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Information Flow Analysis of the Container Discharging Process

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Information Flow Analysis of the Container Discharging Process

Susanne Kellberger

Abstract

Information technology is no longer the limiting factor but rather the enabler for the analysis of enormous amounts of data and the transformation of data into information. However, there is a lack of information quality due to wrong, late or imprecise information. The adequate quality of information is crucial for logistics processes due to accompanying information flows in order to properly handle the flow of goods.

This paper will take a closer look at the discharging processes of import and transshipment containers and the information which is transferred simultaneously between the involved stakeholders. An information flow analysis is conducted including a description of the single steps of the discharging process. Special attention is paid to step three: the selection of the appropriate yard block. In regard of process efficiency this step forms the most critical one. A decision tree reveals the necessity of high information quality. An analysis of the relevant UN/EDIFACT messages enables a combination of the information with the four process steps in a process information flow matrix.

Due to a research gap regarding the connection of information flows and process efficiency within that maritime context, the aim of the paper is to contribute to fill that gap by increasing the transparency of the discharging process at container terminals. This research is important to identify the state of the art regarding current EDI communication between terminal operators and shipping lines from the terminal point of view before and during the container discharging process. This paper forms the basis for the subsequently following research which will

further model and simulate these processes in order to quantify the impact on process efficiency by improving the information quality.

Keywords: container discharging process, information flow analysis, information quality, process efficiency

1. Introduction

A vessel on the Asia-North Europe route loads containers at terminals in Asia for discharge at terminals in Europe. Further containers are discharged and loaded at terminals on the way. Due to the number of terminals involved it is very complex to have an always updated version of the stowage plan. With such a complete plan all terminals involved could stow their containers to the vessel with as few shifts as possible. In addition they could discharge their containers directly or only with minimal movements of other containers. The manual stowage plan (or bayplan for container vessels) is a series of diagrams consisting of each cross-section of the vessel and a list of possible locations on the ship and its contents. Traditionally the bayplan was transmitted between container terminals and ship planners by fax which often was a 60 pages long document. When container ports received such a bayplan for a vessel, all the information had to be inserted manually into the terminal's ship planning tool for further processing. This operation could take an experienced operator several hours, was prone to errors and the information passed was not always up-to-date (Garstone, 1995). Nowadays terminal operators do not have to rely on telephone, fax or email communication when they share information with their clients, the shipping lines. A high number of different terminal operating systems (TOS) is available that support the terminal in all processes by connecting all departments and systems involved, electronically sharing information with them and supporting decision finding by proposing solutions based on internal rules. These TOS receive information via different interfaces like electronic data interchange (EDI) or more specific via UN/EDIFACT messages in a raw form that is not yet readable and

translate the data into information for the benefit of the terminal operator. The seamless information flow is essential in order to assure efficient processes. Highly flexible logistics chains, with fast response to customer demands, require a precise information flow for tracking, planning and control. Information logistics require the right information to be in the right place at the right time in the right quality.

In daily terminal operation not all necessary information is available at the moment when it is requested. Especially the means and modes of the on-carriage transport are relevant for the decision where to store the container in the yard before it is picked up again. However they are not provided regularly (Jürgens et al. 2011). This lack of information often leads to unproductive restowing and therefore inefficient processes (Hildebrand 2011). Unproductive moves like reshuffles occur when access to a container is only possible after others on top of it have been removed. According to Steenken et al. (2004) the most important reason for reshuffles is wrong or incomplete information about containers to be stacked.

In accordance with the structure of messages and possible segments of information that are transferred between the shipping lines and the terminal operators all requirements could be fulfilled if all information would be provided. It has been demonstrated by Svilen (2013), that misdeclared information can lead to severe incidents when the weight of a container is e. g. actually 5 times as high as the declared weight.

However there is little scientific literature about these information flows, their content and when they are sent and requested. In order to demonstrate the potential of different levels of information quality, the information flow of the storage process needs to be analyzed. An overview of decision problems at container terminals and various approaches to solve them is given in Vis and de Koster (2003). Their findings from the literature include many sub processes and their specific decision problems from berth allocation, via stowage planning on the vessel, routing and scheduling of vehicles for horizontal container yard transport, distribution of empty containers to ports, up to crane scheduling.

Storage strategies are though well described by Chen (1999) for export containers. By focusing on export containers, the demand for information was rather neglected by him for import containers. The research gap of inbound containers has not been filled since then. In addition to that, the connections between the physical container discharging processes on the one hand and the information flow between the two most involved stakeholders on the other hand have not yet been considered in the literature as well.

The aim of this paper is to increase the transparency of the container discharging process at container terminals from the terminals point of view in terms of information flows. This work helps to understand which information is relevant for which physical process and when and where it is exchanged.

Section 2 describes the applied method and section 3 presents the findings about the process steps and the respective information flow. Section 4 puts the results in context and discusses them while section 5 provides suggestions for further research.

