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Ships and Port Idle Time: Who are the Culprits?

by

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Overview

We introduced the problem of ship idle time during port visits in an earlier concept note.[1] In this note, we estimate an average idle time for a container ship's port call to be 1.85 hours. This figure might be lower for some other ship classes (ferry traffic and cruise ships) while it is typically higher for bulk and other traffic not running on a fixed schedule. At any rate, the missed opportunity cost for container ships alone exceeds EUR 100 million, and this is just for the European ports. Futhermore, an analysis of Maersk reveals what coordinated port call events could mean for the industry and identified potential of 4bn EUR overall. This concept note identifies the 'culprits'.

As we shall show in this concept note, there is no single culprit or culprits in the port. Rather, the culprit is in the overall organization of port calls, or more correctly in the lack of a coordinated, synchronized procedure for making effective port calls based on up-to-date timestamps and transparency of information sharing.

This concept note is a more detailed discussion and extension of the discussions and supplements of an earlier concept note.[2] We first provide a short account of how to estimate the total loss caused by idle time, followed by a detailed classification of the port call actors according to the significance of their role - one might even say, their relative part in the culprit burden. Thirdly, we present how Port Collaborative Decision Making (PortCDM), as one of the enablers of the Sea Traffic Management (STM) concept, might substantially contribute to a reduction in the ship idle time in connection with port calls.

A successful PortCDM implementation needs to cover all ship types, including Cruise, Ferry, RO-RO, Dry & Liquid Bulk, etc. However, in this concept note, we use only data from the container ship segment, which is the most significant in size and has a reasonably high-level of complexity.

[1] Lind M., Ward R., Michaelides M., Lane A., Sancricca M., Watson R.T., Bergmann M., Andersen N-B., Haraldson S., Andersen T., Park J., Theodossiou S. (2018) Reducing idle time with collaboration and data sharing, Concept Note #16, STM Validation Project

[2] Ibid

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Introduction

A ship's port visit can be seen as a series of episodic tight couplings, when two or more actors must jointly synchronize their activities. Examples of such couplings include ship and pilot, ship and tug, ship and linesmen, and ship and terminal operator. To maximize capital utilization, episodic tight couplings should be organized to minimize the idle time of the most expensive resource - typically the ship. Ideally, a port visit should consist of a series of synchronized just-in-time couplings for the ship. However, the shipping industry currently falls short of this just-in-time goal.

Estimating the costs of idle time

In 2017, the 38,425 container ships calls at Europe's so-called Tier 1 and Tier 2 Ports,[3] [4] collectively spent 71,202 hours waiting to enter the ports – an average of 1.85 hours per port call. Depending on the "*value of an hour*", this might amass to an industry value loss in excess of EUR 100 million per year for container ships.

Data about container ship port calls were sourced from the JOC/IHS-Markit Port Productivity Database. The berth time data were provided by the majority of the global container ship operators who collectively operate 67% of the global cellular ship fleet in terms of capacity. With over 180,000 port calls captured in 2017, from which a total of roughly 350 million TEUs were exchanged at 798 container terminals in 451 ports, this represents fractionally under 50% of all container terminal activity globally.

The data provided by the ship operators and the proprietary IHS-Markit historical AIS database were merged to determine the arrival and departure times at ports of call. IHS-Markit has been able to match 87% of the port calls submitted by the ship operators with realistic and accurate AIS data, and it is only these which were used in our analysis. We did not include any records where the time between port arrival and berth arrival exceeded 72 hours, as any such ships may have been idling for reasons other than deficiencies in port planning or operations.

The time difference between arrival at a port's control area and berth minus the standard steaming-in time yields the idle or waiting time per ship call.

The industry value loss that we quote assumes that for every hour a ship is idle, it also spends one hour less sailing and therefore needs to sail at faster speed (even if only slightly) to maintain its

[3] In PortCDM/STM, Tier 1 and 2 ports are defined as ports which receive and handle at least one regular (weekly) call by an inter-continental ("deep-sea" or "ocean crossing") container ship service. There are 55 such ports in Europe. For this purpose, we define Europe as including all ports along the coasts bordering including Baltic Sea, North Sea, English Channel, Irish Sea, Atlantic Ocean, and Mediterranean Sea (including ports within North Africa) and Black Sea.

