, the system automatically adapts the lighting conditions during the hours of daybreak and dusk so that there are no abrupt changes to the lighting levels at the container port terminal.</p> <p>The objectives of this prototype are, on the one hand, to improve the management and reduce energy consumption for lighting at the terminal, (with a subsequent fall in associated greenhouse gas emissions). Furthermore, the system is expected to operate remotely and in real time, adapting the lighting needs using a user-friendly interface that facilitates decision making by terminal staff.</p> <p>The pilot project is expected to improve the efficiency and the quality of lighting conditions during nighttime operations at the port container terminal, minimizing energy consumption. This is made possible by reducing the levels of lighting to adapt them to the operations in question and natural lighting, using operational and service alarms to ensure the real-time functioning of each individual luminaire.</p> <p>The prototype will be connected to the groundbreaking Operational Management System, developed by</p>	

Noatum, Amplía Soluciones and the Valenciaport Foundation within the framework of the SEAMS Platform project.

The SEAMS Platform prototype will comprehensively monitor the Noatum terminal in Valencia generating real-time key performance indicators (KPIs). This facilitates better operational planning while also improving energy efficiency by reducing fuel and energy consumption because of identifying operational bottlenecks. Furthermore, the reductions in greenhouse gas emissions can be quantified depending on whether the equipment is operating in normal operating mode or in ECO mode (limited speed and power).

At the end of November, a public demonstration is scheduled at the Noatum Container Terminal Valencia as well as a presentation of the results of the six pilot tests that were carried out at the terminal (in addition to the Dynamic Illumination System mentioned earlier and the real-time Operational Management System (SEAMS Platform). Noatum will present to the international port industry the three machine prototypes: a 100% electric terminal tractor, developed by Terberg; a Reach Stacker and a forklift for empty containers, both equipped with fuel saving and CO2 emission reduction systems, developed by Hyster; and a new hybrid generator for RTG cranes based on super-capacitor storage technology. At the event, attendees will be able to see these eco-efficient systems for themselves in a real-world environment.

SEA TERMINALS Project

The aim of this particular project, which is financed by the European Commission's Ten-T Programme, is to fast-track the transition of the port industry towards more efficient operational models, incorporating the energy variable as a key improvement factor in Port Container Terminals (PCTs).

The guiding principles behind the SEA TERMINALS project come from the lessons learned in the GREENCRANES project, the results of which showed that the efficient management of energy consumption and the use of alternative fuels is viable and generates major benefits at all levels of the PCTs.

The SEA TERMINALS project partners are the Valenciaport Foundation (coordinator), the Port Authority of Valencia; Noatum; Amplía Soluciones, S.L.; Ingeniería de Aplicaciones Energéticas SLU, (EDAE); Technological Institute of Energy – ITE; NACCO Materials Handling BV; Terberg Benschop B.V.; Italian Ministry of Transport - MIT and Baltic Ports Organization. Also participating in the project as MIT collaborating partners are: the Port Authority of Livorno, Global Service, Scuola Superiore Sant'Anna (PERCRO) and OLT Offshore LNG Toscana S.p.A.



LED Luminaires installed at Noatum Container Terminal Valencia

Reference

Valenciaport Foundation

<http://www.fundacion.valenciaport.com/Schedule-news/News/El-proyecto-SEA-TERMINALS-disena-un-sistema-de-ilu.aspx?lang=en-US>

