An Expanded JIT Approach

Improving synchronization across maritime global value chains

By Mikael Lind and Wolfgang Lehmacher | Photos by Jan Hoffmann

Congestion at places such as the Port of Valencia can be addressed with the introduction of slot time management.

The *Ever Given* incident in the Suez Canal in March 2021 brought global shipping into the news. Many were thinking about the massive delay caused when the Suez Canal was blocked for six days. However, the disruptions facing global supply chains today have a more structural nature and stretch far beyond ship operations. Seaborne supply chains are increasingly disjointed, and ports are insufficiently synchronized with ship journeys on the one hand, and multi-modal transport capacity in the hinterland on the other.

The hinterland is the area behind coasts or ports that the maritime industry serves for imports and exports through activities like handling, storage and the movement of cargo by various modes of transport such as road, rail/railways, river/barges, and airfreight. Record high ocean freight rates and rising costs of hinterland transport are a clear invitation to reassess current practices in goods flow management. With the supply chain under pressure, imbalances between demand and supply have led to a surge in prices to move containerized cargo over the oceans (see figure 1). Today's market sees premium surcharges of between $1,500 and $10,000 U.S., which are often attributed to equipment shortages and congestion at the land-sea interface.

The ports of the United States West Coast (USWC) are key to world commerce and a bellwether of current challenges. The California ports of Long Beach and Los Angeles in the San Pedro Bay area and Oakland near San Francisco together handle approximately 40% of U.S. imports from Asia. The delays at these ports reached unprecedented levels in May 2021, with some of the largest ships waiting weeks to get to berth. This has had severe impacts on both import and export cargo flows. Latest reports on the waiting time and the number of container vessels outside the Port of Los Angeles/Long Beach showed 82 as of November 15, 2021. It was 44 vessels as of September 9, 2021 and increased to 71 by September 17, after which a modest improvement to 54 vessels was seen around October 10—only for the development to be sharply reversed.

The congestion has been blamed on shortcomings in infrastructure and resource capabilities at both the ship-shore and port-hinterland interfaces. Manning availability at ports and in inland transport has been questioned. Hinterland transport capacity and infrastructure is seen as insufficient, with driver shortages appearing as a bigger issue than tight supply of chassis and trucks. But the situation is more complex than a simple shortage, as the reasons for constrained port infrastructure are many. These include COVID-driven temporary suspensions of port operations, and factory closures and stimulus packages fueling U.S. demand causing volatility and shortages of capacity, including ships, containers, trailers, trains, and vehicles needed for efficient intermodal transport operation as well as the behavior of the different actors along the chains.

Reducing demand or expanding supply would deblock the chokepoints and bring rates down. But this will probably not happen before 2023/2024, when new ships are put into service and additional semiconductor capacity is established. The driver shortage, however, may be here to stay until, at some point, autonomous vehicles may bring relief.

On the sea side of the chain, shipping companies and other maritime supply chain actors are working to develop mitigating strategies to reduce vessel waiting times and uncertainty about when a vessel will be served by a port. Such strategies include getting to the port area as quickly as possible or overbooking facilities. This also is wasteful, costly, and inefficient. Some shippers have taken

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extraordinary measures. For example, IKEA, the global home furnishing retail company, has begun buying containers and chartering ships. It is not the only one. The Home Depot is also chartering its own containership to ensure supply. These are just two examples of the unusual measures that companies are taking as they cope with the supply chain challenges. This is, however, just solving part of the problem potentially with the risk of containers getting stuck in destination ports due to lack of onward handling and transport capacity, capability, and understanding.

Behavior at congested ports

It is commonly assumed that, when confronted with congestion, ships drop anchor outside a port and sit and wait. However, it is more common for vessels to drift while waiting (if there is sufficient sea room) instead of taking up anchoring at a position where there may be a fee charged for anchorage. When a vessel is drifting, it can do so by using the auxiliary engine to produce power just for onboard purposes.

As of mid-2021, for example, the port rotation from Long Beach to Oakland—with a usual traveling distance of approximately 385 nautical miles—peaked at an average traveling distance of more than 1,600 nautical miles for the larger container vessels. For rotations from Los Angeles/Long Beach to the congested zone of Oakland/San Francisco, port congestion increased the usual steaming distance by a factor of about 4. For containerships traveling in the opposite direction (Oakland to Long Beach) in the same period, the distance traveled ranged from 389 nautical miles to 425 nautical miles, indicating that Long Beach was less congested and/or was able to manage more port visits, resulting in reduced waiting times.

