Rethinking transport
27–30 April 2020

TRA 2020 HELSINKI

Proceedings of 8th Transport Research Arena TRA 2020, April 27-30, 2020, Helsinki, Finland

Ship departure time estimation and data sharing practices in Finnish ports

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Abstract

In ship port calls, cost efficiency and minimum duration are important. For that, port actors need up-to-date information on the ship's readiness to sail.

The paper focuses on the availability and quality of the ship's estimated time of departure (ETD) information. Based on interviews, a workshop, port information systems and channels observations and regulation analysis, paper studies how the ETD in Finnish ports is generated and how the information flows to its users.

The results show that ship clearance process is the key to the official ETD formation. Agent enters ETD into Portnet system, which automatically distributes it to several open channels. However, Portnet does not support updating the ETD or presenting its uncertainty. Port actors follow different media and typically combine a situational awareness spreadsheet for themselves. That requires manual work and poses a risk of "multiple truths". Thus, ETD data sharing should be automated instead of manual processing.

Keywords: maritime traffic; port call; estimated time of departure; data sharing; Portnet

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SHIP DEPARTURE TIME ESTIMATION AND DATA SHARING PRACTICES IN FINNISH PORTS

1. Introduction

In merchant vessel port calls, cost efficiency and the shortest possible duration are of high importance (Alderton 2014; Ducruet and Merk 2013). The vessel does not generate income for the shipowner while docked. The port authority and the port operator on the quay want the berths to rotate fast. Unnecessary idle time may also have impact on the next port of call of the vessel. On the other hand, less time spent in ports could enable reduced sailing speed at sea, which decreases the ship's CO_2 emissions (Johnson and Styhre 2015).

The port is a multi-actor environment where representatives of many different organizations work for a smooth port call and the efficiency of the entire logistics chain (Merkel 2016). The challenge is that different parties act according to their own interests, but still no-one can act alone – cooperation is necessary. Whereas the duration of the port call, or the turnaround time, depends most on the quantity of cargo to be unloaded and/or loaded (Iikkanen 2018), certain ship, cargo or documentary checks may also take some time. Furthermore, vessel may also need external assistance from the port for departure, such as linesmen, towing, pilotage and icebreaking. Problems with the availability of the vessel services may delay the departure even if the ship would otherwise be ready to sail.

To be able to allocate limited resources properly and be capable of delivering timely services to vessels in a cost-effective manner, the service providers need as accurate and up-to-date information as possible on the ship's readiness to sail. In the future, the importance of high-quality time information will continue to grow, as maritime logistics will be digitalized as part of the development of the entire transport system and tasks carried out by humans are performed by data-based digital systems (Heilig et al. 2019).

Earlier research on vessel port time information has mainly focused on the arrival of the ship (e.g. Jahn and Scheidweiler 2018; Pani et al. 2014; Lang and Veenstra 2010). However, studies focusing on the availability and quality of the estimated time of departure (ETD) in ports remain absent.

This paper focuses on ETD information, which is transmitted in a digital form. The paper has two main research questions (RQs):

RQ1. How is the digital ETD information in Finnish ports currently generated? By whom and on what basis? What is the process of knowledge formation? What development needs can be identified in knowledge formation?

RQ2. How does the departure time information flow to those in need? Who are the parties involved in the ETD process and who base their activities on it? In which channels and media does the time information appear? How to describe the data stream? What are the development needs for access to information?

This study focuses on Finnish ports, but the results are comparable to all locations that have similar arrangements for port operations. For comparison and discussion, a brief literature review is provided on the solutions outside Finland.

2. Port call collaboration and information sharing outside Finland

In order to improve the flow of information and collaboration, port community systems (PCS) have been established in several ports around the world. Instead of traditional bilateral communication, information – e.g. departure time data – is gathered in one place, accessible to all parties. PCS systems seem to focus on large ports, especially ports for large containers ($\geqslant$1 million TEU/a). Well-known European systems include PortBase in the Netherlands and DAKOSY, which started in the 1980s in the port of Hamburg. There seems to be only a few PCS systems in the Baltic Sea region and none in Finland. (Posti et al. 2010.)

