CALL FOR QUICKER AND BETTER DECISION MAKING AT MARITIME TERMINALS

"WITH THE SCHEDULED ETAS NOT BEING FOLLOWED, SHIP VISITS TEND TO CLUSTER AT SOME DATES, LEAVING OTHER DAYS WITH NO ARRIVALS."

Karol Suchan, Head of Centre for Innovation in Transportation and Logistics (CITYLOG), Universidad Diego Portales, Chile, **Rosa G. González-Ramírez**, Associate Professor of the Faculty of Engineering and Applied Sciences, Universidad de los Andes Chile, **Luis M. Ascencio**, Director of Porthink and SCM-think portals and part-time professor at the Faculty of Engineering and Applied Sciences at Universidad de los Andes Chile

COVID-19 & MARITIME SUPPLY CHAINS

The COVID-19 pandemic has left a deep mark on the maritime shipping industry. In the past two years, the Global Schedule Reliability (GSR, the percentage of ships that arrive within the 48 hours window around the scheduled Estimated Time of Arrival (ETA)) has fallen far below the 75 per cent mark that was common before the pandemic (see Figure 1). With GSR about 35 per cent to 45 per cent, maritime terminals have been forced to replace well optimised operational plans based on service demand well spread over the planning horizon with ad-hoc contingency plans for alternating periods of peak demand and idle time. Indeed, with the scheduled ETAs not being followed, ship visits tend to cluster at some dates, leaving other days with no arrivals. Although we can observe a recovery trend since April 2022, the Global Average Delays for Late Vessel Arrivals (see Figure 2), delays increased from 3 to 4 days, to up to 7 to 8 days during the pandemic and presenting at present, 6 days on average.

Such a mixture of periods of demand that exceeds the capacity of a terminal with intervals of idle time leads not only to much higher operational costs, but also produces even greater delays for the shipping companies due to congestion: with longer vessel waiting times and truck congestion at peak demand. These delays have been reflected in the evolution of the

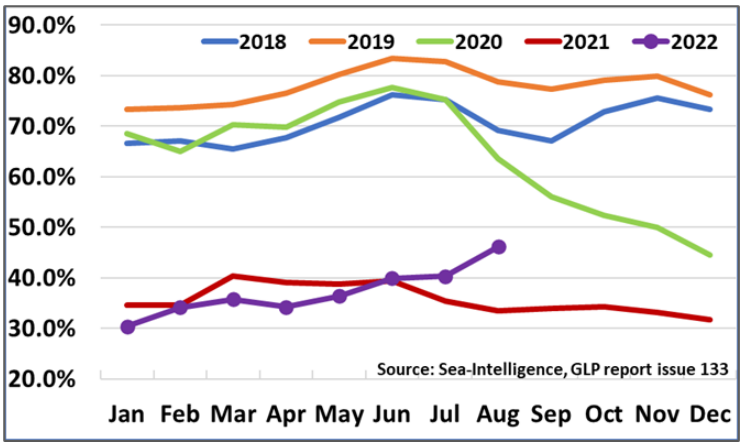

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Fig. 1. Global Schedule Reliability. Source: Sea-Intelligence, GLP Report Issue 133

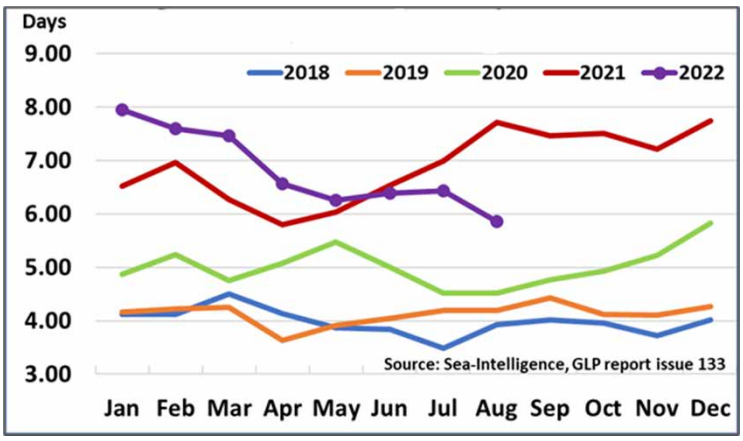

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Fig. 2. Avg. Delays for Late Vessel Arrivals. Source: Sea-Intelligence, GLP Report Issue 133