2. Method

In order to narrow the scope an appropriate process is selected. The maritime container logistics comprises of many potential processes that could be analyzed. The part on which this paper is focusing on is the container discharging process from the terminal operator's point of view. This includes import as well as transshipment containers. After specification of the selected process, the most relevant process steps are identified. These are further described in section 3.1. The process chart does not include all stakeholders in every detail but is rather limited to the two most important parties: The terminal operator as well as the shipping line and accordingly its liner agent. In the next step it is analyzed how these stakeholders communicate with each other in order to transmit the respective information. Certain EDI messages are used for that purpose. A closer look at these messages identifies those that are relevant for the container discharging process. In the next step the content of these messages, the

segments of their structure and the order and timing of their transmission are analyzed. Finally a process-information-flow matrix is developed that brings together the information used and the steps of the analyzed process where the information is used. Within that matrix the reading or writing operations are indicated. This method is based on the process-information-flow analysis from O'Shea, Pawellek and Schramm (2013) with an adoption to the application of the specific container discharging process. These results form the basis for further research like the simulation of the ideal and the as-is situation which will demonstrate the potential that lies in the provision of information in the best possible quality.

3. Results

3.1 Process

The object and area of investigation is the process of discharging containers from a vessel and storing them in the yard area of the terminal at the exact position where they stay for the next 1-10 days. This includes import containers that are predetermined to be further transported to the hinterland as well as transshipment containers because both are stored in the stock. Hinterland processes are not considered neither is the main haulage by vessel. Export containers are collected from the hinterland of a port, stacked in the yard and transported to the apron before they are loaded onto the vessel. These loading processes include other stakeholders, request other information and are different from the unloading processes to a large extent. They are not covered by the following analysis.

The examined process starts with a vessel announcement and ends, with the storage of the container in the respective yard block. The block is not to be confused with "blocks" in automated container terminals with chaotic storage strategies. Here "block" refers to an area in the yard dedicated to containers with same or similar characteristics.

Shipping lines, their liner agents and terminal operators are the only stakeholders that are considered here, because they are in the focus of this process. The stakeholders are not further subdivided into roles or systems. Other stakeholders like customs, shipper, road or rail land transport operators are masked out.

Process step 1: Vessel announcement

The process starts with a vessel announcement by the shipping line. This announcement is given the first time when the vessel is leaving the first port on the route and is renewed every time when changes occur in the time schedule. Reasons can be bad weather conditions or delays at other ports caused by strike, technical problems or organizational problems. The terminal indicates the receipt of the announcement afterwards and confirms the possibility to call the terminal. With regard to the container discharging process, this step assures that the containers are discharged from the right vessel.

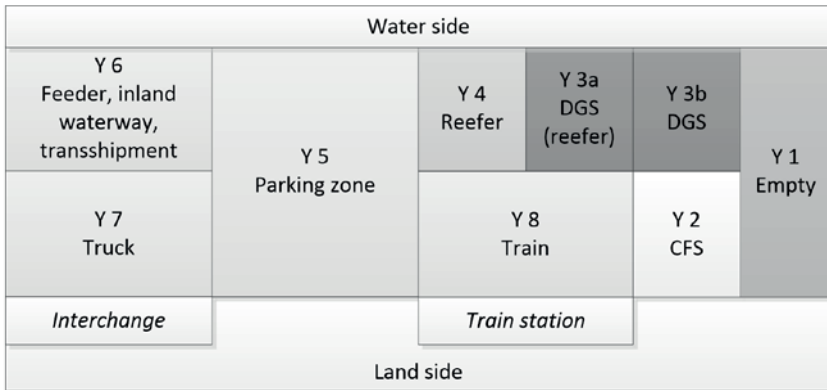
Process step 2: Container discharge

In order to assure that the containers are discharged in the right port, the terminal needs to get information in advance that contains a list of containers that are to be unloaded and their position on the vessel. With this information it is able to plan the staff and equipment allocation to the vessel. Further, the TOS can calculate the best discharging strategy. With regard to the container discharging process, this step assures that the right containers are discharged from the vessel.

Process step 3: Transport to yard block storage

The storage yard has the function of a temporary buffer area for containers. It is organized in block sections in order to consider all specific requirements of different containers. Specific areas in the yard are reserved for containers with different characteristics, like e. g. the content and the hinterland transport mode. Often the yard is also separated into export and import containers. However, export containers are not discussed here. A symbolic layout of a general container terminal is drawn in Figure 1. This layout is to be used only as a rule of

thumb as each terminal is different and the preconditions, purposes and restrictions are diverse. Every terminal requires a unique design and the following symbolic general layout is based on Brinkmann (2011) with influences from discussions with terminal planners. Damaged containers sometimes are also separated from the rest and brought to a reserved area, which is not included in



the following analysis.

Fig. 1: Symbolic general layout of a container terminal

The decision process where to store the container in the yard demands certain information and clear answers to different questions. Figure 2 summarizes the single steps of the container discharging process. The decision tree is developed in order to highlight the single decisions that need to be made within this process. The first step is to check if the container is empty or full. About 20 % of all transported containers are empty (United Nations, 2007). This is mostly due to imbalances in international trade. However, the share of empty containers is almost the same in a yard. Nevertheless, due to higher dwell-times and the possibility to stack them higher than full containers, empty containers are often stored separately with a higher density. This empty container block is symbolized here at Y 1.