[4] Lind M., Michaelides M., Watson R.T., Andersen N-B., Bergmann M., Haraldson S., Andersen T., Ward R., Sancricca M., Gerosavvas N., Heidecker A., Lane A., Gimenez J., Ferrus Clari G., Gonzales A., Richarte M. A. M., Voskarides S., Pouros G., Deosdad I. (2018) Extending the boundary from ports to hubs: A new role for container terminal operators, Concept Note #15, STM Validation Project

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schedule and thus consumes more fuel. This is a direct cost to the ship operator as well as increasing environmental pollution in terms of raised CO2, SOX and NOX emissions.

Root-causes of Port to Berth delays

There can be many reasons and root-causes for idle-time delays.

In our concept note 16,[5] we identified three major causes for port to berth delays based primarily on container ship operations: port/terminal congestion, weather, and terminal operating inefficiencies.

Port or Terminal Congestion – During the 2001-2006 period, port congestion was rife globally, as worldwide container demand was growing at 10-15% per year, and ports and terminals were struggling to bring new capacity on line to meet this escalating demand. However, since 2008, triggered by the global financial crisis, container demand growth has been far more modest at 3-5% per year, and the ports and terminals have generally been able to maintain sufficient handling capacity.

Even when port or terminal congestion prevails, this does not automatically mean that idle times will increase as just in time ship arrival at ports can still be achieved. As we have described in an earlier concept note[6] delays and disruptions to plans and timetables can be diminished through closer collaboration among all the key actors in the maritime transportation chain, assisted by better communication, accurate timestamps, better transparency and the sharing of relevant plans – in essence, PortCDM.

Internationally, the most notable examples of port congestion have been at Chittagong, Manila and Santos in 2017. However, as none of these ports are in Europe they are not reflected in our analysis figures.

Flying into Istanbul, one cannot avoid noticing the huge number of ships waiting to pass through the Bosporus Strait going north, with a similar number of ships waiting in the Black Sea in order to go south. In order to increase safety, most ships (over 75 meters in length) are only allowed to sail through the Strait in one-way traffic (cruise and military ships are exempt from this rule due to international agreements). However, for any cargo ship this means that traffic is only allowed in one direction for six to eight hours, before the flow is reversed. This comes on top of other congestion in this extremely crowded waterway. In some situations, cargo ships have been delayed for up to two days in this bottleneck even though Turkish authorities do their best to optimize traffic dynamically based on the information that they received about the ETA of ships.

[5] Lind M., Ward R., Michaelides M., Lane A., Sancricca M., Watson R.T., Bergmann M., Andersen N-B., Haraldson S., Andersen T., Park J., Theodossiou S. (2018) Reducing idle time with collaboration and data sharing, Concept Note #16, STM Validation Project
[6] Ibid

Weather related delays – Especially in northern Europe in the November to February winter period, fog, snow, high winds, and similar extreme weather conditions can result in the relatively sudden temporary closure of ports which can lead to an increase in idle time.

While one cannot realistically avoid sudden extreme weather conditions, providing the earliest possible warning to all the actors in the transportation chain can still reduce the impact by allowing for plans and resources to be adjusted in a timelier manner.

Terminal Operating delays – These are most commonly caused by sudden equipment breakdowns and this has a significant impact when it involves highly utilized equipment. In theory, when equipment is released for planned maintenance as per the manufacturer's recommendations, then it should not fail – but it does. In such situations, keeping all the downstream actors informed is vital to avoiding cumulative delays and to maximize the efficient use of the available resources.

Finally, some ships have cargo operations longer than their pre-arranged berth windows or expected completion times. In many cases, this is caused by the incorrect or late provision of vital planning and progress information between actors coupled with an absence of collaboration.

It is clear that a more dynamic berth and port planning process would benefit all actors involved by informing them in a timely manner of changes that may affect their operations. This is exactly what PortCDM is all about, because it seeks to avoid or minimize the impact of all three of the sources of delay described previously, and we shall return to this issue in the last section of the concept note. The proposed implementation of one global standard also means that shipping lines, terminal/port operators, and global service companies, like tugs, only need to integrate and adjust their information systems to one standard, not one per port. This will increase the adoption rate and reduce cost.

Process Actors

In order to identify potential improvements, and to develop specific solutions, it is important to first understand the actor hierarchies (decision makers) involved in the planning processes.

We have classified them into three groups, primary, secondary and tertiary actors.