8 Equipment Monitoring

8.1 Equipment Monitoring (Port of Cartagena)

Project Name	Equipment Monitoring
Underlying Technology	Sensors, Data cloud
Location	Cartagena, Colombia
Information Released	August 2016
Involved Parties	Port of Cartagena, IBM
Article	
<p>How IoT analytics at the edge keeps shipping lines moving</p> <p>At the Port of Cartagena, time is always a factor – we are operational 24 hours a day without stopping. Strategically located as an entry point to the Panama Canal, the Port of Cartagena is one of the busiest ports in the Americas, shipping goods to almost 600 ports in 136 countries and handling over 40 million tons of cargo per year.</p> <p>With a recent expansion, our canal has doubled cargo capacity to ships with more than 14,000 containers, which inspired us to evaluate our processes, technologies and equipment. We determined that new technology could improve our existing equipment monitoring and alleviate costly downtime delays.</p> <p>The value of data changes over time</p> <p>Through the years, we have monitored engine temperature, engine speed, and run hours, which improved efficiency and lowered maintenance costs. While a historical view of our business assisted in decision making, we believe that further digitizing our business to capture data in real-time gives us the ability to immediately act on our data to keep our port continuously operational. To combine instant and historical views of our operations, we turned to IBM and Cisco for immediate insight into the health of our equipment locally at the edge, and our overall operations in the cloud for further, later analysis. Now analytics are performed closer to the point of collection, helping us deeply understand and act on critical data both in the moment and over time, resulting in better insights, reduced costs and increased control. The Cisco and IBM solution allows us to forecast equipment failures and keep our machines running effectively by ensuring we get ahead of equipment degradation with needed maintenance.</p>	
Reference	
<p>IBM</p> <p>https://www.ibm.com/blogs/internet-of-things/iot-shipping-lines/</p>	

8.2 Equipment Monitoring (CHS engineering)

Project Name	Equipment Monitoring
Underlying Technology	Sensors, Mobile network,
Location	London, UK
Information Released	July 2017
Involved Parties	CHS Engineering Services, DP World
Article	
<p>Alex Hughes finds out if improved remote monitoring tools are making redundancy redundant</p> <p>As technology has advanced, port terminal equipment manufacturers have been able to convince their clients that quay cranes and yard machinery benefit tremendously from the incorporation of varying degrees of redundancy. They do so arguing that if vital parts and components fails, there is always back-up in place to ensure that the particular handling equipment can continue to function.</p> <p>Other manufacturers have taken a different route entirely, suggesting that only by investing in expensive top-end engineering can they be sure that their gantry crane or pneumatic unloader will not break down when it can least afford to.</p> <p>The most worrying aspect of either approach is that a premium has to be charged. Redundancy equals duplication of equipment or systems, while opting for top-of-the-range components automatically means higher capital investment.</p> <p>Yet these two differing approaches may well have had their day.</p> <p>The dramatic fall in price of technology suggests that a third approach is now possible: remove high levels of redundancy and replace them instead with remote monitoring equipment that has the ability to detect anomalies that suggest a problem is developing.</p> <p>Such an approach is already becoming commonplace in many industries and, crucially, could bring down equipment prices by taking away redundant redundancy.</p> <p>CHS Engineering Services Ltd, for example, is currently monitoring the performance of quay cranes at DP World's London Gateway terminal on the River Thames. Chief operating officer Giles Price notes that this involves fixing one of the company's mobile-phone sized Foundations Connect Hubs to the crane and connecting that to a power supply. An array of sensors is then attached to this device, which monitors three variables: temperature, vibration and humidity. Using a SIM card embedded within the hub, information is sent directly to the Foundations Connect cloud platform. This is analyzed in real time and the results made available live to the client online and via SMS, Email and status dashboards.</p> <p>In the past, this type of activity was done manually on site, but by turning to using cloud-based technology,</p>	

CHS can cut costs by up to 40%.

According to Mr. Price: “By constantly checking vibration, temperature and humidity, CHS is looking to both spot trends and, crucially, any changes compared to historical data. A drop in temperature, a rise in humidity, or increased vibration, might indicate that components in a machine are failing, or that the ambient conditions around the system are causing problems and that this could have a negative operational impact,” he says.

However, first thresholds have to be set. If these are breached, an alarm is sent to the client. If no action is then taken to bring the variable back into a normal range, a second alarm is sent.

Pricing leaps

“The technology for doing this type of monitoring existed ten years ago, although was prohibitively priced. Prices have subsequently fallen and now any equipment operator can make a financial case for adopting such monitoring. At CHS, we believe that this will enable any crane operator to generate a return on investment within a year,” says Mr. Price.