"QUICK ADJUSTMENTS ARE POSSIBLE ONLY WHEN INFORMATION FLOWS AND PLANNING PROCEDURES ARE DIGITALISED AND AUTOMATED."

Ocean Delivery Times indicator prepared by Flexport (see Figure 3), which measures the amount of time it takes for a shipment to travel from the port of departure to the port of destination. On the two main maritime routes, Far East Westbound and Transpacific Eastbound, transit times rose from an average of 50 days in 2019 to almost 120 days in April 2022. Moreover, this increase in shipping times have been accompanied by almost 600 per cent increase in shipping costs, due to an attempt to adjust supply and demand. These two factors together have led to important disruptions in the supply chains of large importers in North America and Europe.

High rate of disruptions calls for more agile supply chains in general and, in particular, for maritime terminals to respond quickly when original schedules cannot be followed. But quick adjustments are possible only when information flows and planning procedures are digitalised and automated. Unfortunately, despite the availability of technologies such as the internet of things, blockchain, cloud computing, digital twins, and artificial intelligence, many ports are still lagging in their journey towards digitalisation. In other words, most procedures are still carried out in person and communications are based on paper, or on rudimentary digital means such as email, with little structure that could speed up information processing and facilitate integration of diverse information systems. This implies greater inefficiency in operations and, in turn, greater vulnerability to the uncertainty of operations and the occurrence of disruptions such as those caused by the COVID-19 pandemic.

ABOVE
Ports in Chile

DIGITAL TRANSFORMATION FOR BETTER OPERATIONAL PLANNING

Digitalisation of port operations is a critical factor to enhance port resiliency when facing challenges and disruptions of port operations such as those that the pandemic COVID-19 has imposed, along with other geopolitical issues faced nowadays. Automating time-consuming and repetitive tasks reduces human error and improves workplace safety and productivity. Moreover, digitalisation of communications, planning and execution control allows for a much faster implementation of all kinds of adjustments necessary in case of a disruption. Efforts of digital transformation of ports can be classified at three main levels. At the first level, there are Terminal Operating Systems (TOS) that digitalise and integrate all transactions of

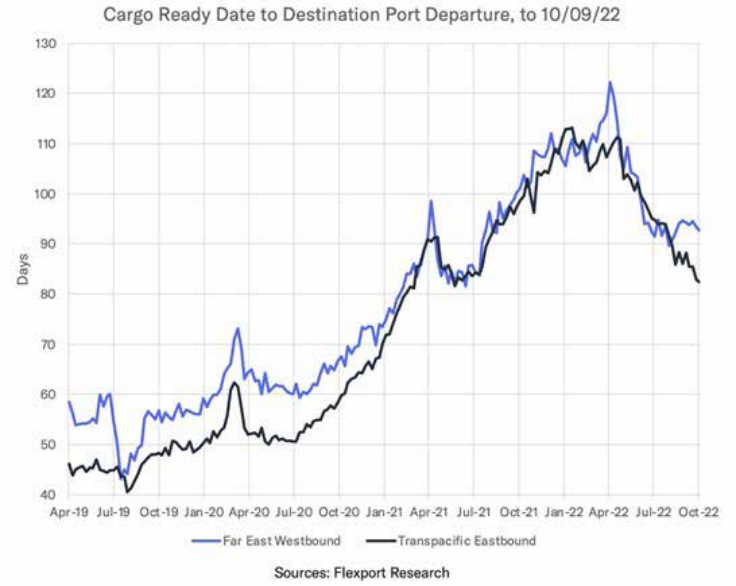

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Fig. 3. Ocean Delivery Times. Source: Flexport Research

"HIGH RATE OF DISRUPTIONS CALLS... FOR MARITIME TERMINALS TO RESPOND QUICKLY WHEN ORIGINAL SCHEDULES CANNOT BE FOLLOWED."