If the containers are LCL (=less than full container load) and not FCL (=full container load), or are in carrier's haulage, they are brought to the container

freight station (CFS) for stripping and re-stuffing in Y 2. The goods inside are temporarily stored in the warehouse, before they get commissioned in another container.

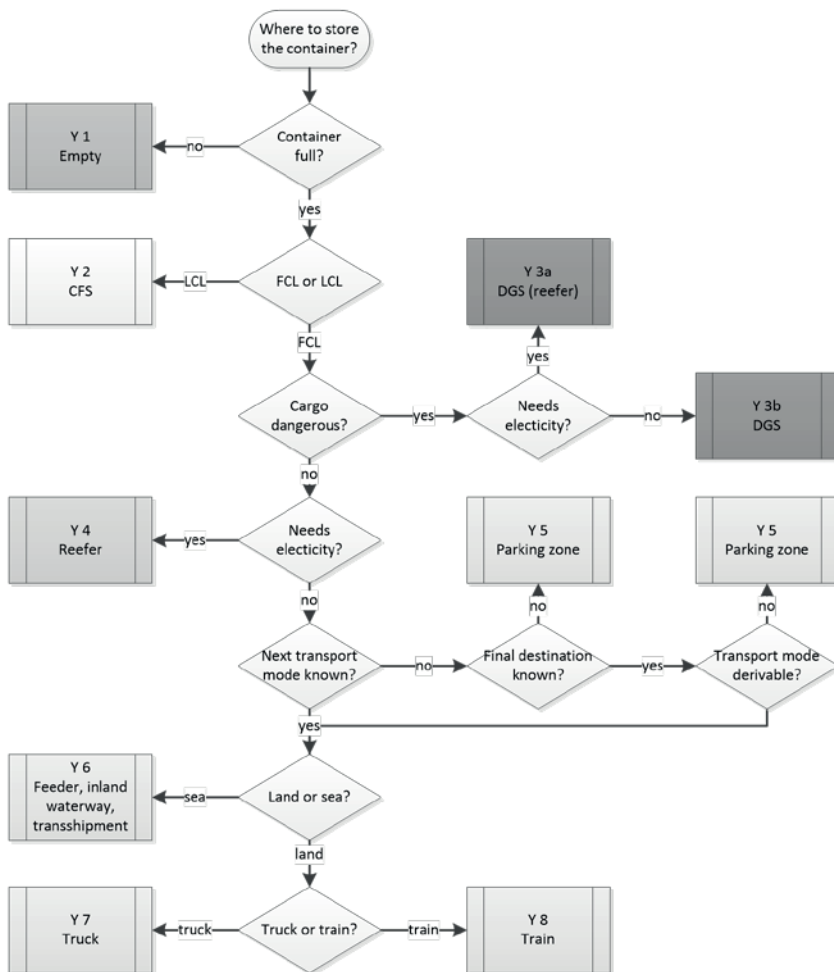


Fig. 2: Decision tree for container transport to specific yard blocks

Full containers in merchant's haulage are stored separately when their content are hazardous materials or dangerous goods (DGS). They need to be stored in special areas to prevent accidents. These areas have a basin underneath in order to hamper hazardous materials to get into the groundwater. Some of them need to be kept at a certain temperature. Otherwise the quality of the product cannot be ensured any more or they could even damage the container by an explosion or at least by an expansion. Such containers are plugged to the electrical generator for temperature-controlling in Y 3a. All other dangerous cargo is stored in Y 3b, according to their specific requirements that are expressed by the hazard code identification IMDG (International Maritime Code for Dangerous Goods).

Containers without a special declaration often also carry temperature-sensitive goods like food or pharmaceuticals. These refrigerated containers (or reefer containers) therefore need electricity in order to regulate the inside temperature as requested. Thus, they are transported to and plugged in at the electrical generator of Y 4.

Following the decision tree in figure 2 all containers with dangerous or refrigerated goods, LCL and empty containers have been sorted and assigned to their specific areas. The next distinguishing feature is the hinterland transport mode. Unloaded containers are usually transported to yard blocks near to their on-carriage transport. However, in many cases (20-85 %, depending on the terminal and person interviewed) the next transport mode is not known. According to Steenken, Voß and Stahlbock (2004) for example the hinterland transport mode is not known by the terminal operator at 85 % of the containers in the moment of discharge. In these cases it can be checked whether at least the final destination is known and the transport mode can be derived from that information. If the final destination is not known or the transport mode cannot be derived from a given final destination, the container is brought to the parking zone Y 5 which is placed in the middle of the terminal.

If the transport mode is known or can be derived from the final destination, another question is to be checked: Will the next transport mode be via land or via

sea? In case of transshipment containers or containers that will be transported by the mode inland waterway, the container is transported to Y 6, which is closer to the water side.

If the on-carriage transport is done via land transport modes, the last differentiation is done between road and rail. Y 7 groups all containers that are meant to be transported to the hinterland by trucks. This block is as close as possible to the interchange where all paperwork is carried out. Containers that use trains as on-carriage transport means are stowed in Y 8 which is located closer to the rail tracks.