Both temperature and humidity sensors are now extremely affordable, he adds, while even vibration sensors can no longer be regarded as prohibitively expensive.

“Depending on what is being monitored, we might need just one or two sensors, or eight or nine if it is a more complicated item,” he says.

Asked how customers can save money, he says that CHS monitoring equipment has already prevented major bearing failures. Added to which, comparing current performance against historical data can rapidly identify anomalies.

“If we know how a bearing normally behaves, we can spot, for example, additional vibration building up around it, perhaps suggesting that something is amiss and requires investigation,” he says.

Significantly, CHS can build up a knowledge bank of different types of equipment – perhaps similar bearings provided by a different supplier – and determine which performs best in various quay crane applications. This means the company can help customers plan maintenance strategies and decide when to choose best operational downtime.

“By being able to provide better independent information on performance and reliability of equipment could eventually result in less redundancy having to be built into equipment, since a lot of redundancy is there to cope with unpredicted failures. Through better monitoring, significant capital benefits can accrue while also improving the lifecycle of equipment. So, instead of providing 10%-20% redundancy, manufacturers might feel happier with just 5%,” says Mr. Price.

He also stresses that, being an independent provider of monitoring equipment, crane operators know that

information on crane performance is secure when passing through the CHS IoT powered system.

“We have no client versus supplier confidentiality issues. There is no conflict of interest,” he stresses.

Redundancy needs

In respect of how much redundancy cranes need to ensure that they do not often fail in operation, Thomas Jähnig, Liebherr’s marketing manager for maritime cranes, notes that company focus has always been on maintaining high levels of availability, which results in both reduced acquisition cost and maintenance costs.

“Redundancy does not increase either availability or safety, since the crane would be heavier and more expensive. Nevertheless, we do incorporate redundancy systems, but this is to bring our cranes in line with current legislation, above all where safety systems are concerned,” he says.

As to how much redundancy adds to the overall cost of units, Mr. Jähnig says that this is harder to define, because it very much depends on the system development process. “In terms of additional weight that redundancy adds to the crane, this is also hard to define for exactly the same reasons,” he says.

Rather than incorporate high levels of redundancy, Liebherr has instead developed its own fleet management monitoring system, called LiDAT. As well as being able to position quay cranes, it also helps in operations, monitors fuel consumption and schedules service intervals.

Data is updated several times a day and can be called up in a browser via GPRS or using a data carrier. This allows individual cranes to be located and some assigned either time or movement limitations in respect of use.

According to Mr. Jähnig, this helps optimize use of cranes on the quay at all times, especially in respect of scheduled maintenance interventions, which can be better planned to minimize downtime and hence save costs as well as increasing availability of units.

The additional "Teleservice" package offered by Liebherr allows the company’s service staff to login to the controls of cranes from any location and rectify malfunctions or potential faults.

Asked whether existing cranes can be retrofitted with LiDAT, Mr. Jähnig says that it can be used on any CAN Bus-equipped Liebherr units, which effectively means any units built within the past two decades. “However, we offer LiDAT as an option and not all customers decide to install it on their machines,” he says.

REMOTE MONITORING FINDS PAIN POINTS

Given that remote monitoring technology is getting better by the day, Port Strategy asked Liebherr's Thomas Jähnig whether this would reduce the need for redundancy since terminals would be able to identify when a part or component is acting strangely and replace it before it fails.

He responded by pointing out that Liebherr's fleet management monitoring system LiDAT is already able to identify possible problems on components before they happen, but forecasting failure is more difficult, because the system tracks real time loading parameters and it is only possible to derive predictions from that data. The

main advantage for the customer is that they are able to track current efficiency while cargo is being handled and optimize potential use, he says. The cost of the GSM/GPS-based LIDU Box monitoring, he adds, is negligible.

