



Final Report

Online Seminar on Exponential Ports

Economic Recovery

*Permanent Secretariat
Caracas, Bolivarian Republic of Venezuela
19 and 21 - 26 and 28 April 2022
SP/SPE/IF-22*

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I. RAPPORTEUR'S REPORT

1. The Seminar on Exponential Ports, organized by the Permanent Secretariat of SELA, through the Network of Digital and Collaborative Ports (D&C Ports Network), jointly with CAF-development bank of Latin America, the National Port Authority (APN) of Peru, the Port Authority of Santander - Spain and Next-Port.ai, was held in four working days on 19, 21, 26 and 28 April 2022 in a virtual modality, as part of the activities related to the Network of Digital and Collaborative Ports Project, included in SELA's Work Programme for 2022-2026.
2. The seminar was attended by an average of 610 participants per day, representing the following Member States of SELA: Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay and Venezuela. It was also attended by representatives from the following countries: Antigua and Barbuda, Canada, Costa Rica, Spain, the United States, Equatorial Guinea, the Netherlands, Switzerland and the United Kingdom.
3. The opening remarks were delivered by Ambassador Clarems Endara, who highlighted the three thematic areas on which SELA has focused for the period 2022-2026, namely: economic recovery, social development, and digitalisation, with a view to addressing the equitable development of Latin American and Caribbean society and fulfilling the organization's commitment to promote more and better integration through plans and strategies that respond to the needs of the region. He commented how the pandemic had highlighted the crucial role of ports and their logistics chains for regional and global trade. He added that the pandemic had led to the acceleration of the digitalisation of the maritime port sector in the region. He recalled the existence of the digital divide in LAC and the efforts that some countries have made to digitalise port logistics through, for example, the Foreign Trade Single Window (VUCE) and Port Community Systems (PCS), with countries such as Chile, Jamaica, Panama and Brazil standing out, followed by Argentina, Peru, Suriname and Trinidad and Tobago. The Permanent Secretary also stressed that smart ports require the synchronisation and collaborative work of the multiple stakeholders involved, both within each port and within the port logistics community in general, in order to move towards the interconnected port or smart port.

On the other hand, Mr. Antonio Silveira, Manager of Physical Infrastructure and Digital Transformation of CAF-development bank of Latin America, pointed out that CAF is concerned about the incorporation of ICTs in all areas of society and the digital economy, especially in the logistics environment where ports are particularly important for a region whose economy is based primarily on the export of raw materials. Thus, the D&C Ports Network must promote digitalisation to be able to participate effectively in the efforts to recover productivity and competitiveness and to get back on the path of development. Finally, he expressed that the topics planned to be considered at this event are of the utmost importance for the development of the maritime-port sector, as is the sharing and exchange of knowledge among the various stakeholders involved.

Ms. Ana Margarita Reyes, Deputy Administrator of the Panama Maritime Authority (AMP) and President of the Network of Digital and Collaborative Ports (D&C Ports Network), commented that this event would be considering the reinvention of conventional ports and their transition to the smart port paradigm through appropriate approaches and best practices within the framework of the evolution of the industry towards a digital

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environment. Ms Reyes pointed out that to meet current and future challenges, investments are being made in innovative technologies and in elements of digitalisation, artificial intelligence (AI), massive data management, and equipment and strategies for cargo handling, with a view to the transformation of the conventional port to the smart port, in order to respond to increasingly demanding expectations. Finally, she expressed that "the future is today" and that the industry is on the verge of a true technological transformation.

In relation to the above, Mr. Manuel Gilberto Hinojosa López, Chairman of the Board of Directors of the National Port Authority (APN) of Peru, stressed that the pandemic contributed to intensifying the use of ICTs and promoting changes in the way of interacting and doing business, and that such changes came along with greater access to information that "has made us more vulnerable" and more technologically dependent. He added that the changes experienced in the port and logistics industry force us to achieve operational excellence, to make better use of productive assets, to reach a new Business to Business (B2B) and Business to Consumer (B2C) experience and to use technology to get closer to the customer, understand their changes and prevent and induce their behaviour.

Mr. Francisco L. Martín Gallego, President of the Port Authority of Santander, Spain, praised the receptivity achieved in the dissemination of the event as an indicator of the importance of the subject. He pointed out that ports constitute an excellent environment to conduct trials for the sake of productivity, competitiveness and the economic recovery of countries. He thanked the panellists for their efforts to make it possible to share this knowledge through the Internet, and congratulated SELA and the organizing team for holding the event.