Process step 4: Stacking within the selected yard block

As soon as the system decided in which area of the terminal the container should be stored the exact position of the container in the stacks needs to be found. However, there are some constraints for this decision. The containers volume gives a first indication: It is rarely possible to stack different types of containers on top of each other, because of the resulting instability of the stack. There is just one exception: A 40' container can be stacked on top of two 20' containers. The gross weight is another restriction that follows the rule that heavy containers should not be put on top of light containers. Thus, the containers have less weight the higher their position in the stack. Within the parking zone Y 5 there is flexibility which means that containers that most probably are carried by land transport will be put nearer to the land side than to the water side and vice versa.

The time when the on-carriage transport is expected plays another important role. If the container's estimated dwell time is very short, a top position in the stack is preferred for that container. In case that a longer dwell time is expected, the container is most probably put in a lower position of the stack so that other containers can be stacked on top of it. The lack of information about the time when the container is transhipped to the next transport mode often causes bottle neck situations according to Ilmer (2005). So he proposes a better coordination and communication between the shipping line and the terminal operators.

With regard to the container discharging process, this step ensures that the container is stored in the right position of the stack in the yard block.

3.2 Information

3.2.1 Communication between stakeholders

Before EDI was established as the standard for sharing information between all actors of a supply chain, it was daily business to use telephone, fax or letters for this purpose. Later emails have replaced the slower postal letters where possible but still a manual action was necessary to trigger information exchange. This form of communication with the terminals' clients, the shipping lines, facilitated the appearance of errors due to the media breaks. Today many IT systems help to keep track of all relevant processes, share necessary information with other stakeholders in advance and minimize transmission errors due to less media breaks.

TOS support those terminal processes by connecting all involved departments and systems and electronically share information with them. These TOS receive information via different interfaces like EDI or more specific via UN/EDIFACT messages. UN/EDIFACT (the United Nations rules for Electronic Data Interchange for Administration, Commerce and Transport) comprise a set of internationally agreed standards, structures and guidelines for the electronic interchange of structured data, between information systems since the late 1980s.

The development of those EDI standards was closely monitored by the industry. Different interpretations of these standard messages in various implementations resulted in a lack of interoperability. The growth of international e-commerce requested a solution for this problem and for that purpose members of the Transport Group harmonized the message implementation guides and improved user manuals in 1995. This International Transport Implementation Guidelines Group (ITIGG) produced guidelines for all modes of transport and developed recommendations which provided software developers with a series of tools to assist in designing applications which can be used for worldwide electronic trading. The Shiplanning Message Development Group (SMDG) is an official pan-European user group with stakeholders from the maritime industry, like

container terminals, shipping lines and related companies that develop UN/EDIFACT messages as international standards for the maritime industry. Its focus is on container-related messages, i.e. stowage plan, load, discharge and inland transport.

All previous mentioned organizations aim to harmonize messages used in the transport sector, so that the same message specifications can be used and interpreted anywhere in the world in the same way.

3.2.2 Relevant UN/EDIFACT messages

An EDI message is a set of structured data for transmission by electronic means, prepared in a computer readable format and capable of being automatically and unambiguously processed.

For the maritime container transport a multitude of UN/EDIFACT messages can be and are used to communicate and share information. From over 180 possible messages the six most relevant ones are chosen for the analysis of the container discharging process: CALINF, BAPLIE, COPRAR, MOVINS, COARRI and VESDEP. The following figure 3 gives an overview of those messages, in which order they are exchanged and who the respective sender and receiver are. The BAPLIE is actually sent twice during that process. The first time is indicated in figure 3 and the second time an updated version of BAPLIE is sent from the terminal to the shipping line and other following terminals right after the discharging process. This repetition is not part of this analysis.

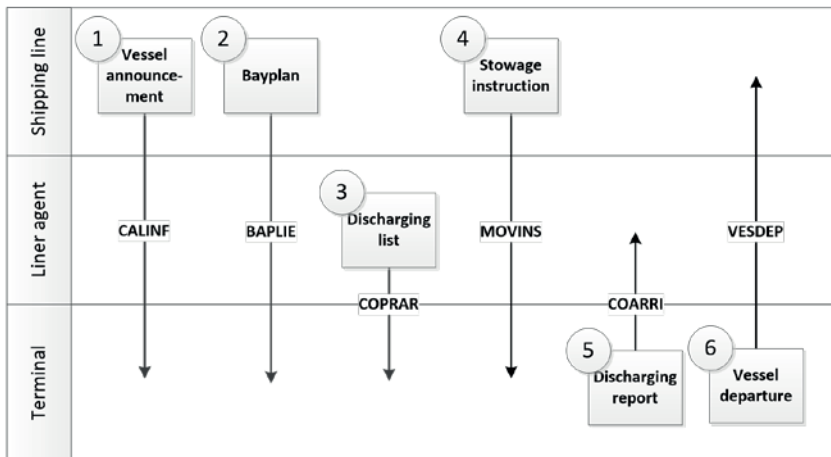


Fig 3: Relevant UN/EDIFACT messages for the container discharging process

The names of these messages often arise from their actual meaning and shorten it to 6 letters. The full names are listed in Table 1.

