

DIGITAL TRANSFORMATION IN PRACTICE

Foreword – Hans Rook, Chairman IPCSA – April 2021



Dear reader,

In today's world, digitalisation is advancing daily. Due to the pandemic situation, more and more ports are realising that the shift from paper document to digital information exchange is an urgent need for all of us. This 'digital transformation in practice' paper gives you inside information on how and what has been achieved by some of IPCSA's members to enhance their trade facilitation goals. We hope that apart from making fascinating reading, this will help you to achieve your goals in optimising the logistics flows in and around your port area. Feel free to respond. Looking forward hearing from you.



Hans Rook

Thanks go to Port of Ravenna, India Ports Association and Djibouti Port Community System for their support in creating this paper.



Digital Twin: Port of Ravenna works with CNT to build a complete and dynamic picture

A Digital Twin project will assist the Port of Ravenna in managing its assets, planning projects and maintenance, and fulfilling a major canal dredging programme.



The port is working with Ancona-based CNT Technologies, whose managing director, Saimon Conti, says the idea of a port Digital Twin started when working with two shipyard clients.

“We are a small company developing software and robotics for the construction, shipbuilding, energy, agriculture and other sectors,” he says. “The idea of a Digital Twin started after a long journey between 2015 and 2017, testing our robotic solution on a couple of shipyards in Ancona. The idea was – shipbuilding is a mature

industry with many complexities in the construction of a ship, but in terms of processes and technologies, it is quite old-fashioned. We saw that if you want to have precise control over your ship construction process, you need to have many technologies. But one of the main challenges was – how can I control the shipyard and optimise the process of shipbuilding? We started from that idea to think about how we can digitalise a shipyard and all the processing associated with its operations.”

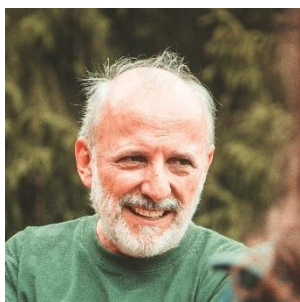
It soon became clear, he says, that this was not a matter of just the shipyard, but of the whole harbour. “We began to consider if there was a way to digitalise an entire asset and to get benefit from it independently, wherever you are in the value chain of a port.”



As a small company looking for a big challenge, CNT wanted to find a port with many complexities in terms of shipping and the environment. Ravenna was the answer; one of Italy's biggest ports, stretching 14 kms from sea to city centre, Ravenna is home to a range of operations, including oil & gas, while the city is a UNESCO World Heritage Site.

CNT started a conversation with the Port of Ravenna Authority, an active member of IPCSA, on how to approach this challenge. They found a common background – they wanted to create a Digital Twin. CNT started with the idea that it only needed to talk to the port authority in such a project. However, the port was looking to integrate all its information into a dataset, and the project expanded to include numerous other authorities and stakeholders.

The completed Digital Twin will provide the port authority with an information model which Saimon likens to an interactive video game. It will include layer upon layer of information and will, of course, never stand still.



Andrea Minardi, IT and security manager at Ravenna Port Authority, says: “As part of the Ravenna Port Hub project, in the next few years we will be dredging the entire port canal – from 10 metres depth to 12.5 metres in the first phase, with plans to reach 14.5 metres. This will open up new markets and opportunities for the port. The Digital Twin will provide

real-time information on the depth of water – how it is changing and how it has changed. This will be helpful in evaluating the works to be done in the different sections of the canal.”

Saimon adds: “Up to now, the port authority has had all the historical and current information on the status of the seabed stored in many folders, from many surveys; in the future, this Digital Twin will provide a unique database showing the chronology of the water depths and how they have changed.”

The dredging project is just one example of what can be achieved. The Digital Twin is bringing together information on everything from light towers and buoys to port infrastructure and assets, and also incorporates data collected from regional and local authorities, public service providers and other interested parties. To give an idea of the diversity, it ranges from information on soil to the layout of cables.

CNT is embedding all this information into a unique, multi-layered 3D file, linking through to data sheets, certification and a range of other information. “Anyone searching for information can visualise what they need in one process,” says Andrea.

Going back to the start, Saimon points out that in Italy, 90 per cent of shipyards are built on land owned by a port authority. “You can build a Digital Twin of a shipyard but it is much more intelligent if you try to build a Digital Twin of the whole port authority, then embed the information about the shipyard.”