Long Beach and Oakland are not the only ports facing extreme disruptions. Figure 2 shows global figures for containerships waiting outside ports globally.

Container port congestion will continue to occur and tends to move from location to location along capacity-constrained supply chain networks. For example, congestion at USWC ports was temporarily relieved with less ships traveling from Asia to the U.S. due to disrupted operations in South China ports. But the network knock-on effect is powerful and has a multiplier effect throughout the supply chain system. As the constraints eased in Asia, USWC congestion re-emerged at an even higher level. This volatile development also exerts significant pressures upon storage, warehousing, and hinterland transport capacities and operations.

The disruptions also are partly due to the decisions and behavior of supply chain actors. Reports indicate that some shippers are not picking up containers at the terminals, are holding empty containers too long, or are considering ships waiting outside the port as "convenient" storage facilities for their cargo. Shippers, carriers, and ports are optimizing their part of the chain in their best interest. While understandable, this may not be optimal for the overall system.

A better normal

The maritime industry basically has two options to reach a better normal.

One, the industry can increase the pool of equipment and expand capacity. This will take time and, in our opinion, is inherently inefficient. Shipbuilding faces a significant time lag of 1.5 to 3 years between order and delivery. Truck and other transport equipment assembly operations are slower than before due to the shortage of semiconductors and the impact of COVID.

Or two, the sector can introduce measures to handle more volume with the existing capacity.

In reality, in the longer term, we expect a combination of both solutions to materialize.

Optimizing the system means more synchronization along the whole supply chain, both between geographical hotspots and also between different modes of transport. Supply chain actors can also contribute—for example, by arranging faster pick-ups of containers at terminal sites and improving the flows and repositioning of empty containers. The ports on the USWC have become bottlenecks for imports and exports and

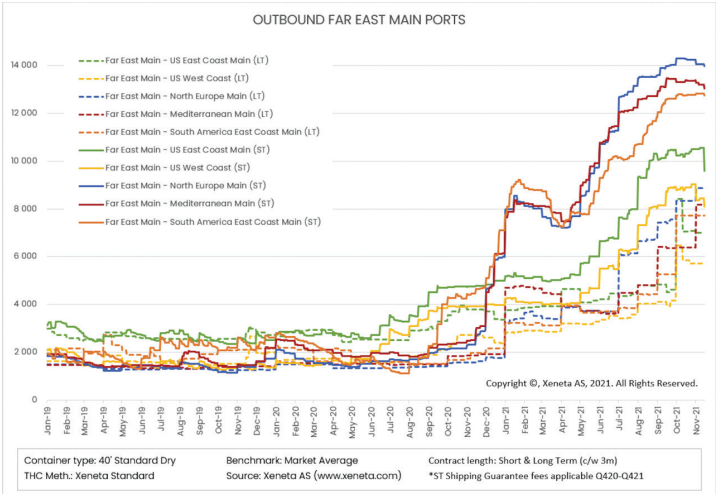

FIGURE 1: Development of long- and short-term freight rates for a 40-ft. container on selected trades outbound Far East main ports during the period from January 1, 2019 to November 15, 2021.