1. CALINF	Call Information
2. BAPLIE	Bayplan/Stowage plan
3. COPRAR	Container Discharge/Loading Order
4. MOVINS	Stowage instructions
5. COARRI	Container Discharge/Loading Report
6. VESDEP	Vessel Departure

Tab. 1: Meaning of the names of UN/EDIFACT messages

3.2.3 Common segments of the messages

In UN/EDIFACT each message consists of a header section with information identifying the vessel and a body section with a group of segments which in the case of BAPLIE for example is repeated for each container on board and contains relevant information about the container. Table 2 shows that many of the segments that form the body of these messages contain similar content.

A segment...	CALINF	BAPLIE	COPRAR	MOVINS	COARRI	VESDEP
to specify total numbers	•					•
to specify the document or message to which the current message relates		•		•		
to specify a reference to the whole message, and its date and/or time	•		•		•	•
to indicate the main carriage means of transport			•		•	
to identify locations related to the means of transport			•		•	
to identify a party and related contacts	•	•	•	•	•	•
to identify a contact and its communications related to the party	•	•	•	•	•	•
to identify the means of transport and related details		•		•		
containing information about dangerous cargo		•		•		
to specify dangerous goods details			•		•	
to specify contact information			•		•	
to specify the planned on-carriage details			•		•	

Tab. 2: Common segments of the messages

CALINF and VESDEP for example provide both summaries and total numbers. All of the messages include segments to identify partners, their contact details and how this party should be communicated to. BAPLIE and MOVINS both give information on dangerous goods while COPRAR and COARRI provide even more details on those dangerous goods. They also give details on the planned on-carriage transport.

3.2.4 Individual presentation of the UN/EDIFACT messages

CALINF (vessel announcement)

The first UN/EDIFACT message CALINF is sent from the shipping line to the terminal operator and announces the vessel to call at that port (see UN/EDIFACT, 2000b). It contains general information about the vessel like the reference voyage number, the operating shipping line and the water displacement dimensions for the berth allocation. Information about the route like the previous and next port of call as well as the estimated time of arrival (ETA) / departure (ETD) are also provided. In table 3 all segments that only belong to the CALINF message are listed. They cover details for the arriving vessel and the total number of containers to be discharged.

A segment...	CALINF	BAPLIE	COPRAR	MOVINS	COARRI	VESDEP
to specify details for the arriving means of transport	•					
to identify locations related to the transport details	•					
to specify supplementary information and to describe totals to be discharged	•					

Tab. 3: CALINF segments of UN/EDIFACT container messages

BAPLIE (bayplan)

In order to best plan the efficient use of equipment some key data about the cargo to be discharged needs to be provided. At least 24 hours prior to the arrival of the vessel at the port, the shipping line has to send the bayplan to the terminal operator's head office. Where the discharge and load of containers is planned based on that document.

The BAPLIE-file is the document a message with a lot of information (see UN/EDIFACT, 2000a). The following non-exhaustive enumeration focuses only on the most interesting ones. Per port of discharge a summary is given regarding the number, dimension and weight of all units, whether they are full or empty, dry or reefer container and contain dangerous goods or not. Each container is also described by its ID number, the place of delivery or at least the port of discharge (POD) and the exact current position on the vessel.

Container terminals always have a port scope of two ahead. So the next coming port is informed via BAPLIE UN/EDIFACT message in case there are containers on board that will be transshipped to another third port so that the next port has the chance to stack them in their yard properly and consider the transshipment. A complete bayplan of the containers onboard the vessel is prepared and transmitted. All terminals on the vessel’s route need this information for planning purposes some time before the vessel berths. Therefore updates of the bayplan are sent to all of the ports of call as soon as the information has changed as a result of operations in the previous ports. This process is repeated every time when the vessel leaves another terminal. According to SMDG it is estimated that over 50.000 BAPLIE messages are used per day worldwide. Both segments of table 4 belong to the BAPLIE message. These segments contain information about the type of containers and their stowage location onboard.

A segment...	CALINF	BAPLIE	COPRAR	MOVINS	COARRI	VESDEP
containing information about the equipment and/or goods and its stowage location onboard a vessel		•				
containing information about the type of equipment		•				

Tab. 4: BAPLIE segments of UN/EDIFACT container messages

COPRAR (container discharge order)

On a physical level the vessel berths at the assigned place. Latest at this time the order to discharge certain containers is sent from the liner agent to the terminal via a COntainer-PRE-ARrival message COPRAR (see UN/EDIFACT, 2000d). Based on this message, the container terminal can start discharging the containers from the vessel.

The COPRAR message contains the following information amongst others. The country of origin as well as the port of loading, the coded port of discharge and ideally the UN country code for the country of destination. There is room for the provision of the contact data of the recipient of the goods. For the discharging process it is crucial to know the container status (import or transshipment), the container ISO code, the mode of transport for the on-carriage transport, the

temperature setting for reefer containers, the container weight (gross and tare), stowage instructions and special requirements for yard stowage, hazard code identification (IMDG) and the coded indicator of full or empty containers. The codes are necessary because free texts cannot be interpreted by computers and therefore hinder the automatic transmission of information which is the main purpose of the usage of EDI.

Not relevant for the process are for example the seal number, the description of goods, and the customs code and paper number.

The segments of table 5 form the unique part of the COPRAR message. One segment is about the containers to be discharged and the other about the following on-carriage transport.