If improved remote monitoring means redundancy is reduced, this won't necessarily lead to either cheaper or lighter cranes, he says, since reduced redundancy will have little impact on overall crane weight. Nor will quay loadings be reduced. "It's difficult to define how much money an operator can save by increasing remote monitoring of parts and components on a crane, since this depends on many parameters, including exactly how the machine is used," he says.

However, cost savings accrue because of several factors: reduced downtime, because problems can be located and analyzed very fast; reduced downtimes because of prognoses via tracked machine history; and reductions in travel and maintenance cost, since it is possible to clarify possible problems from a distance.

Reference

Port Strategy

<http://www.portstrategy.com/news101/port-operations/cargo-handling/remote-crane-monitoring>

8.3 Intelligent street lighting (Port of Moerdijk, Netherland)

Project Name	Intelligent street lighting
Underlying Technology	Intelligent lighting
Location	Moerdijk, Netherland
Information Released	August 2017
Involved Parties	Port of Moerdijk, Tvilight, Dynniq
Article	
<p>Dutch port taps smart street lighting, with IoT on the horizon</p> <p>Published on August 23, 2017</p> <p>By Mark Halper Contributing Editor, LEDs Magazine, and Business/Energy/Technology Journalist</p> <p>Sensors and software from Tvilight should reduce energy and maintenance costs. Technology specialist Dynniq looks to tie lights to other systems such as traffic.</p> <p>The Port of Moerdijk in southern Holland is installing smart street lighting controls across 2600 hectares of land in a bid to slash energy consumption and maintenance costs.</p> <p>The Port will equip 1100 new LED street lights with motion sensors and management software from Amsterdam-based Tvilight. Dutch company Dynniq will oversee the rollout and the LED light installation. Dynniq is a technology firm that specializes in managing infrastructure, traffic, and energy systems.</p> <p>The Port of Moerdijk is Holland's fourth largest port. It sits on the Hollands Diep River, which is an estuary of the Rhine and Meuse Rivers leading to the North Sea. The port serves maritime as well as inland cargo, and is connected by canal to Antwerp.</p> <p>It made the decision to roll out the system across its industrial park — Moerdijk houses chemical companies that connect to other chemical clusters in the Netherlands and Belgium via pipelines — following a trial in a small portion of the port using LED luminaires from Philips Lighting. A public tender will decide the luminaire provider on the bigger rollout.</p> <p>A Tvilight spokesperson said the new smart street lighting system should slash the lighting electricity bill by up to 80% — in large measure by dynamic dimming — compared to the existing fluorescent lights, which do not benefit from smart controls. Tvilight's CitySense sensors and CityManager software will also help cut maintenance costs by as much as 50%, through preventative maintenance, the spokesperson said.</p>	

Intelligent street lights will smarten up operations at the Port of Moerdijk.

“The combination of new LED street lights, dynamic dimming, and remote control options offered in the first project phase by Tvilight and Dynniq is an optimal investment because it helps us save energy while improving public safety and security at the port,” said Port of Moerdijk project manager Bas van den Bosch.

The smart street lighting system will play a key role in the port's aim to become “energy neutral” by 2030, noted Henk Schakenraad, program manager for infrastructure and maintenance.

“While delivering immediate results, such as energy savings, this technology also unlocks new opportunities for smart ports and industrial IoT [Internet of Things],” added André Meijer, managing director of Dynniq Mobility Netherlands. “The system can be easily connected to other solutions, which empowers the port with flexibility to support countless new applications, such as scenario- and traffic management.”

The smart lighting announcement at Moerdijk, which counts chemicals among its mainstays, is the second this summer at a southern Holland chemical facility, following the Chemelot Industrial Park's deployment of smart lighting use mesh controls from Chess Wise. Chess Wise rival Tvilight, the sensor and software provider at Moerdijk, is 47.5% owned by German lighting company Osram.

Reference

LED Magazine

<https://www.ledsmagazine.com/articles/2017/08/dutch-port-taps-smart-street-lighting-with-iot-on-the-horizon.html>