Finally, Mr. Oscar Pernía, Founding Partner of Next-Port.ai, in making the technical presentation of the seminar, emphasised the importance of incorporating technologies such as big data, digital twins, physical internet, Port Community System (PCS), blockchain, and artificial intelligence (AI) to the docks and to know, in practical terms, what such technologies mean for the port industry. He also stressed the need to accelerate the technological transformation and ensure its homogeneity for the whole sector, especially interoperability between platforms and standardisation.

4. The seminar aimed to: i) help the port logistics community in Latin American and Caribbean countries understand the immense disruptive capacity of exponential technologies; ii) offer a vision of the effects that such technologies are bound to have on the modus operandi of ports and their logistics chains; and iii) reflect on strategies for transitioning and taking advantage of the opportunities that they will bring about.
5. To access the agenda for the event and the presentations, please visit the Seminar on Exponential Ports in the Events tab of SELA's Web page (www.sela.org), at the bottom of which you can also visit, in specialized portals, the sub-portal Network of Digital and Collaborative Ports, whose contents refer to the achievements and present and future challenges of port logistics communities (CLP) in Latin America and the Caribbean, and the Network's activities.

II. SUMMARY

Following is a summary of the ideas and visions put forward by the panellists in their presentations, as well as the thematic order of the agenda for the event:

Theme. The physical internet and its influence on ports

- 1) The physical internet was defined as an integrated digital layer for analysis, planning and optimisation of processes, which in turn enables the development of a complete data exchange platform, or as an open logistics system whose coordination among all stakeholders allows for greater resilience, making it possible to adapt to change. The physical internet is not a technology in itself, but a different way of conceiving transport systems and focuses on their optimisation at the system level, using an open and collaborative philosophy based on the premise that the transport of goods should be conducted in a similar way to the flow of data on the digital internet. In the port-logistics context, the challenge is to understand the physical internet and its influence on ports, transferring the collaborative concept to the maritime port context
- 2) Three dimensions of the physical internet were identified as influencing port connectivity and answering an equal number of questions: i) operational dimension: how are operations conducted in the port? ii) digital dimension: how do stakeholders share information in the port and how are data-driven decisions made to optimise operations? and iii) governance dimension: what are the rules, protocols and standards for a cooperative, open and reliable ecosystem of data exchange?

Theme. Digital port ecosystems for operational excellence

- 3) Due to the speed at which technology is advancing and the increasing quality of service demanded by port customers, transport and logistics are constantly evolving. Ports are expected to be operationally excellent, but to become so, they must have an advanced digital ecosystem; be integrated with the business; have state-of-the-art connectivity; and have digital logistics collaboration platforms. This is the only way to move towards a smart port.
- 4) Growing customer demand for service quality is driving the constant evolution of transport and logistics.
- 5) The problems currently affecting ports and maritime transport associated with stock-outs and the uncertainty of the geopolitical context require the optimisation of supply chains through the implementation of models that improve logistics visibility and agility, as well as synchro-modality and the verticalisation of supply.
- 6) In their move towards sophisticated digital ecosystems, port logistics communities in the region should provide tailored solutions according to the specific needs of each port, considering their size and the volume of business.
- 7) The main challenges identified in the path towards achieving port operational efficiency were the following: i) effectively administering change management; ii) creating and enhancing new professional profiles and skills; and iii) incorporating technology into business. To do so, the partnership of public and private factors, including academic stakeholders, will be fundamental.
- 8) As a best practice, the Port of Algeciras Bay in Spain stands out, where coordination between public and private stakeholders made it possible to minimise waiting times, increase transparency in operations and reduce the carbon footprint thanks to collaborative, intelligent, synchro-modal and sustainable action. In addition, this port took

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on digital transformation and innovation as key pillars of its business strategy, as well as the implementation of the Digital Operations Orchestration Platform with a view to ensuring full coordination among all stakeholders in its port ecosystem, adopting the Port Community System (PCS) planned to evolve towards Teleport 2.0, and data analytics.