He says the journey has proved more challenging than expected; that was due to one of the perennial challenges in this sector, encouraging people to share information and trust each other.

“The process itself is easy because we know what we have to do. But the main challenge was to collect the data. The port authority has a lot of data on assets but there are many other authorities working with them which own the data. Most difficult was to collect the data from the town, the region, the Environment Ministry, all the agencies dealing with the port authority, and public companies providing services within the port and to the port authority. We had to investigate where we would have to go to find information, who we would have to contact to reach the goal. It was more about public relations – finding the right person. Sharing information was a bit

step for many. I have been talking to public authorities and they are not trusting each other – they are possessive of their own data.”



No port is an island, of course. When considering a development or project in the port, neighbouring buildings and infrastructure must be considered as well as direct assets. All need to be mapped in the Digital Twin.

Work to import into the model information about all the trees surrounding the port involved a three-step effort. “The town sent me to the company that is in charge of keeping the town clean; that company sent me to another that is in charge of gardening.”

The Digital Twin will be a really valuable asset and archive of information for the port authority, helping with planning port developments or simulating new operations or vessel calls, for example.

However, the benefits will extend a great deal further, supporting many other stakeholders. The data and 3D visualisation embedded in the Digital Twin could be used by organisations planning a city concert or event, for developers to visualise and put in context a proposed building, for working out and optimising traffic flows or even analysing and preparing security and emergency response plans.

Elements of the Digital Twin project will be explained in internal presentations soon, and then a public presentation is expected in May.

There is, says Saimon, no way to say it is finished. It never will be. “Think about all the surveys being done for controlling or providing information for dredging – the model will be like a living object that you need to update daily, weekly, monthly in order to support its integrity,” he says. CNT plans to train the Port of Ravenna Authority staff to create, use and update data.

In the meantime, new ideas are emerging. “We are testing the use of drones in order to acquire data, especially for the depth of water and to map the seabed,” says Andrea. “A drone can transfer and share data almost in real time so that we can

update the Digital Twin. It's a kind of dialogue. We have been testing a USV – unmanned surface vehicle or, colloquially, an aquatic drone – which also helps to gather information for maintenance and also to assess what might be the impact of a ship collision, for example. This is an opportunity to test things and to be ready for a possible emergency situation.”

Discussions are ongoing about using UGVs – unmanned ground vehicles – to patrol and monitor the port area. Ravenna is aware that the Digital Twin will be incredibly helpful if a shipping company wants to train a new captain quickly before entering port for the first time – or, indeed, for any operator wanting to practise in advance of bringing autonomous vessels into the port.

“Any company wanting to build a new terminal can simulate the scenario in the port and surrounding area and decide on the optimum project,” says Andrea. “The Digital Twin will be a good tool for acquiring new traffic and business for the port, and for helping to reduce and reorganise maintenance costs. It will provide a revolution in the way that we work.”

To find out more about the Port of Ravenna Digital Twin Project

Port Ravenna Authority

Andrea Minardi, CIO

andrea.minardi@port.ravenna.it

www.port.ravenna.it





Indian Ports Association leads the effort in digitalisation for efficiency, transparency and ‘Ease of Doing Business’



Across India’s ports industry, digital transformation measures are showing results – speeding up import/export processes, reducing bottlenecks, increasing security and improving the nation’s ‘Ease of Doing Business’ (EoDB) performance throughout the supply chain.

As the responsible agency for the country’s ports, the Indian Ports Association (IPA), an apex body of major ports under the administrative control of the Ministry of Ports, Shipping and Waterways (MoPSW), Government of India, is leading the effort. As IPA Executive Director, Dr Abhijit Singh, says: “Ports are the gateway to prosperity for the country. Adoption of next-generation technology is critical to revamp the maritime industry – to enhance user experience and make it more efficient and safer.”

IPA, an active member of IPCSA, acts as a ‘think-tank’ for MoPSW and is recognised as a centre of excellence, helping ports achieve excellent in their operations and management. The sector needs some ‘out of the box’ ideas, says Abhijit.

“India has been working on its digital infrastructure and enabling of e-governance for many years and digitalisation is gathering pace across all industries,” he says. “The arrival of technologies such as the Internet of Things, AI and big data, blockchain, etc., have made it possible to collect and process larger and larger volumes of information at increasingly lower costs. Ports have embarked on this journey with an objective to improve port performance, bring efficiencies and increase productivity.”