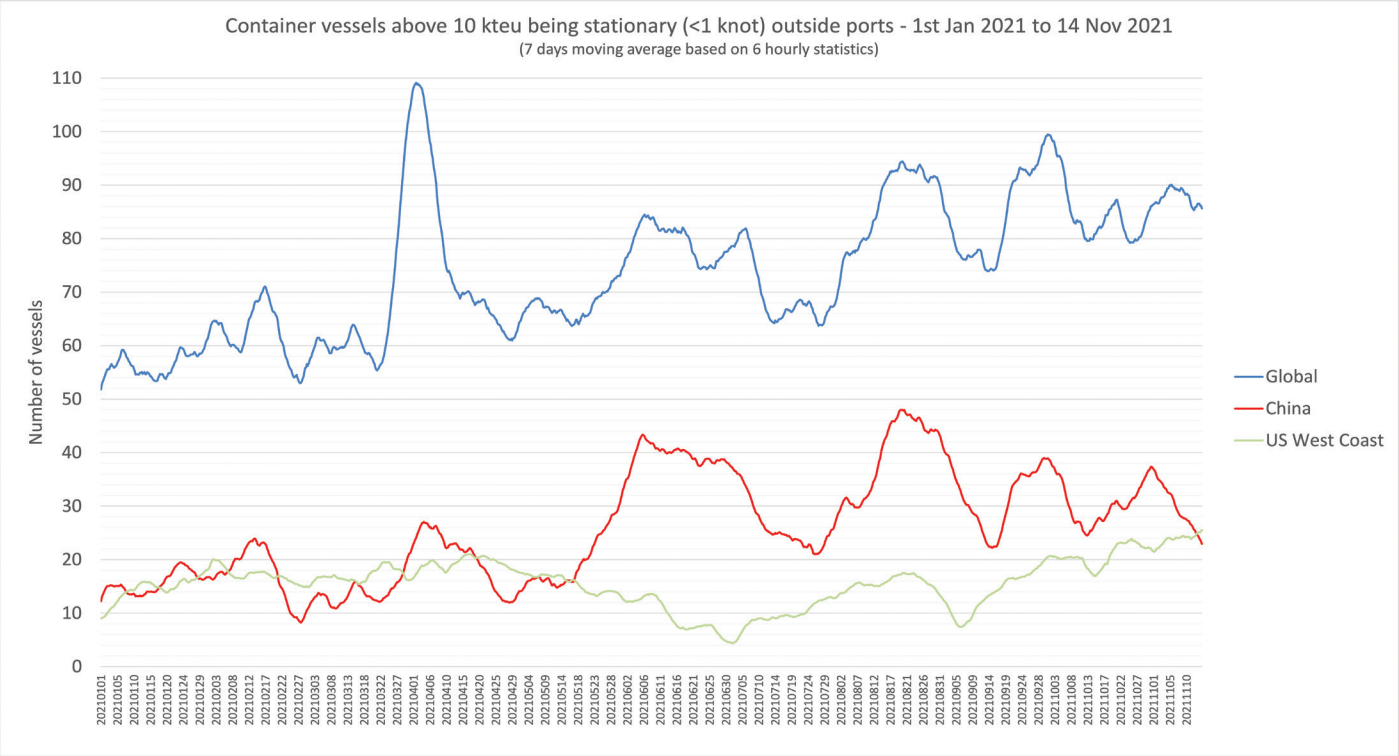

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FIGURE 2: Number of containerships being stationary outside ports globally and outside China and U.S. West Coast ports between January 1 and November 14, 2021.

the U.S. government is focusing extra attention on the matter. In other parts of the world, including China and Europe, container ports also are facing operational challenges to process container flows and deal with the ripple effects of disruptions caused by other bottlenecks around the world.

Our purpose here is to focus on improving asset productivity through an enhanced degree of visibility and synchronization.

Actors are at the same time part of the problem and the solution. The situation indicates that individual actors in the self-organizing maritime network optimize primarily for themselves, which produces sub-optimal results for the overall system. A behavioral change toward a more collaborative approach based on data sharing and more aligned practices may bring the breakthroughs for which many are waiting.

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Improving predictability

One promising initiative to improve the situation is the introduction of virtual vessel arrival and standardized data exchange for just-in-time (JIT) arrival promoted by numerous stakeholders associated with the maritime industry. The proposed JIT arrival approach, building upon virtual coordination, makes the case that a port provides a recommended time of arrival.

One way of avoiding the "hurry up and wait" syndrome is to introduce slot times that can be used in an elastic way, and under conditions that are governed collectively by the involved parties. When implemented in a transparent fashion, this gives beneficial cargo owners increased visibility and greater confidence, leading to less uncertainty, less need for inventory contingency buffering, and less money wasted.

Accordingly, we propose an expansion of the JIT arrival approach to incorporate a slot management concept resulting in a dynamic view and control of ship arrivals and departures. This would be informed by shared data, providing up-to-date progress and planning information on queues and waiting times associated with ports as maritime chokepoints.

Approaches for using slot times as a means for the synchronization of activities involving multiple parties is common in other areas of the service economy; for example, doctors' appointments and car repair, or producing a particular product where resources and infrastructure that are co-shared by many clients are planned to be available for the particular client at a specific time. This is also common practice in the aviation industry and for coordinating express deliveries.

It must be acknowledged that the maritime sector is characterized by relatively long journey times. Air transit will seldom exceed 48 hours, including intermediate stopovers. Even an intercontinental road transit delivery

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can be measured in days rather than weeks. Meanwhile, a trans-global ship journey could last many weeks with a number of intermediate port visits. This means many more opportunities for conditions to change en-route (weather, breakdown, port delays and so forth), resulting in more unpredictable and sometimes cumulative delays or disruptions during the journey. Therefore, any time slot mechanism adopted for port calls must be much more dynamic and capable of adjusting for such ongoing changes. This can be achieved through improved data sharing between all of the involved actors and by adopting the principles of Port Collaborative Decision Making, or Port Call Optimization.