Theme. Ports in digital ecosystems 4.0: integration in supply chains and new digital products

- 9) The pandemic has generated disruptions in supply chains, which have resulted in shortages, delayed arrivals, increased dwell times and waiting times at gates, and increased costs. To face this crisis or bottlenecks in the supply chains, ports will require greater optimisation through the implementation of models that allow for improved logistical visibility and agility, synchro-modality, and verticalisation of supply.
- 10) In the case of Latin America and the Caribbean, economic take-off in the coming decades will require efficient supply chains, supported by new multimodal transport structures and investments in supply chain technologies, whose providers offer proven solutions to address the challenges of the port business.
- 11) The sector has strongly attracted the attention of strategic and institutional investors with high M&A (Mergers and Acquisitions) activity and large volumes of financing available for the development of digital products.
- 12) The Digital Partnering strategy (accompanying digital processes), with the use of supply chain software or other collaborative models, enables the expansion of the logistics product and thus the operational optimisation of the port sector. In practice, logistics visibility, Estimated Times of Arrival (ETA) and loading platforms are ideal complements to port information technology (IT) systems.
- 13) Achieving adequate levels of synchro-modality is a primary objective in new digital port products, requiring the integration of different systems (PCS, TOS, logistics visibility, p-ETA, loading platform).
- 14) In a context of increasing verticalisation of the port-logistic offer (esp. M&A, with PSA-BDP, DP World - Imperial - Belloré, CMA - Gefco), port centric logistics, supported by technology and/or ad-hoc regulatory framework (e.g., Free Zones, SEZ), appears as an emerging business segment with enormous potential for value generation.

Theme. The present of automation in container terminals

- 15) Automation helps terminals operate in a largely unassisted manner, for which there must be effective coordination among all stakeholders in the port system, based on digitalisation.
- 16) To evolve towards a smart port, quantifiable elements are required through the following variables: i) operations; ii) environment; iii) energy; and iv) security.
- 17) A smart port can be visualised as a container logistics warehouse that is ultra-connected through information and communication technologies (ICT), similar to the three parameters of Industry 4.0, namely: interoperability, autonomy, and sustainability.

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- 18) Classical automation levels range from ERP (Enterprise Resource Planning) systems to sensors. However, there are now automation systems based on artificial intelligence that make it possible to predict events and move from signal identification to data analytics and from calibration to optimisation processes.
- 19) Three keys for automation were identified: i) definition of a general process framework; ii) digitalisation (through PCS, Terminal Operating System (TOS) or terminal data centre / Equipment Control System (ECS), robotisation and machine autonomy or machine learning); and iii) standardisation (cyber security, connectivity, robotics, sensorics, among others). Other examples of automation discussed were the VBS (queue reduction, access decongestion, lower emissions and fuel savings) and the automatic entry and exit gate system.
- 20) The critical factor in automation is the human factor, and the technological innovation that is inherent to it is essential for its evolution. To that end, it is necessary to maintain a clear medium- and long-term vision, the greatest willingness to overcome resistance to change and to maintain a process of ongoing education and training of human talent, aimed at offering them new training that allows them to incorporate new skills, especially managerial and technological skills, which in turn enable them to take on new roles based on creativity and improvisation with a view to adding value to the repetitive tasks performed by machines. Such scenario calls for the presence of collaborators with new profiles such as analysts and data scientists, professionals in science, technology and mathematics.
- 21) As regards the benefits of automation in shipping, automation and technology make it easier to identify bottlenecks in a port, which in turn facilitates better decision-making. Historical data can be used to calculate predictions. People can be moved in risky areas and congestion on both the land and the sea can be reduced. A return on investment is achieved by speeding up operational times. In terms of risks, one of them is exposure to cyber-attacks. In addition, automation requires 20% adaptation, which can be an added cost. There has also been talk of a social risk in terms of job losses as a result of automation which, on the other hand, would be compensated by the creation of millions of jobs for positions requiring human-machine dialogue.

Theme. Infrastructure for digital transformation: 5g - IoT - edge computing

- 22) Following are some of the challenges or actions that the ports of the future will have to undertake: i) adapting port capacities to achieve an efficient and viable balance between passenger and cargo traffic; ii) implementing intelligent solutions with the objective of integrating the different sources of information and systems for knowledge through pre-configured and customised alerts; iii) generating reliable dashboards that enable rapid decision-making; iv) analysing cruise and passenger behaviour; v) offering a reliable, scalable and secure communications infrastructure; vi) incorporating physical and logical security elements to ensure safe access and movement of people and goods in port facilities; vii) enhancing cyber security tools to anticipate and address cyber threats in a timely and effective manner; and viii) having DRS (Disaster Recovery Service) plans in place. Addressing these challenges in a timely and adequate manner will allow ports in the region to be agile, initiative-taking, transparent, secure, optimised, connected, and sustainable.
- 23) 5G technology is emerging as a key communications element that enables digital transformation at ports, leveraging wireless technology, higher speeds, low latency (1 millisecond), greater immediacy and IoT scalability. The World Economic Forum has

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estimated that "smart connectivity, enabled by 5G, will be a catalyst for socio-economic growth in the Fourth Industrial Revolution, which will total US\$13.2 trillion by 2035."