Recently the focus has shifted from port-specific systems to industry-wide standards in information sharing. The Sea Traffic Management project – led by Swedes – has created a Port Collaborative Decision Making (Port CDM) concept (Lind et al. 2018a). The concept aims to improve port access by defining internationally and collectively used operating models and technical details for port communication. Better information sharing, concerning for

example departure time, should improve port fluency and performance. Also, from the vessel's perspective, fluency is important. According to a previous study, the average non-productive waiting time at departure was approx. 1.5 hours. (Lind et al. 2018b). The waiting time could be reduced to an estimated half an hour by improved collaboration and information sharing, which would mean about one hour of time savings per port call.

3. Study design, data, and methods

To be able to answer the defined research questions, data was gathered from four main sources: 1) interviews; 2) observing port information systems and time information channels; 3) analysing port call regulation; and 4) an expert workshop.

Interviews to port community members (20 persons) were conducted between September–November 2018, and the aim was to examine the significance of time information from the perspective of different actors. Interviewees represented a wide range of port call actors (shipowners, agents, port authorities, terminal operators, pilotage, ice-breaking, towing, VTS and Finnish Transport Agency). In addition, one aviation expert was interviewed for understanding the possible similarities to aircraft airport visits. All interviews were personal one-to-one interviews with a loose structure enabling respondents to present their own ideas and comments on the topic.

Interviews were augmented by observations to port community IT systems and time data media. In addition, regulation concerning port calls was analysed in depth. Final form of data collection was an expert workshop (40 participants) in March 2019. The aim of the workshop was to validate earlier findings and acquire new viewpoints.

4. Results

4.1. Generation of ETD

The key factors to the formation of official departure time information are the ship's port agent (either shipowner's internal personnel or external agent company) and the ship clearance process. The agent acts as a producer and intermediary of information. When assessing the duration of the port visit, the cargo handling and vessel service needs are considered. The time of the year and the conditions also affect in the Baltic Sea region. In assessing the duration of cargo handling, the agent utilizes his/her own experience-based knowledge, information on cargo operator's handling capacity and numerical data from various technical documents describing the effectiveness of terminal cargo handling. As cargo handling is the most important factor in the duration of port operations, cooperation between the ship's agent and the port operator is crucial.

In Finland, there are no PCS systems in use. The closest example is the mandatory vessel traffic reporting system Portnet (Finnish Customs 2019). The agent establishes a port call to Portnet and announces the estimated departure time, which forms the official departure time information (Fig 1). When the background factors change, the ETD should be updated actively. However, according to users, Portnet is poorly usable for real-time updating of the situation and enrichment of the time information. Agents do not actively update the situation during the port visit to Portnet, nor does it have any incentives.

Fig. 1 Generation process of departure time pre-information before the port call

4.2. ETD information flow and data utilization

Once the agent has inserted the ETD information into Portnet, some port actors (other agents, port and maritime authorities) can access it directly from there. All port community members don't have user rights to Portnet. Therefore, the time information entered into Portnet is automatically distributed to different open channels, such as the PortTraffic portal (www.porttraffic.fi), Traffic Management Finland's "Liikennetilanne" service (Liikennetilanne.tmfg.fi), port authorities' websites and Finnpilot's traffic list (www.finnpilot.fi). Also, unofficial data sources like timetables, AIS services (e.g. www.marinetraffic.com), Baltice service (www.baltice.org), weather services and enterprise information systems are utilized for defining vessel departure times. These provide secondary type of information compared to official Portnet data.

Based on these departure time sources, different port call actors each typically create an excel spreadsheet for themselves for situational awareness purposes (Fig. 2).

In addition to the official Portnet information, informal but potentially high-quality information on the ship's readiness to depart is flowing in ports. The informal information is distributed mainly through bilateral communication: e-mail, telephone, face-to-face, or radio.