IPA's main agenda is to achieve greater operational efficiency, he explains. "We see this through the lens of the performance metrics of ports, employee empowerment, less waiting time, better

customer experience and reduced logistics costs. As this involves extensive change management, it cannot happen overnight. Hence, we are doing it in a phased manner, so that change happens in the desired direction."

Already, a number of digital transformation measures have been successfully introduced across India's major ports, including Direct Port Delivery, Direct Port Entry, development of the Port Community System, the installation of container scanners and RFID systems, and eliminating paper forms.

Central to the effort, IPA has established a centralised, uniform, web-based Port Community System in order to move towards a paperless system. The PCS covers not only all the major ports but, in line with IPA's collective, collaborative and cooperative approach to EDI implementation, and for the benefit of all stakeholders in the Indian ports industry, the PCS covers non-major ports too.

In December 2018, an upgraded version – PCS1x – was launched as an open platform. It is evolving into a National Logistics Portal (NLP-Marine), a secure, neutral and open electronic/Internet-based platform for all stakeholders in maritime trade and Indian seaport communities. "It will optimise, manage and automate logistics-efficient processes through a single submission of data, linking the entire maritime transport and logistics chain and enabling real-time information exchange and business transactions," says Abhijit.

Other developments include implementation of an Enterprise Business System (EBS) at five major ports – Mumbai, Chennai, Deendayal, Paradip and Kolkata (including Haldia), at a project cost of approximately 320 crores. The EBS work is staggering; a total of 2,474



different processes from the five ports have been rationalised, harmonised, optimised and standardised to produce a streamlined 162 processes. The performance of each department and process will be tracked against defined Key Performance Indicators (KPI) for each department and process. A key aim has been to provide a digital port ecosystem adopting international practices, but without losing alignment with local needs.

“The proposed EBS will comprise three core solution components – Port Operations Solution, standard ERP solutions and auxiliary solutions, and will tightly integrate with PCS and other retained applications of ports,” says Abhijit. “This will completely digitalise most processes at ports, improving their role as trade facilitator. There has been a ‘soft launch’ of the EBS at Chennai Port and the project is in progress at the remaining ports.

IPA has also overseen the introduction of RFID-based gate automation systems, to enhance security, remove bottlenecks for seamless movement of traffic through port gates, provide tracking and tracing of people, materials, vehicles, equipment and other assets, and ensure accurate and timely collection of revenue. Alongside this, another RFID solution, is being handled by Delhi Mumbai Industrial Corridor Development Corporation (DMICDC) for tracking and tracing movement of export/import containers in the major ports.



“Implementation of such digital technologies is bridging the gap between operators and customers and is actively improving the user’s experience,” says Abhijit. “Real time cargo tracking, where customers can find out the status of their cargo anytime, is leading to a frictionless and hassle-free experience. Technologies such as MoorMaster, DUKC (e-navigation), etc., are supporting the safe, swift and efficient handling of vessels. Other technology modules such as automatic berth allocation, plot/yard planning, and linking rail booking with port systems, which form part of the state-of-the-art Terminal Operating Systems, are also helping ports to deliver operational efficiencies.

All of this work is delivering real results, and playing an important part in India's overall performance as a business and trading nation.

In 2015, India was ranked 142 in the World Bank's EoDB rankings. Four years later, in 2019, India had shot up to 77 – and in 2020, it rose again, to rank 63.

“The MoPSW has a huge role to play in improving the country's ‘Trading Across Border’ ranking, thus impacting the overall EoDB ranking,” says Abhijit.

India is currently ranked 68 on the Trading Across Borders Indicator, which measures the time and cost (excluding tariffs) of the logistics process for exporting and importing goods, taking into account documentary compliance, border compliance and domestic transport.

“The modernisation and digital transformation of major ports, along with initiatives such as Direct Port Delivery and Direct Port Entry, have helped in reducing time and cost in EXIM trade and improving Ease of Doing Business. Our aim is to bring India into the top ten countries on the Trading Across Border Indicator in the next four to five years,” says Abhijit.

There is obviously much more to come. As he says, digitalisation is pushing the maritime industry beyond its traditional limits and providing many opportunities to enhance the productivity, efficiency and sustainability of logistics.



“A wave of technological innovation and integration is pushing ports and shipping companies to transform themselves and become more data- and insight-driven. Smart Ports are transforming their model to take advantage of their position in the supply chain and to add value through better use of the data generated by the embedded IoT infrastructure.