A segment...	CALINF	BAPLIE	COPRAR	MOVINS	COARRI	VESDEP
to specify containers that are to be discharged			•			
to specify locations related to the on-carriage transport			•			

Tab. 5: COPRAR segments of UN/EDIFACT container messages

MOVINS (stowage instructions)

The shipping line gives the terminal operator the instructions which containers are to be discharged from the vessel and which stowage instructions have to be considered. This EDI message, called MOVINS (see UN/EDIFACT, 2000e), is transmitted from the shipping line to the terminal. It contains information about the containers to be discharged and their stowage location on board of the vessel. It further includes details like off-standard measurements (e. g. overheight, overlength, overwidth), the temperature setting and range and information about dangerous cargo in great details.

As can be seen in table 6 MOVINS has the most extensive list of segments. The segments provide information about the containers to be discharged and many details like stowage location, temperature settings and attached equipment.

A segment...	CALINF	BAPLIE	COPRAR	MOVINS	COARRI	VESDEP
containing information about the container to be discharged and its stowage location on board				•		
containing information about the location, identification, type and handling details of containers				•		
to specify a temperature (and range)				•		
containing information about the number, type and identification of container to be discharged				•		
containing information about the number or the identification of attached equipment				•		
containing information about the number of packages and kind of goods				•		
to specify dangerous goods and additional information				•		

Tab. 6: MOVINS segments of UN/EDIFACT container messages

COARRI (container discharge report)

After the containers are discharged the head office generates the COARRI (COnTainer ARRIVAL message) UN/EDIFACT message. This message is used to report to the shipping agent that the containers specified have been discharged from the vessel. For larger vessels with a high amount of discharged containers the COARRI can be transferred via so-called periodic reports every 15 or 30 minutes. This intermediate reporting enables faster pick-up of the discharged containers by inland carriers. It contains information about damaged containers such as the exact point of the damage on the container and the type of damage. This message also reports shortlanded or overlanded containers. In the first case it specifies containers that had to be discharged (according to the discharge order message COPRAR) but could not be discharged due to various reasons. The container details are only required if they differ from the details given in the respective order message. Overlanded containers are containers that have been unloaded, but are not on the discharge order COPRAR. In that case COARRI contains the full container details with as much information as possible (see UN/EDIFACT, 2000c). It further confirms the same details that previously have been given by COPRAR like physical dimensions, seal number, actual time of arrival and clip on units such as generator sets. The specialty of the COARRI message can be derived from table 7. The shortlanded or overlanded containers

are specified in a segment, another identifies a location and the third specifies damages at the container.

A segment...	CALINF	BAPLIE	COPRAR	MOVINS	COARRI	VESDEP
to specify containers discharged (with consideration of shortlanded or overlanded containers)					•	
to identify a location or country related to the equipment					•	
to specify damage details related to the equipment					•	

Tab. 7: COARRI segments of UN/EDIFACT container messages

VESDEP (vessel departure)

The last message VESDEP does not really contain information that is necessary for any of the identified process steps. However it indicates the end of the discharging process and therefore closes the circle after the vessel announcement CALINF started it. As presented in Table 8 it contains one segment about the departing means of transport and another one about the next port of call (see UN/EDIFACT, 2000f).

A segment...	CALINF	BAPLIE	COPRAR	MOVINS	COARRI	VESDEP
to specify details of the departing means of transport						•
to specify a place or port of call of the conveyance						•

Tab 8: VESDEP segments of UN/EDIFACT container messages

3.3 Process information flow matrix

In the following table 9 all previously collected information is inserted in order to demonstrate the relationship between the UN/EDIFACT messages and the respective process steps. The “r” represents a reading operation and the “c” stands for “create” in a writing operation. The “x” in the right column is neither reading nor writing but rather not applicable here, because that information is not used during any of these process steps.

The first message (CALINF) has only little influence and the last message (VESDEP) has none regarding the discharging process. The information within the discharge order (COPRAR) and the discharge report (COARRI) are in many

cases similar. The terminal operator rather confirms or corrects the given information in the COARRI report. This is especially necessary in the case of divergent information like in 0210 EQD (overlanded or shortlanded containers). Process step 1 (right vessel) draws most information from CALINF, BAPLIE and COPRAR. Process step 2 (right container) needs the fewest reading operations while two come from BAPLIE and one each from COPRAR and MOVINS. The question of the third process step (right block) requests the most information. 15 reading operations are quite equally distributed between COPRAR and MOVINS with a little support from BAPLIE. The fourth process step (right position) mainly uses information from BAPLIE and COPRAR while two reading operations from MOVINS bring further specification regarding off standard measurements and more information concerning dangerous goods. All writing operations occur only at the COARRI message.