- 24) In the port sector, 5G technology is aligned with the concept of Multiple Access Edge Computing (MEC), which brings traffic and service computing from a centralised cloud to the edge of the network and closer to the customer, and Mobile Private Network (MPN), both of which are compatible with 4G networks. The MPN is a local, dedicated, port-limited mobile network capable of supporting any business-critical service, ensuring security, reliability, and availability.
- 25) The experience of the Port of Algeciras in the use of 5G technology stands out, in which the management, operation, and the security and safety systems of the port were optimised thanks to the use of augmented reality (AR) technology for the representation of geolocated asset information on the ground and video streaming transmission, all in bidirectional real time.
- 26) It is necessary to maintain a hyper-connected port at the level of a supply chain that is linked to logistics networks. Furthermore, the interrelationship with stakeholders and their convergence with the environment must correspond specifically to the situation of each city, country or region.

Theme. Use of AI techniques to assist in the design, construction, operation and management of port infrastructures

- 27) Artificial intelligence (AI) was defined as the branch of mathematical statistics that uses computing, mimicking human intelligence to study, model and infer patterns and model multiple physical and engineering processes. Three conditions were considered for an effective application of AI, namely: i) existence of dependency relationships for the application of the AI algorithm; ii) availability of a sufficient amount of data (big data); and iii) existence of training and validation phases to verify the results.
- 28) AI enables reliable planning, robust contingency management, and more adaptive execution. It also facilitates the structuring of an inclusive intelligence of people, systems and algorithms through the capture and use of data from different platforms and technologies; the introduction of algorithms to help transform existing processes; and the integrated redesign of organisation, profiles, and qualifications.
- 29) AI in ports is the simulation of human intelligence in machines that will provide the necessary capabilities for ports to evolve and become smarter, more resilient, competitive and sustainable. AI must be incorporated into port dynamics by planning and executing activities based on historical data, opening up opportunities for the future and enabling contingency management, all of which will define decision-making and synchro-modality.
- 30) Smart port is a concept linked to Industry 4.0, in which a port uses emerging technologies such as IoT, big data, blockchain, distributed ledger, AI, machine learning, among others, to improve its economic competitiveness and efficiency, optimising the environmental and energy sustainability of operations, as well as the safety and security of its facilities.
- 31) AI will help redefine processes and relationships and will enable the evolution towards new operating and management models based on the consolidation of information and structuring of data sources. It will also facilitate the orchestration of processes in an

integrated way with the supply chain, and predictive mechanisms will facilitate the activation of paradigms such as just-in-time and synchro-modality.

- 32) The benefits of the transition to digital infrastructure include the following: i) reduction of transit times for cargo and transport, through predictions in times and service levels, catalysing synchro-modality paradigms through AI; ii) increased transparency and collaborative work that facilitate effective decision-making based on performance, sustainability and competitiveness parameters; iii) compliance with environmental regulations to integrate the transport decarbonisation agenda with the port community; iv) digital asset management and improved resource allocation in waiting times and utilisation; v) proactive port planning; vi) adoption of a continuous improvement mindset that connects processes, systems, and data; vii) generation of added value for customers through operational excellence of the port and its efficiency, flexibility, and resilience; viii) optimisation of predictability in ship arrival by providing an effective ship/port interface to facilitate sustainable ship navigation; ix) adoption of collaborative decision-making in port to optimise coordination between the agents involved in ship arrival and departure; x) development of mechanisms for deep analysis and learning of patterns associated with goods and destinations, optimising the cargo value chain in port; xi) linking the shore side and the end customer in a transparent, secure and prescriptive way for connection to operational and document processes in ports; and xii) optimisation of problem solving, which can be identified and aligned to the Sustainable Development Goals (SDGs).
- 33) Following are some practical applications of AI in the port context: i) Operations System to support the construction of the Port of Açu, in Brazil; ii) analysis of the impact of climate change in the Ports of Galicia (Spain), through climate projections and numerical simulations with a methodology based on clustering techniques; iii) characterisation of the tugboat service of the Port of Santander, also in Spain, with the application of machine learning technology to optimise the dimension of tugboat operations in a port; and iv) prediction of the operability of a vessel berthed at the Port of Bahía de Algeciras in Spain, to predict the safety and efficiency levels of port operations.