“As the technologies and ports evolve, IoT, Cloud Computing, Big Data and GIS will have significant implications for port operations. The amount of automation will increase and dependence on human intervention for taking repetitive decision might decrease.”

He gives some examples of the way in which such technologies can shape the future for Indian ports.

IoT and Big Data analytics-based technologies such as crane sensors can help to increase the productivity of cranes by reducing downtime and ensuring timely maintenance.

GIS can help with real-time updating of plot/yard occupancy status and minimise the time spent in completing manual checks and processes during allocation:

- ▶ Asset health monitoring and predictive maintenance. Similarly, capex projects monitoring and progress management for infrastructure management can dramatically reduce capex and maintenance costs.
- ▶ Tools such as vessel arrival prediction, vehicle booking systems and hinterland truck marketplace can significantly help in streamlining port operations, increasing transparency and ultimately improving the ease of doing business while increasing port efficiency.
- ▶ Technologies such as Hyperloop, 3D printing of spare parts for vessel repairs and Automated Guided Vehicles are being piloted internationally; they may well become mainstream and relevant for the Indian context in time to come.

Indian ports are in a healthy state – and IPA is committed to setting ever high standards for them, says Abhijit. “Further expansion, modernisation, diversification and digitalisation are the keywords for the future development of our ports.”

To find out more about the Indian Ports Association and Digital Transformation



Indian Ports Association

md.ipa@nic.in , ipa@nic.in , cao.ipa@nic.in

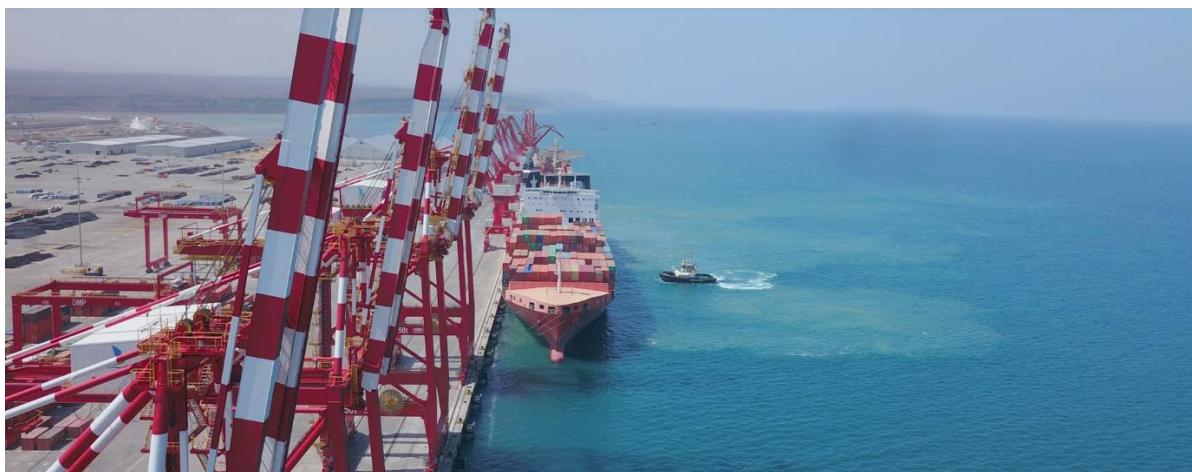
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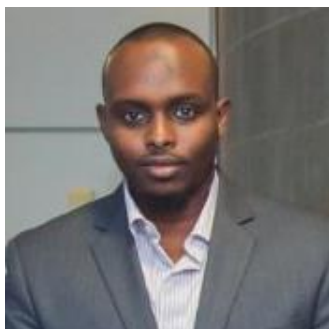
Tracking, tracing and transparency: Djibouti PCS smooths the flow of vital cargo and documentation across the border into Ethiopia

A package of digital solutions introduced by Djibouti Port Community System (DPCS) is proving transformational for the flow of cargo through its ports and across the border into landlocked Ethiopia.

About 90% of Ethiopia's imports pass through Djibouti's ports and a key focus of DPCS has been providing as much transparency and visibility as possible to the final customers who, of course, are in another country entirely.



First launched in July 2018, Djibouti Port Community System, an active member of IPCSA, covers the ports of SGTD Container Terminal (former DCT), Doraleh Multipurpose Port and the Port of Tadjourah. Before its implementation, all Djibouti ports, Customs and government agencies had their own separate systems. Since 2018, DPCS has developed rapidly.