Information Flow Analysis of the Container Discharging Process

Tab. 9: Process information flow matrix for the container discharging process

PROCESS INFORMATION FLOW MATRIX				Process	Vessel is berthing (right vessel)	Container discharge (right container)	Transport to block storage (right block)	Put down in the block (right position)	Nice to know (but process irrelevant)	# Write operations	# Read operations	
No.	Message	Reference	Information									
1		0060 MEA	total measurements (gross weight)						x	0	0	
2	CALINF	0070 EQN	the number of units	r						0	1	
3		0180 DTM	estimated date/time of arrival and departure	r						0	1	
4		0210 LOC	transport details (previous/next port of call,...)								0	1
5		0130 TDT	means of transport	r							0	1
6		0150 DTM	date and time	r						0	1	
7		0160 REF	loading voyage number	r						0	1	
8		0190 LOC	storage location onboard the vessel		r					0	1	
9		0200 GID	number of packages		r					0	1	
10		0210 GDS	specification of the goods						x	0	0	
11	BAPLIE	0230 MEA	physical weights				r			0	1	
12		0240 DIM	off standard measurements (e.g. overheight)				r			0	1	
13		0250 TMP	temperature setting			r				0	1	
14		0260 RNG	temperature range			r				0	1	
15		0300 EQD	container size/type				r			0	1	
16		0320 NAD	owner/operator of container						x	0	0	
17		0350 DGS	identification of dangerous goods		r	r	r			0	2	
18		0130 LOC	place terminal within the port	r						0	1	
19		0220 EQD	container status (import, export, transhipment)		r	r	r			0	2	
20		0250 TMD	(Less than) Full Container Load (LCL/FCL)		r	r	r			0	1	
21		0260 DTM	actual date and time of arrival and departure	r						0	1	
22		0270 LOC	(final) place/port of discharge, place/country of destination			r	r			0	1	
23	COPRAR	0290 DIM	physical dimensions (off standard)				r			0	1	
24		0320 SEL	seal number						x	0	0	
25		0360 DGS	UN-number/class of the dangerous goods			r	r	r			0	2
26		0410 EQA	clip-on units, such as generator sets			r	r	r			0	1
27		0440 TDT	on-carriage transport details (mode, means,)			r	r			0	1	
28		0450 DTM	arrival/departure date/time of on-carriage transport				r			0	1	
29		0480 LOC	on-carriage transport details (place of departure)			r	r	r		0	2	
30		0190 HAN	type of handling (discharging or loading)		r					0	1	
31		0210 LOC	information about storage location		r	r	r			0	2	
32		0250 DIM	off standard measurements (e.g. overheight)				r			0	1	
33	MOVINS	0290 TMP	temperature setting			r	r			0	1	
34		0300 RNG	temperature range			r	r			0	1	
35		0360 GID	number of packages of the goods						x	0	0	
36		0390 GDS	nature of the cargo						x	0	0	
37		0430 DGS	identification of dangerous goods			r	r			0	1	
38		0440 FTX	more information concerning dangerous goods			r	r	r		0	2	
40		0210 EQD	equipment status (overlanded, shortlanded)		c	c	c			2	0	
41		0230 GDS	broad classification of the goods within						x	0	0	
42		0240 TMD	(Less than) Full Container Load (LCL/FCL)				c			1	0	
43		0250 DTM	actual date and time of arrival and departure	c	c					2	0	
44		0270 LOC	(final) place/port of discharge, place/country of destination			c	c			1	0	
45		0300 DIM	physical dimensions (off standard)			c	c			2	0	
46	COARRI	0330 SEL	seal number		c				x	1	0	
47		0370 DGS	UN-number/class of the dangerous goods			c	c	c			2	0
48		0420 EQA	clip-on units, such as generator sets			c	c				2	0
49		0430 PIA	commodity code							x	0	0
50		0470 DAM	container damages (point and type)		c	c				2	0	
51		0500 TDT	on-carriage transport details (mode, means,)			c	c			1	0	
52		0510 LOC	on-carriage transport details (place of departure)			c	c			0	0	
53		0520 DTM	arrival/departure date/time of on-carriage transport				c			0	0	
54	VESDEP	0180 LOC	Maritime Mobile Ship Identifier (MMSI number)						x	0	0	
55		0200 MEA	gross tonnage (of the vessel)						x	0	0	
			# Write operations	1	6	6	4	0				
			# Read operations	8	5	15	10	0				

4. Discussion and conclusion

In a vision of optimistic experts and stakeholders of the process, supply chain visibility, just-in-time logistics and real-time information sharing is key for future freight transport. However, there are two prerequisites to be considered: The availability of stable and proven technological solutions on the one side and the willingness of stakeholders to share information on the other.

The first is constantly under development for all logistics processes and already applicable for the analyzed process in this paper by the availability of efficient telecommunication infrastructure like TOS and reliable standards by the agreement on certain UN/EDIFACT messages.

The second is rather a matter of political and company cultural issues and cannot be solved by plain technological solutions. It is one thing to have access to all information within one single company, but the true benefit from the latest technology will be experienced only when all strive to a global optimum. This would include the provision of information in the highest possible quality to supply chain partners whenever it is needed.

The consequences of the sharing or not sharing of information, reflected by different degrees of information quality can however be measured when the processes are thoroughly analyzed, modeled and simulated. This work has contributed to the first part by analyzing not only the process steps but additionally the information flows.