Theme. Tools 4.0: digital twins in ports

- 34) A digital twin is a virtual representation of an object or system that spans its life cycle, is updated from real-time data and uses simulation, machine learning and reasoning to support decision-making. In the port field, digital twins have been applied in the following areas: i) traffic systems with an access gate to a port terminal, allowing foreseeing that incoming trucks do not impact city traffic; ii) distribution warehouse designs, specifically in a container inspection platform; iii) liquid terminals; iv) ship flows in the Bay of Cartagena to identify the capacity of the access channel over time; and v) analysis of passenger movement in a port terminal.
- 35) Emulation technology has been applied mainly in those terminals aiming to automate operations to improve their productivity, such as the PSA Terminal in Singapore, the Maher Terminal in New Jersey and the Port of Cartagena in Colombia. This technology makes it possible to determine future scenarios and to evaluate the efficiency and productivity of port-logistics operations. For example, planning container yards, understanding the logic of truck dispatching and testing strategies to avoid bottlenecks at the access gates of a traffic system.

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- 36) For a port to successfully engage in the use of AI and digital twins, it must promote a culture of data and information generation to analyse, measure and study logistics events as a source of intellectual wealth and have trained human resources.

Theme. Environmental management 5.0 for ports: how exponential technology is fuelling a new environment

- 37) Exponential technologies are those disruptive technologies that serve to transform certain business models and solve different problems and whose power is enhanced when combined with each other. Exponential ports are based on data management and use exponential technologies as their operating model to be more competitive and generate better services for customers. To that end, they manage the wealth of data (data driven ports) to generate new innovative and disruptive business models based on exponential technologies.
- 38) Currently, the Fourth Industrial Revolution is dominated by technologies such as AI, IoT and blockchain that impact various sectors, business models, globalisation and people.
- 39) Based on the experience of the project being carried out at the Port of Santander in Spain, a roadmap was presented based on big data architecture that could be embedded in a digital twin or any other technological development and envisages the following stages: i) planning; ii) identification of data sources; iii) data loading; iv) refining and analysis; v) visualisation; and vi) feedback. In addition, the importance of considering a cost-effective business model was highlighted, considering factors such as cyber security, data strategy and governance, and system viability.
- 40) The green port is a port whose activity not only considers the economic sphere, but also the environmental and social spheres, which defines it as a sustainable port, characterised as exponential and causing the minimum impact and providing environmental protection measures.

Theme. Artificial Intelligence applied to ports. Dynamic planning and synchro-modality

- 41) In a smart port scenario, technology is a means used to optimise, among other aspects, competitiveness, decarbonisation of transport and to design the response to multiple challenges.
- 42) Ports have a responsibility regarding the environmental impact of their activity and the promotion of sustainable development.
- 43) Today, ports must face the new logistics models of e-commerce, with digital transformation being the answer to the demanding requirements posed by the evolution of the industry.
- 44) The dynamic planning and synchro-modality paradigms in ports will need to rely on the analysis of multiple sources of information to be analysed by AI algorithms. This requires moving towards an integrated and inclusive intelligence of people, systems and algorithms.
- 45) AI fields such as machine learning provide the capabilities that smart ports are demanding to: i) make dynamic and resilient decisions; ii) enable systems to interoperate in order to optimise coordination in operations; iii) frame a connected ecosystem for the benefit of port customers; and iv) respond more efficiently to the challenges of climate change.

- 46) The adoption of AI requires elements such as: i) the design of a truly connected and intelligent port ecosystem; ii) the ability for data to feed algorithms and for algorithms to provide solutions to systems; iii) the inclusive reshaping of organisation, training and transformation to enable intelligence in an integrated way, between systems, data and people.
- 47) The smart port concept arises as a response to the demanding requirements associated with the development of the maritime port industry, such as the following: i) evolution in the methodologies and technologies used in port development promoted by the UN and other institutions; ii) the need for ports to respond to new logistics models that use digitalisation as their basis of operation; iii) the need to update regulations and regulatory frameworks concerning reliability and environment for ports; and iv) the need to digitalise the standardisation of processes and data exchange in the maritime port industry.
- 48) The smart port is a concept linked to Industry 4.0, in which a port uses emerging technologies such as IoT, big data, blockchain, distributed ledger, AI, machine learning, among others, to improve its economic competitiveness and efficiency, optimising the environmental and energy sustainability of operations, as well as the safety and security of its facilities.