Chartering mode, technical characteristics, master qualifications and cargo type are important for the ship's ability to leave the port on schedule. Liner vessels are very predictable for the vessel service providers. Approximately in 2/3 of all Finnish port calls pilotage is not used. A significant part of the remaining third consists of rarely visiting tramp vessels. These types of vessels carrying weather sensitive bulk cargo are the most uncertain types in their departure time estimate. Thus, the most difficult for vessel resource resourcing are rarely visiting ships that need tugs, pilotage and icebreaking.

In Portnet, there is no possibility to take a stand on the uncertainty of the time estimates because the data is entered in a numerical format and the system offers no designated place to insert either qualitative or quantitative estimate of the time uncertainty. When the agent cannot express the uncertainty of the estimated time of departure, they may utilize the actual time to encode the uncertainty. As an example, uncertain departure times may be labelled in Portnet with "17 over", such as ETD 14:17. The interviewed agents say they have copied this protocol from pilots.

The pilotage company Finnpilot has a dual role in sharing time information: the company is a user of information, but also a producer for others. The company uses lots of effort to enrich the time information. In practise this means that the basis for their ERP system and website traffic list comes from Portnet, but they correct the departure times with better information. Many interviewees said that they follow Finnpilot's traffic list instead of Portnet information because it's more up to date.

In the workshop, it emerged that Estimated Departure Time (ETD) may not be the right kind of time information to describe what it is supposed to describe. Instead, the concept of planned time of departure (PTD) was suggested, which would be defined by the agent. PTD would be the original time plan that exists at the time when the port call is established to Portnet. In turn, ETD would be a real-time updated and refined value during the port call. This would make a conceptual distinction between the pre-port plan and the up-to-date status information during the port call.

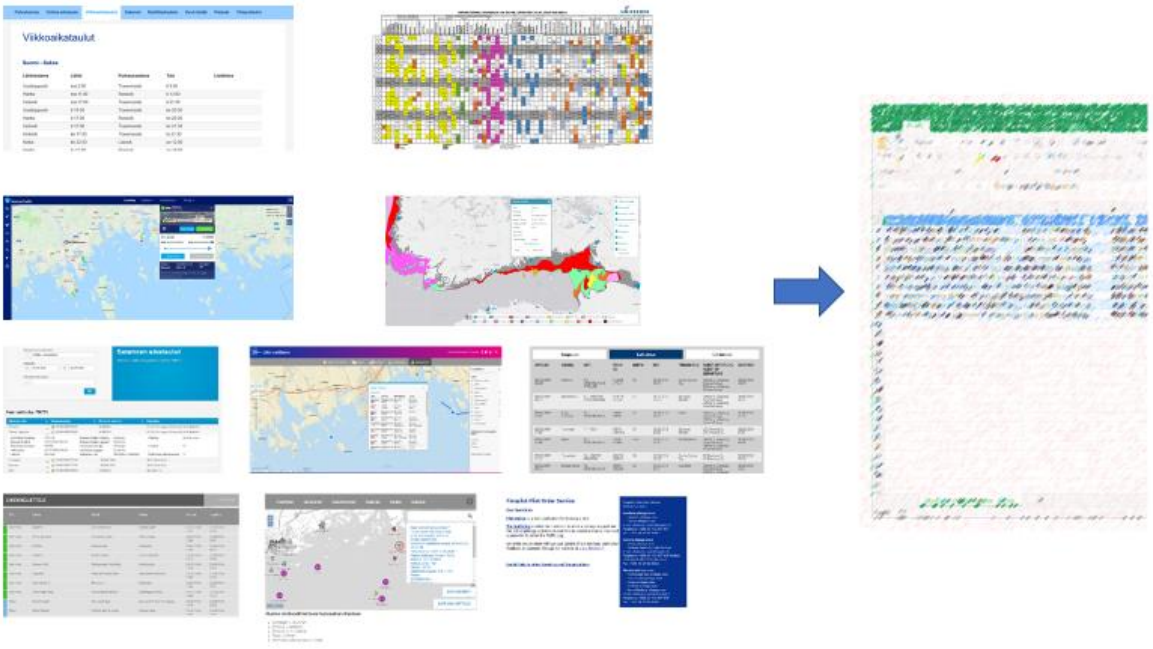

Fig. 2 Many Finnish port actors use information from various sources for defining vessel departure times and then typically create their own excel spreadsheets for situational awareness