Primary process actors

1. *Ship Operators***.** Ship operators are the ultimate "decision makers" when it comes to planning and fine-tuning port calls and terminal stays. If a ship is delayed within a port/terminal, the ship operator must decide whether to:
   - extend the ship's stay, then steam faster to maintain the expected arrival at the next port;
   - extend the ship's stay, steam at the originally intended speed and then arrive later than expected at the next port/terminal; or

- cut and run (leave cargo behind) in order to sail as per the original schedule, steam as per the existing plan and arrive at the next port on-time.

Only the ship operator can make this call, and the decision-making process can be highly complex because of the multiple profitability impact factors to be considered.

2. *Terminal Operators.* We place terminal operators slightly ahead of port operators (Authorities) within the decision-making hierarchy on the basis that in many Tier 1 and Tier 2 Ports, the port services and channel navigation provided by the port operators are generally available with only limited possibilities for disruption. However, where this is not the case, the port operator assumes our #2 position. A terminal operator's decisions are normally driven by:
   - utilization, especially at both quay wall and quay crane;
   - honoring service commitments (to the ship operators), either as they exist within Service Level Agreements (SLA's) or as previously committed to; and
   - minimizing costs, through avoiding over-time costs as well as running minimum quantities of equipment to reduce energy costs and wear-and-tear.
3. *Port Operators.* Most are government-controlled (central, regional or local) entities. They are driven more by objectives like facilitating business rather than generating profits. Safe navigation clearly is their highest priority. They often also need to balance the requirements and priorities of different ship types, multiple ship and terminal operators as well as the requirements of the port as such. In this concept note, we have assumed that pilots are employed and assigned by the port operator which is the most common model, however where this is not the case, pilots/pilotage process requirements may be considered as secondary process actors.

<u>Secondary Process Actors</u>

Secondary process actors are those that play a direct role in the berthing and un-berthing of ships within a port but whose decision-making is driven by the primary actors. Where a secondary actor has capacity constraints, they might assume the role of a primary actor. However, this is potentially only temporary, as scaling their services and capacity to facilitate the needs of the primary actors can usually be accomplished relative quickly.

1. *Tug Boat Operators.* These might belong to the port operator. In some ports they could also be a sub-division of the terminal operator(s) but acting somewhat independently. A more common model, however, is that they are stand-alone entities within the port eco-system and there can often be more than one operating within a single port. Within the planning processes, they are generally served by being informed of needs and changes and then optimizing their resources to satisfy the requirements of their customers – who are generally the ship operators. In the event that constraints exist and that the plans

made by the primary actors cannot be executed, there is and will always need to be a feedback-loop for re-planning ship arrivals and departures.

2. *Mooring Services.* These fall under either/or the terminal or port operators, or they can be stand-alone private service providers. Any constraints are driven primarily by labor shortages, and while this might be considered as rare, it happens, certainly for temporary periods. The mooring service providers operate within the ecosystem in a similar way to the tug boat operators, where they need to have access to dynamic and accurate information to be able to plan/re-plan their resources, and in the event that they cannot execute the plan, they need to notify the primary actors.

Tertiary Process Actors

Tertiary process actors do not significantly influence the port and terminal planning processes, but they still need to receive planning and progress information in order to execute their tasks and deliver services on time or just-in-time. Their needs are summarized as follows:

1. *Regulatory.* This includes Customs, Immigration, Port Health, Safety, and other entities that perform a number of “clearance activities”. They need to know the arrival and departure timings for ships.
2. *Husbandry Agents and Suppliers.* Need to synchronize their deliveries, supplies or services to meet the schedule of arriving and departing ships.
3. *Bunker providers.* Need to synchronize their activities to meet the ship’s schedules.
4. *Importers, Exporters and their Agents.* Need to understand deadlines (exports) or dates/times of availability (imports) of the cargo/containers being exchanged by a ship.
5. *Feeder ship and Barge operators.* Need to adjust their “schedules” based on any changes to scheduling experienced by the deep-sea ships that they service/connect with.
6. *Rail and Truck operators.* Need to adjust their plans when changes to ship schedules occur.
7. *Co-loading parties.* These might include Alliance partners, Vessel Sharing Agreement (VSA) partners, Slot Charter parties, etc. As their operated containers (cargo) are affected, and deadlines might change, they need to be aware. However, they usually play no part in the decision-making processes, which are the sole prerogatives of the ship operator.

All tertiary process actors require outputs (information) from the overall process but do not normally need to provide any inputs, unless authorities detain a ship.