“We have two main strategies driving our PCS implementation,” says Warsama Guirreh, CEO of DPCS. “Due to our location, we have about 30,000 vessels passing our coast every year; Djibouti Ports and Free Zones Authority is working to create an interconnected International Maritime Centre, investing in ports, in feeder services and in bunkering on the high seas, with the aim of attracting more liner services into our ports. Secondly, we are working to further improve the transit services provided to our neighbour, Ethiopia. The focus of our PCS has a lot to do with tracking and tracing; we have to provide as much transparency and visibility to the final customers as we can. After all, we have seen more than US\$1.2 billion of investment in creating logistics and trade infrastructure in Djibouti – building digital services to improve the efficiency of those infrastructure is an essential component of that investment.

In respect of the first strategy, Djibouti PCS is compliant with IMO FAL recommendations. The seven FAL Forms are submitted electronically to ease vessel documentation submission. Other maritime e-services that have contributed to a considerable increase in efficiency include electronic berth requests and vessel clearance e-certificates.



DPCS is also connecting all the different stakeholders – ports, shipping lines, forwarders, Customs – to provide a 360-degree view of cargo and documentation flows. “We are tracking the cargo to identify when it has been unloaded at the port, position of the container within the yard, gate-in/gate-out and at the same time

tracking the documentation process – including e-do, port fees invoice, clearance, booking collection of the cargo, etc.,” says Warsama. “Recently we have integrated Djibouti Corridor agency (DPCR) systems to provide ‘check points’ where the customer can follow the truck and its cargo all the way to Ethiopia. This is done through a QR Code scan of the DPCR ticket along the corridor.”

With the addition of this latest functionality, importers/exporters from Ethiopia can follow their trucks in Djibouti, verify the cargo that the trucks are transporting and investigate any delays on deliveries by tracking operations and documentation activities associated with their trucks. The shippers can also use this tracking and data availability to improve services and cut out unnecessary costs. Having said that, it’s important to emphasise that DPCS is not physically stopping anyone from doing anything; the transparency is there for the community to make use of.

This tracking capability has generated a lot of interest from the Federal Transport Authority of Ethiopia, whose transport department contacted DPCS with a view to integrating systems to provide full tracking and visibility of Ethiopia-based trucks, from starting their journey, through loading goods at the port to crossing the border and final delivery.

“From our side, we wanted more information about the transport companies and drivers registered in Ethiopia,” says Warsama. “Initially, we had no way of knowing whether transport companies were legitimate and registered in Ethiopia, even if they said that they were. Through this integration, the Ethiopian government provides full information on the truckers that are heading our way.

“Our biggest objective is reducing the time and cost of logistics. We have demonstrated that just through digitalisation, existing customers have been able to save four to five hours on each consignment. Where there were nine manual processes, we have reduced this down to five, all electronic. Now, we expect documentation to be finalised within an hour.”



By continuing to analyse data, DPCS' relevant stakeholders have been able to identify bottlenecks, assess customer behaviour and adjust processes accordingly.

"Since we have been working for almost three years, we have had access to a

great deal of data – basically anything that comes into Djibouti, delivery data, gate in/out – and that data is becoming more and more valuable," says Warsama. "We are in a position to take better decisions that can significantly improve the logistics chain and our services.

"Following the integration with Customs system Asycuda, Djibouti PCS has been operating as the sole submission platform for all manifest and e-do operations in Djibouti. This year, we also aim to finalise the Customs declaration submission functionality and the integration with the rail operator."

Is all of this encouraging cargo volumes into Djibouti? Warsama says yes – efficiency and cargo flows are interlinked. "Better service means more business," he says.

For example, sometimes containers spend more time in ports due to a delay in the documentation. "With Djibouti PCS, we are able to find out the source of this delay within the logistics chain. Better coordination and increased transparency resolve these types of issues and increase the flow of cargo in the logistics chain. This integrated digital service helps the importer to plan the whole process of retrieval of cargo. It is more efficient and cheaper for the importer and more efficient for us, because the cargo is moving faster."

And there are certainly new opportunities ahead. Djibouti is in discussions with South Sudan and other landlocked countries. "Ethiopia is keen to become a transit country itself, using Djibouti ports and delivering goods all the way to South Sudan and into central Africa," explains Warsama. "This has been a long dream of both Djibouti and Ethiopia. For this, we need to be very efficient and provide exceptionally good logistics services for customers choosing to use the Djibouti ports.