5. Discussion

Of all the data related to port operations the development of time information sharing is considered necessary. Sharing is facilitated by the fact that there is no reason to hide the schedule and estimated movement information, as they are not business or security critical, sensitive information. In Finnish ports it is recognized that there is room for improvement in ETD sharing. However, the information is still transmitted satisfactorily, especially compared to certain other ports in the Baltic Sea region. Not all port call actors have a clear idea of where the data entered into Portnet's ETD data field is spreading. For example, the PortTraffic portal or “Liikennetilanne” service are poorly known.

One of the most interesting findings of this study is that professional sea logistics uses publicly available open information sources in its operational control. Port call actors collect shattered pieces of information. Typically, the actors compile the data and information they receive manually in an excel spreadsheet. Aim is to create a snapshot for the person itself and for the organization in order to plan workflow and allocate resources rationally.

The problem is that informal information is distributed mainly through bilateral communication. Somebody, a person or organization in port knows the ship's departure time best, but who? Logically, the ship should have the best idea of its readiness for departure, and this, or other time information, should be available in real time for everyone to use.

The interviews revealed that pilots also produce time estimations. Thus, in addition to fairway navigation know-how, pilots have significant scheduling expertise that should be utilized in developing time information sharing.

If an up-to-date and accessible ETD is not possible, the port actors could benefit other time information or timestamps regarding the port call processes. As an example, the data of the port operators' information systems would probably be of interest to many parties, as they could be used to evaluate the estimated time of completion of cargo handling (ETC).

In the PortCDM concept, the parties involved in planning and implementation of port calls are divided into three groups. Primary actors include ship operator (shipowner or charterer), port operator and port authority. Secondary actors include pilotage, fairway icebreaking, towing and port icebreaking and mooring services. tertiary actors consist of other vessel services (e.g. bunkering, waste management, water supply, cleaning, maintenance and repair services), authorities, VTS, shippers, receivers and road and rail carriers. Information flows best between primary group actors. It seems like secondary actors should have better time information available in order to execute their duties effectively. It should be kept in mind that their lack of high-quality information may have a significant effect on the primary actors.

An interesting finding was the attempt to hide hidden meanings in numerical data. Numerical form is poorly suited for conveying hidden meanings and machines do not understand them. There is a possibility of misunderstanding and another way should be found to express the quality of the time estimate.

In the workshop, the idea of expanding information producer responsibility from agents to other parties emerged. In this case, it would be necessary to decide who is entitled to produce official time information and to ensure that no individual entity is able to drive its own advantage through deliberately incorrect time information.

6. Conclusions

This study has focused on the availability and quality of the ship's estimated time of departure (ETD) information. It has examined how the ETD information in Finnish ports is currently generated and how the users of that information receive it.

The main conclusions from the findings can be summarized as follows. First, ships' port agents are in a key role in the creation of ETDs. Their experience and expert knowledge form the basis of the departure time estimation. Second, Portnet, the technical system serving as the source for the official ETD, does not support either updating the ETD information during the port call or presenting uncertainty regarding the estimate. These, together with the lack of incentives for updating, form a major bottleneck in providing accurate and up-to-date estimated departure time information to the port actors. Third, the actors currently form their situational awareness based on various sources of departure time information which they then use to make their own overview of the vessel operations. While with the current traffic volumes this might not be a very tedious task, some manual work is still needed, and there is a risk of "multiple truths". Thus, the ETD information should flow automatically to all users from a common source.

The study focused on Port of HaminaKotka. In order to get a comprehensive overview of the situation in Finnish ports, more interviews in other ports as well should be conducted in future. Additional interviews should be carried out especially with captains, pilots and cargo handlers of various cargo and chartering types. Country-level research could support the creation of national procedure for sharing estimated ship departure time. Also, to support that, studying which types of solutions have been taken into practice internationally and what are the experiences from using them is a topic for future research.

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