Theme. Impact of 4.0 technologies on port processes in international trade: advances and challenges towards the Callao smart port

- 49) The progress towards the conversion of the Port of Callao into a smart port is framed in the Peruvian government's digital policy, in different legislative decrees referring to data governance and interoperability, and in other regulations that integrate the public and private sectors. The port underwent a four-level digital transformation, namely: i) internal digital transformation; ii) port connected to other projects; iii) community connected through PCS; and iv) hyper-connected port, constituting an extraordinarily rich experience in the use of different technologies.
- 50) Some projects being conducted within the framework of the digital transformation of the Port of Callao are the following: i) Foreign Trade Single Window 2.0 (VUCE 2.0) project; ii) New Trends in the Logistics and Port Chain Programme, which integrates the public and private sectors to define the digital strategy; and iii) Port Community System (PCS).
- 51) Some examples of the 4.0 technologies used in the Port of Callao are the following: i) implementation of AIS AtoN devices for the signalling and beaconing system of the port access channel; ii) VTS for the port; iii) blockchain-based tradelens pilot of container cargo information; (iv) big data - business intelligence to operate the trade intelligence portal; v) information portals such as the Foreign Trade Logistics Observatory; and vi) physical and cyber security and protection schemes with the use of drones.
- 52) As a best practice, the self-financed private initiative project (IPA) for the implementation of a PCS in other Peruvian ports was highlighted, under the modality of a public-private partnership contract, such as: the Paita Port Terminal; the Salaverry Multipurpose Port Terminal; the General San Martín-Paracas Port Terminal in Pisco; the Matarani Port Terminal and the Ilo Port Terminal.
- 53) Some challenges for the implementation of these technologies were identified, namely: promotion of change management, cyber security, the need for qualified personnel, and the generation of port logistics communities, among others. In addition, there are technical

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challenges that emphasise the importance of data, connectivity and internal organisational culture as critical success factors.

- 54) Change is inevitable. It is no longer a question of large or small ports. It is about linear or exponential ports. The falling costs of technology offer ports an opportunity to invest and move towards becoming smart ports.

III. CONCLUDING REMARKS

The following is a summary of the considerations made by the panellists in the colloquiums held at the end of each working session:

- 55) Digitalisation should be an objective for all ports, regardless of their size, for which it will be essential to carry out a cost-benefit analysis of the implementation of new technologies and of their digital ecosystem; as well as to take into consideration the reality and capacity of each port and the barriers to entry, and to identify the problems that must be solved as a matter of priority.
- 56) Digital port transformation implies convergence and synergy among public and private entities, academia and all stakeholders in the port ecosystem. It also implies the creation of cooperation and coordination partnerships between national and international stakeholders to jointly face the challenges posed by the digital transformation and to make the most of the benefits it brings.
- 57) Following are some recommendations to implement new technologies: i) have a strategic plan for digital transformation; ii) effectively administer change management; iii) create and enhance new professional profiles and skills (have a multidisciplinary team); iv) integrate technology with business; v) promote a culture of data and information generation to analyse, measure and study logistics events as a source of intellectual wealth and, especially, know-how.
- 58) Turning a traditional port into a smart port requires: i) strategic vision; ii) public policy instruments that encourage digital transformation; iii) cultural change, which implies moving towards 4.0 institutions; iv) the formation of strategic alliances (public-private partnerships, such as port logistics communities); and v) cyber security.
- 59) The digital transformation of ports and the maritime industry in general requires not only the allocation of economic resources to the acquisition of equipment and innovative technology, but also an organisational change of the ports and a review of the administrative, management and governance models of these infrastructures, as well as the human capital linked to this transformation.
- 60) National, regional and local governments, as well as port authorities, should be prepared to generate guidelines to drive these changes, starting with the design and implementation of strategic plans focused on the digital transformation of the sector, framed in a coordinated national action through their incorporation in national development plans (NDP) and national port development plans.
- 61) Digital transformation is seen as a vehicle for the region's economic recovery, offering better port and logistics services and boosting the competitiveness of port terminals.

- 62) In order to know the perception that the ports of Latin America and the Caribbean themselves have with regard to their digital transformation, a questionnaire was distributed among those attending the seminar. The purpose is to determine how this challenge is understood and how it is being faced in the ports of the region. The results will be published shortly. The answers to the questions raised by the participants during the event will also be published in a special document.