Basic Planning Processes

For port calls, there are three distinctly different processes:

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1. Pro-forma Plans. These are baseline plans that are made/amended infrequently. Any decisions are usually reached well in advance between the ship operator (who typically will have already discussed and agreed standard schedules with its Alliance members or VSA partners) and the terminal operators.
2. Initial Plans. This is a one-off process, the link between pro-forma and dynamic planning, where the detailed plan for the named voyage initially is created. The data requirements are the same as for the dynamic planning process and this data input then feeds the dynamic processes.
3. Dynamic Plans. This is the process where any disruptions to the Initial Plans are handled. Changes are primarily driven by port ETA changes announced by the ship operator, which in all likelihood are driven by changes in the ETD at previous terminals (in previous port). Such changes can occur at very short notice and they potentially impact the schedule and plans of many down-stream ports, terminals and other actors.

In the preceding list, the first two are not short-term or daily activities; we have not considered them as part of the initial PortCDM solution. However, the data that they generate as outputs could be useful input in PortCDM and serve a purpose from a statistical or analytical perspective. It would assist the assessment of overall scheduling success, as well as the reliability and accuracy of forecasting and planning.

The Dynamic PortCDM process

As we have highlighted in this concept note, PortCDM has the potential to address many of the shortcomings and time-losses in the port call process. Importantly, PortCDM does not call for process changes but proposes to facilitate a more dynamic and effective delivery of existing processes through enabling greater collaboration through higher quality data made available almost real-time to all the relevant actors in the maritime transportation ecosystem.

The PortCDM process is intended to be dynamic and transparent through the use of standardized messaging and interfaces that trigger and prompt the various actors to review exception alerts and take actions based upon their physical capabilities, preferences, and requirements. As actors amend individual plans within ports, this then affects subsequent ports and terminals, and revisions to their planning processes should therefore be dynamically handled. Thus, there could be several or multiple revisions required during a single port call.

The following flow chart,[7] illustrates the procedure that the primary actors would follow when an existing plan is no longer executable due to delays at the current terminal. In the event of a delayed (at sea) ETA, the process would be initiated by the ship operator at the "Change in ETA" box. The

[7] Ibid

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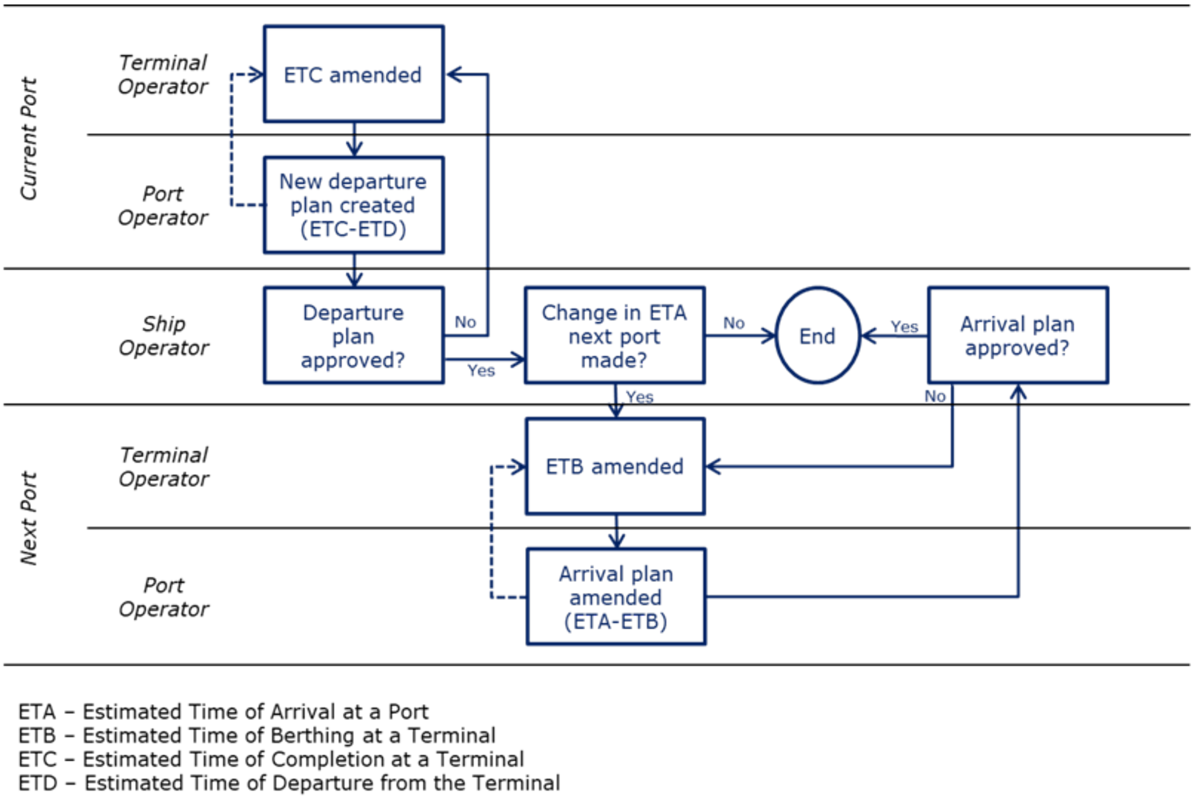
normal progression follows the full lines. Dotted lines indicate repeat loops where a planning process must be redone or re-worked.