Introducing slot time management will change the relationship between container shipping companies and ports.

Slot management

Adopting the concept of slot management can ease current pressures. As is the case for other practices grounded in the appointment economy, the slot time is the unit of analysis, allowing us to move beyond coordination based on physical arrival and the principles of first-come, first-served. A slot time provides each involved actor, on a fair and equal basis, with the opportunity to plan ahead, regularly monitor progress and coordinate their activities toward the common goal of satisfactory, predictable, and timely delivery. At the same time, supply chain visibility for all of those that need to know is improved, meaning less nasty surprises necessitating adjustments at short or no notice.

We see opportunities in expanding the model of JIT shipping to cover a range of typical scenarios by delimiting arrival and departure slots. In this context, predictions of departure are important, as these provide an understanding of when the infrastructure being used for one ship can be made available for another.

SCENARIO A is just-in-time arrival based on previous port departure times, allowing for optimal steaming speed.

SCENARIO B covers delayed departures from previous ports. There are two options for the ship to synchronize with the destination port. B1 is to increase speed to the next port (less energy efficient, causing more GHG emissions); or B2 is to agree a new slot time with the port of destination and then steam at the speed originally planned or at an adjusted speed.

SCENARIO C is constrained infrastructure at the port of destination. Three alternatives have been developed. C1 is the ship stays alongside in the previous port for as long as possible. This alternative, however, requires that the origin port charges lower rates for this extended port stay.

C2 is the ship anchors outside the port of destination. This alternative assumes a minimal anchorage fee providing incentives for the ship to stay at anchor rather than loiter/drift outside the port area.

C3 is the ship anchors somewhere on the way toward the destination. This, however, requires that anchoring areas be established at different locations along trade

routes throughout the world to mitigate for congestion at ports of destination.

The need for data sharing

A well-functioning, dynamic, and responsive slot management regime depends heavily on data sharing that involves and enables all affected actors to share data to create a common situational awareness and knowledge of what is going on. Everything builds upon trust in the slot time at the port of destination, as this relates directly to the destination port's capability to serve a ship and a ship's ability to arrive and depart on time. This can only be achieved by ships and ports collectively and continuously providing information on the predictions of arrival and departure times. Consequently, taking mitigating actions when disruptions occur also is critical. This is the basis for both managing and rescheduling timeslots.

The data management and the synchronization could be organized on neutral global platforms (one or more that are ideally interconnected) to which all actors are connected. Providers would ensure data security and system integrity. The digital platforms would be connected to port and vessel systems.

Slot times as a foundation for maritime supply chain visibility enable cargo shippers to receive up-to-date information about possible delays and help shipping companies to make well-founded decisions on how best to serve their clients. The optimal speed and route to destination are decisions to be made by the shipping company and a ship's captain based on the timing and possibilities that a port offers to serve the ship.

Introducing slot time management will change the relationship between container shipping companies and ports. Contracts will need to be rethought and operating practices redesigned; information systems will need to be aligned and protocols harmonized. The solutions and bodies to drive harmonization exist today, at least partially. It is the belief or otherwise in the benefits of data sharing and data usage that will determine whether the maritime industry will move in this direction.

The maritime sector can take important steps to establish the foundations for enhanced predictability serving all parties equally, rather than sub-optimized for one particular group. The introduction of slot management throughout the global supply chain would enable different modes of transport to be synchronized in relation to each other, bringing enhanced use of available resources. Although slot management is not the silver bullet to solve all maritime network problems, its data sharing aspect will bring more situational awareness, which can drive behavioral changes by the various stakeholder groups that may contribute to a more optimized and balanced system overall.

There is a lot of hype around the reports of congestion emerging at various ports of the world. But those who have worked in this field have been warning of this issue not just for months, or for years, but for decades. The ports are a bottleneck, but they are not the only challenge. We need to look into the supply chain from a holistic point of view, leverage technology, and implement new practices to raise the level of synchronization across the whole supply chain and between all modes. In light of the severe disruptions, it seems now is the time to use data to better understand the impact of individual behaviors and deal with the current challenges in a more data-driven collaborative way. This could both address current issues and stand world seaborne commerce in good stead for the future to optimize finite resources for the common good. **MT**

Container ports, such as the Port of Cartagena in Colombia, often face operational challenges to process container flows and deal with the ripple effects of disruptions caused by other bottlenecks around the world.

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