The process information flow matrix reveals that the terminal operator not at all is interested into the concrete content of the containers as long as it is not relevant for the transport or storage. That information, that is in contrast necessary to support the decisions in the process steps 1 to 4 have to be available in order to ensure a smooth and seamless discharging process. If certain information like the next mode and means of transport or the expected time of the on-carriage transport is missing, then the container will most probably not be at the optimum position. Unproductive moves will then result from that. As Steenken, Voß and Stahlbock (2004) stated the sort and store strategy is hardly

done for import containers in container terminals because lot of information is missing at the moment of discharge. There are strong indications that there is room for improvement of process efficiency when the information quality would rise. Enhancing yard management for unloaded containers and minimizing the number of reshuffling operations is only possible if the right information is available in the right moment with the expected quality.

This segment of terminal processes has been chosen, because the terminal operator is directly benefitting from a higher information quality in that process but it is the shipping line that owns the data and decides when is what information shared with whom. Indirectly the shipping line also benefits from a higher terminal productivity of the terminal operator.

5. Further research

The next topic for investigation is the actual real information demand from each stakeholder involved at each process step. This could be done by modeling, workshops or interviews. In the matrix most of the information has already been written when the message reaches the terminal. It is interesting to know at which previous step of the process this information is added first into the system.

The reading and writing operations are not distributed equally which means that much more information is needed by the terminal operator who requests this information from the shipping line.

For the container discharging case further research should examine to which degree the information available theoretically is really available at the moment of discharge. Furthermore it is necessary to know the probability distribution of the identified scenarios. This includes the frequency distribution of occurrences of the different 'statuses' of containers like e. g. FCL, empty, dangerous cargo or refrigerated containers. With that input the impact of different degrees of information quality on process efficiency should be simulated.

References

- Brinkmann, B. 2011. Operations Systems of Container Terminals: A Compendious Overview. In: Böse, J. W. (Editor). Handbook of Terminal Planning. pp. 35-40.
- Chen, T. 1999. Yard operations in the container terminal - a study in the 'unproductive moves'. Maritime Policy and Management, 26 (1), pp.27-38
- Garstone, S. 1995. Electronic data interchange (EDI) in port operations, In: Logistics Information Management. Vol. 8 No. 2, pp.30-33, MCB University Press Limited
- Hildebrand, K. 2011. Daten- und Informationsqualität. Wiesbaden: Springer Fachmedien
- Ilmer, M. 2005. Enhancing container terminal productivity: A co-maker approach between carriers and operators. In: Port Technology International. London: ICG Publishing, pp.117-119.
- Jürgens, S., Grig, R., Elbert, R. and Straube, F. 2011. Data Flow Across the Maritime Value Chain. In: Böse, J. W., Operations research/computer science interfaces series, Vol. 49, pp.345-357.
- O'Shea, M., Pawellek, G. and Schramm, A. 2013. Durch maßgeschneiderte Informationsversorgung zu mehr Usability. Wirtschaftsinformatik & Management, 6, pp.104-113
- Steenken D., Voß S. and Stahlbock R. 2004. Container terminal operation and operations research - a classification and literature review. OR Spectrum (2004) 26, pp.3-49
- Svilen, V. 2013. Measures to enhance safety of containerized cargo transport by revising standards for cargo information and EDI BAPLIE and MOVINS messages structures. Journal of Marine Technology and Environment, pp.115-122.
- UN/EDIFACT, 2000a. BAPLIE. available at: [unece.org <http://www.unece.org/trade/untdid/d00a/trmd/baplie_c.htm>](http://www.unece.org/trade/untdid/d00a/trmd/baplie_c.htm) (Accessed in 18 June 2014)
- UN/EDIFACT, 2000b. CALINF. available at: [unece.org <http://www.unece.org/trade/untdid/d00a/trmd/calinf_c.htm>](http://www.unece.org/trade/untdid/d00a/trmd/calinf_c.htm) (Accessed in 18 June 2014)
- UN/EDIFACT, 2000c. COARRI. available at: [unece.org <http://www.unece.org/trade/untdid/d00a/trmd/coarri_c.htm>](http://www.unece.org/trade/untdid/d00a/trmd/coarri_c.htm) (Accessed in 18 June 2014)
- UN/EDIFACT, 2000d. COPRAR. available at: [unece.org <http://www.unece.org/trade/untdid/d00a/trmd/coprar_c.htm>](http://www.unece.org/trade/untdid/d00a/trmd/coprar_c.htm) (Accessed in 18 June 2014)
- UN/EDIFACT, 2000e. MOVINS. available at: [unece.org <http://www.unece.org/trade/untdid/d00a/trmd/movins_c.htm>](http://www.unece.org/trade/untdid/d00a/trmd/movins_c.htm) (Accessed in 18 June 2014)
- UN/EDIFACT, 2000f. VESDEP. available at: [unece.org <http://www.unece.org/trade/untdid/d00a/trmd/vesdep_c.htm>](http://www.unece.org/trade/untdid/d00a/trmd/vesdep_c.htm) (Accessed in 18 June 2014)
- United Nations UN, 2007. Regional shipping and port development. Container Traffic Forecast 2007 Update. United Nations ESCAP and Korea Maritime Institute KMI.
- Vis, I. F. A. and de Koster, R. 2003. Transshipment of containers at a container terminal. In: European Journal of Operational Research, 147: 1-16.