In relation to the flow chart, readers should note that:

1. "*Ship operator*" can include the local agent, the ship operator's regional or global management function as well as the ship's command.
2. The entry point for the port and terminal operators will usually be the local agent who will discuss any disruptions with the regional/global management, after which new plans are communicated by the local agent to the ship's command (Captain or Chief Officer). With greater accuracy and visibility of a ship's overall situation facilitated by a PortCDM solution, it might be possible for the regional/global function to assume a more direct control and communication with both port and terminal operators as well as the ship's command.
3. There is a dotted-line feedback loop between the Port and Terminal operators at the current port indicating that the optimal channel slot and/or pilot availability cannot be provided. In this case, the terminal and port actors would need to jointly develop an executable plan that could be sent for approval by the ship operator.
4. Where the disruption of current plans is the result of a delayed ship already in transit, the first process step would be "Change of ETA next port made?" This would be triggered by the ship operator.

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5. Where the terminal at the next port cannot berth a ship in line with the ship operator's request, there could be a dotted-line feedback loop, where the terminal (or port) operator could select a reason from a limited list and provide some "free text" options in a PortCDM software information interface.
6. Where inclement weather, channel congestion, pilot shortages, etc. impact either the ETB or ETD, a port operator would initiate a re-planning process by updating either of these dates/times - for which both the terminal and ship operators would be alerted to also revise and update their own plans.

Conclusions

STM concepts, including PortCDM, deal with relationships and dependencies between ports, the sea voyage, and port operations. Information flow about both intentions and actual events in the entire transport chain is extremely important for reducing idle time.

Conservatively, we have identified in excess of EUR 100 million per year in potentially opportunity costs because of idle time, for container ship operators when arriving in Tier 1 and Tier 2 ports in Europe. If we were to include all ports (including Tier 3), all regions of the world, plus all other ships, this number would be significantly larger.

Currently, all actors in the maritime transportation chain act as best they can, given the current levels of information available to them. The culprit in terms of incurring unnecessary idle time for ships is the current deficiency in the digital information infrastructure, which cannot provide up-to-date, accurate, timely, and transparent data.

While the entire efficiency gap cannot be eliminated, a concept such as PortCDM could generate substantial benefits for ship operators by reducing the gap significantly. Perhaps even more importantly in present times, less ship idle time and more efficient steaming will assist in reducing environmental pollution.

As we have stressed multiple times, PortCDM is a concept, and as we develop and implement this concept in more ports, we have an opportunity to learn from the world's best practices in just-in-time episodic tight coupling. It is possible to learn from the best and the brightest of those who consistently have the least idle time and the most efficient processes in each stage of a ship's port visit. If we systematically analyze global best practices and incorporate them into PortCDM, ports will gain from emulating the behaviors and the processes of the champions for each type of episodic tight coupling

There is no doubt that the PortCDM concept can be a win-win for ship operators and port/terminal operators, and the environment. Nearly all actors could better utilize their fixed assets and resources. Furthermore, the PortCDM concept does not require radical process changes. What it does do, is facilitate improved decision making and planning in a more dynamic way by making use

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of reliable, up-to-date operational data and forecasts. Furthermore, these data could also feed into the secondary and tertiary actors' processes for them to gain efficiencies. Through this enhanced information transparency associated with sea transport, the task of coordinating the use of organizational assets (such as the task of fleet operating centers) or advising movements in geographical areas (such as the task of VTS/Shore Centers) would also be enabled to perform with higher precision. Finally, in our view, the PortCDM solution can be implemented economically using established technology, while at the same time preparing for tomorrow by preparing for emerging contemporary technologies.

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