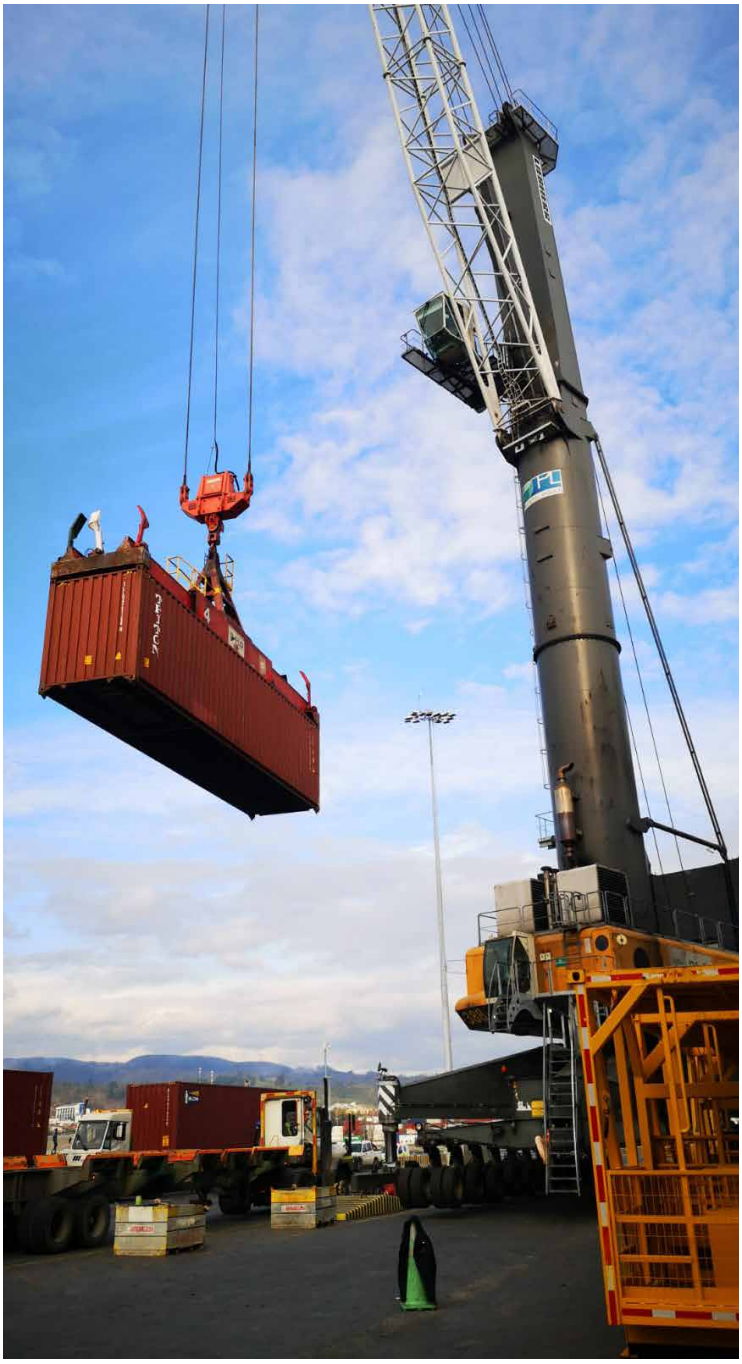
a terminal. At the second level, there are single window-based systems, that integrate the information systems of different stakeholders that are part of a port community, denoted as Port Community Systems (PCSs). Integration of data within a port community permits better planning and coordination among the stakeholders, reducing port congestion, waiting times and delays. Furthermore, visibility and traceability of cargo can be offered to the shippers and consignees to facilitate control of their supply chains. At the third level, there exist initiatives that foster integration between different ports. For example, the Port of Hamburg is networked with other ports to create a chain of smart ports around the world: the chainPORTs. This association, created together with the Port of Los Angeles, and which today also includes Barcelona, Montreal and Antwerp, poses the challenge of facing digital transformation with a collaborative approach.