“Everyone is realising the potential of the landlocked countries of Africa and corridors to the seaports. Djibouti’s population is less than one million, but we have five ports – they aren’t only for us but for other countries.”



None of this has been without its challenges, of course. Warsama highlights one of the more usual difficulties – encouraging people and businesses to get involved, to share

information and to trust each other.

“Getting people involved was definitely very challenging, especially at the beginning when we had to explain that this would help the whole port community. We started with port bookings, invoicing and gate in/out; as we convinced and integrated a party, we built on the achievements in order to continue and extend the influence of the system. Even now we sometimes have forwarders who still come to the port requesting a physical invoice, but 90% of them are using the system and doing everything from their offices.”

In all of this, DPCS has benefited from its membership of IPCSA, says Warsama. “Every single problem we have had, there is a member of IPCSA who has been there before us and has been able to provide advice and support,” he says.

And he is full of optimism: “There is still a long way to go and a lot of improvements to make but we are heading in the right direction.”

Notes: All Photos and images are courtesy of DPCS

To find out more about the Djibouti Port Community System



Warsama Mouhoumed Bouh Guirreh
Managing Director, DPCS

www.dpcs.dj





About IPCSA - Trusting, sharing, collaborating and innovating

As it celebrates its tenth anniversary this year (2021), the International Port Community Systems Association (IPCSA) is reflecting on an extraordinary decade of achievement.

Since its official launch on 15 June 2011, IPCSA has achieved rapid growth in membership, while establishing its reputation and influence as an expert authority and adviser on the electronic exchange of information and digitalisation to smooth the flow of cargo and documentation.

Today IPCSA has nearly 50 members, including Port Community System (PCS) and Cargo Community System operators, Single Window operators, and Seaport and Airport Authorities, drawn from all regions of the world. It is also a recognised NGO with consultative status at UNECOSOC and IMO.

This thriving association traces its roots back to Dryport, an Interreg IVB North Sea Region which ran from 2009 to 2012. A Dryport workshop covering IT and Security in November 2009 included a presentation by Portbase, the Dutch Port Community System, on 'Track and Trace', and a presentation by Maritime Cargo Processing (MCP), a British PCS, on 'Port Community IT Systems – how they can be adapted for Dryports'.

Two years later, both Portbase and MCP were among the six founding members of IPCSA, originally launched as the European Port Community Systems Association (EPCSA) with support from Dryport.

For the first time, Port Community Systems operators, through EPCSA, had a united, strong lobbying position at the European Union level. The other four founding members were SOGET (France), dbh (Germany), Portic (Spain) and DAKOSY (Germany). Three years later, after a steady flow of new members, the association officially became international, as IPCSA, in 2014.

IPCSA soon began working with standards organisations such as UN/CEFACT, the World Customs Organization and ISO. Towards the end of 2019, the standards specialist group PROTECT was integrated into IPCSA as a working group – enabling IPCSA to accelerate its work in supporting international standards, including in the

delivery of Just-In-Time [ship arrival] APIs and data through international standards bodies.

IPCSA places the emphasis on constantly changing and adapting – keeping ahead of the crowd. In their last major gathering before the arrival of Covid-19, members attended a two-day meeting, hosted by the World Economic Forum in Geneva, to discuss The Future of Cross Border Digital Trade.

The pandemic has certainly not held back IPCSA – rather the reverse. In the past year, IPCSA has launched its Network of Trusted Networks (NoTN) a secure port-to-port and cross-border data exchange solution to provide predictability, visibility and certainty within the supply chain, and developed and piloted a Blockchain Bill of Lading. The association was also one of the leading signatories to the IMO's 'Call to Action' to accelerate the pace of digitalisation to cope with a post Covid-19 new normal.

IPCSA has excelled itself in reaching out to members, pushing forward with new technologies and innovations, and helping members get to know each other even better. Regular community 'e-coffee' gatherings via Zoom have been incredibly popular, enabling members to meet informally, share experiences and support each other through the challenges of Covid-19, as true friends and colleagues.

To find out more about the IPCSA, Port Community Systems, Single Windows or membership of the Association.



International Port Community Systems Association

Richard Morton, Secretary General

Richard.morton@ipcsa.international

www.ipcsa.international

<https://notn.ipcsa.international>

The original IPCSA article in the Port Technology International Journal can be found at: <https://www.porttechnology.org/editions/ports-embark-on-digital-transformations/>