DECISION SUPPORT SYSTEMS AS ENABLERS OF DATA-DRIVEN DECISION MAKING AT PORTS

In a port terminal, there are many discrete choices to be made when managing resources and tasks necessary to carry out the cargo transfer processes within a terminal, as well as the coordination of cargo transport to and from the hinterland. These decisions correspond to three areas of action: planning, execution, and control, and can be supported by systems called Decision Support Systems (DSS). These systems are based on artificial intelligence algorithms and mathematical models to support the decision maker, usually implemented as modules of the TOS with a user interface that may complement the transactional capabilities of the TOS.

For an example on the landside interface, consider a machine learning algorithm that helps to predict the dwell times of import containers at a terminal at which truck arrivals for the dispatching of import containers present high levels of uncertainty. Based on such predictions, better policies for stacking containers in the yard could be determined, resulting in lower numbers of container relocations (rehandles) needed when dispatching those containers to external trucks and better equipment utilisation at the port terminal. As other means of dealing with uncertainties and high peak demands on the landside interface, Truck Appointment Systems (TAS) or Vehicle Booking Systems (VBS) have been implemented in several ports to mitigate congestion. Such systems require port terminals to determine the assignment of gate capacity to the different containers expected to arrive. An algorithm or mathematical model that recommends slots assignment per service or segregation of containers may improve truck turnaround times and enhance yard equipment productivity due to an improved capacity management for all resources at the terminal. On the seaside interface, decisions associated with berth allocation to incoming vessels as well as quay cranes assignment and scheduling could be supported by machine learning algorithms that predict weather conditions and anticipate possible port closures, for instance, to proactively prepare contingency plans for such occasions. Or, reacting to a maritime disruption that has already occurred, a mathematical optimisation model could be used to quickly reassign resources to better respond to the new schedule, but still limiting the number of changes to the original plan – to quickly get an actionable recommendation for contingency management.

“A MATHEMATICAL OPTIMISATION MODEL COULD BE USED TO QUICKLY REASSIGN RESOURCES TO BETTER RESPOND TO THE NEW SCHEDULE.”



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Ports in Chile

LOOKING AHEAD

Disruptions originated by the COVID-19 pandemic, geopolitical issues, and other causes are likely to stay with us for the foreseeable future and continue to impact the maritime sector. So, it is mandatory to accelerate port digital transformation and adopt new technologies both at a transactional level (TOS, PCS, etc.) and at an analytical level (DSS) to enhance data-driven decision making. Ports are not alone on their way of digital transformation. They can seek guidance and help from technology service companies and research centres. Once digitalised data is available, DSS can complement the transactional systems in use, providing for a better and quicker decision-making.

ABOUT THE AUTHOR

Karol Suchan is Head of Centre for Innovation in Transportation and Logistics (CITYLOG) at Universidad Diego Portales, Chile.

Rosa G. González-Ramírez is an Industrial Engineer, Master in Industrial Engineering from Arizona State University, and Doctor in Engineering Science from Monterrey Tech in Mexico. She is an Associate Professor of the Faculty of Engineering and Applied Sciences at Universidad de los Andes Chile, Chile.

Luis M. Ascencio is an Industrial Engineer with Graduate Studies in transport planning and policy. Director of Porthink and SCM-think portals. Part-time professor at the Faculty of Engineering and Applied Sciences at Universidad de los Andes Chile, Chile.

ABOUT THE ORGANISATION

Universidad Diego Portales has been consistently ranked among the top 3 in Latin America, according to the Times Higher Education University Rankings.

Universidad de los Andes is a private research institution located in Santiago Chile. It has been ranked among the top 10 universities in Chile.