Empty Container Management

BACKGROUND AND CHALLENGES

The Baltic Sea Region (BSR) witnesses a constant rise in containerised transport. Today, containers are handled in more than 60 ports across the region. As an economic area, the BSR is characterised by heterogeneous economic conditions and trade patterns due to the coexistence of geographically central and peripheral regions, structurally weak areas and major consumption centres as well as a wide range of different industries from raw material producers to high-tech manufacturers. In this setting, myriads of container movements of different types, sizes and qualities can be observed, whereas specific demand and availability of container equipment can vary significantly between places. To balance container supply and demand, empty containers have to be moved both within the region as well as with adjacent regions, especially to and from the large North Range seaports. The share of empties of all containers transported in the BSR (21%-26% between 2005 and 2010) thereby exceeds numbers in the EU as well as globally (both around 20% between 2005 and 2010). Beside the rising trade volumes of containerised goods, which per se cause higher absolute numbers of empty containers, the strong imbalances of containerised trade flows trigger empty container repositioning. Where containerised goods are imported, but fewer containerised goods are exported (and vice versa), empty containers have to be moved to places where they are needed for reloading. This circumstance is reflected in strong differences of the empty share of inbound and outbound container flows of countries and ports that can be observed in several countries in the BSR. The repositioning of empty containers thereby causes negative effects, such as costs, environmental and socio-economic impacts, and ties up transport and storage capacities. In 2010, worldwide costs for empty container repositioning have been

estimated at USD34.8 bn. Mitigation measures, however, are often difficult to implement. Reasons for that emanate from the inherent complexity of empty container management. Often, conflicting interests between companies along the container transport chain, such as shipping lines, terminal operators or forwarders, but also with other stakeholders such as regional authorities and residents, collide. Often a lack of transparency and knowledge about processes and actor interests is the problem.

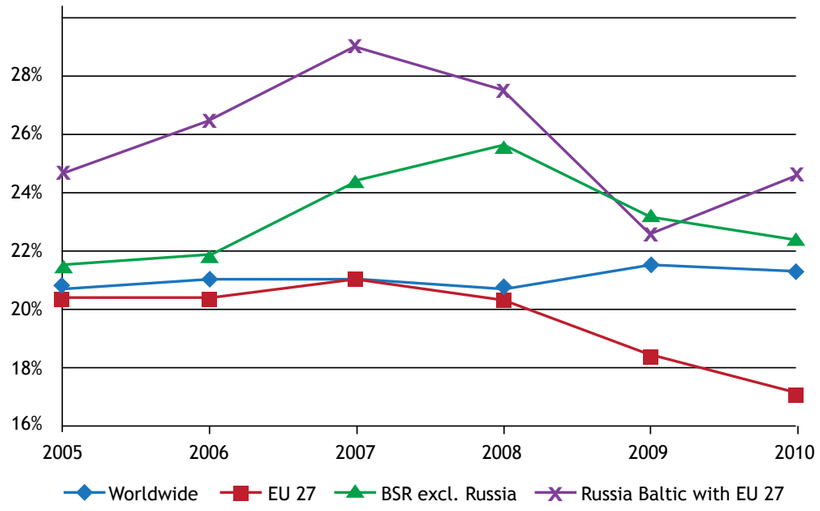

Figure 1: *Comparison of the empty container share in Europe, Russia and the BSR (author's design based on Eurostat, 2012[ii])*

OBJECTIVES

The overall objective of WP 5.2 was to increase transparency on empty container logistics in general and with special emphasis on specifics in the BSR. Therefore, the first goal was to analyse empty container management in the BSR in terms of involved actors, reasons for empty movements, its impacts as well as potential measures to mitigate negative effects. Then, in a second step, to increase transparency for decision-making by involved stakeholders along the container transport chain in the BSR, a case study was performed analysing empty container logistics processes, as well as current issues in empty container logistics and factors that influence empty container logistics design.

KEY ACTIVITIES

To achieve the main objective two studies have been elaborated:

1. "Empty Container Management in the BSR - Experiences and solutions from a multi-actor perspective" provides a broad picture of empty flows and determining factors in the BSR.
2. "Stakeholder Perspectives in Empty Container Logistics between Hamburg and the BSR" focuses on the specific relationships of empty flows and related perspectives of involved stakeholders between Hamburg and the BSR.

Empty Container Management in the BSR - Experiences and solutions from a multi-actor perspective

The first study took a threefold approach. To investigate empty flows in the BSR, statistical data from Eurostat was used. Import and export flows were analysed at the country and port level. A broad literature review was undertaken to amend the specific insights for the BSR as well as to provide a general overview of the state-of-the-art empty container management. Based on these preliminary results a survey was conducted to record experiences and knowledge of the main players in the region. The main objective of the survey was to gain a comprehensive picture of different types of organisations dealing with maritime containers in the BSR. The picture serves as a multi-actor analysis on the flows of empty containers in the BSR and a summary of the experiences made and strategies applied in the empty container management.

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Stakeholder Perspectives in Empty Container Logistics between Hamburg and the BSR

Implications from theory and empirical findings showed that a crucial point in optimising empty container logistics is the different and partially conflicting perspectives of relevant stakeholders. This can be a barrier for implementing measures aiming to improve empty container logistics. Therefore, a case study in cooperation with the Hamburg Port Authority, also a partner in the TransBaltic project, was launched to increase transparency on relevant stakeholders, their interests and influence with regard to empty container logistics. First, empty flows between Hamburg and BSR ports were analysed in terms of container sizes and types. Based on findings from the data analysis, hot spot ports of empty flows in the BSR were identified along with associated relevant stakeholders. In a second step a series of interviews was conducted among stakeholders in Hamburg and the BSR, such as: shipping lines, feeder operators, terminal, depot and transport operators, container leasing companies, authorities, but also associations and other involved stakeholders. By elaborating the different perspectives of the various stakeholders in empty container logistics the aim was to identify the aspects that have to be considered in the preparation for and during the implementation of change processes in empty container logistics. Interviews consisted of two parts. The first part focused on empty container logistics processes that were discussed with interviewees. The result is the detailed process charts providing insight on operational processes (physical and informational) relating to the various stakeholders involved. Second, qualitative questions were posed focusing on current issues as well as on factors influencing the design of empty container logistics.

KEY FINDINGS

Following the logic of activities, key findings are structured according to the two studies.

Empty Container Management in the BSR - Experiences and solutions from a multi-actor perspective

Results of the data analysis provided a detailed picture of empty container flows at the national level as well as at the port level in the Baltic Sea Region. Especially the Baltic countries, Russia and, to a lesser extent, Poland and Finland, show a much higher share of empty containers leaving the country than entering it. Only for the Baltic ports of Germany and Sweden is the empty share of inbound containers larger than the empty share of out-bound containers or, as in the case of Denmark, almost equal. The same can be observed at the port level. Especially eastern European ports, such as St. Petersburg, Gdynia, Klaipeda and Tallinn report high shares of out-bound empty containers.

A literature review provided further insights on the main actors of empty container management. Two perspectives were found to lead toward a comprehensive picture: the empty container transport chain and container ownership. In general, empty containers are repositioned at the regional, interregional and global level.

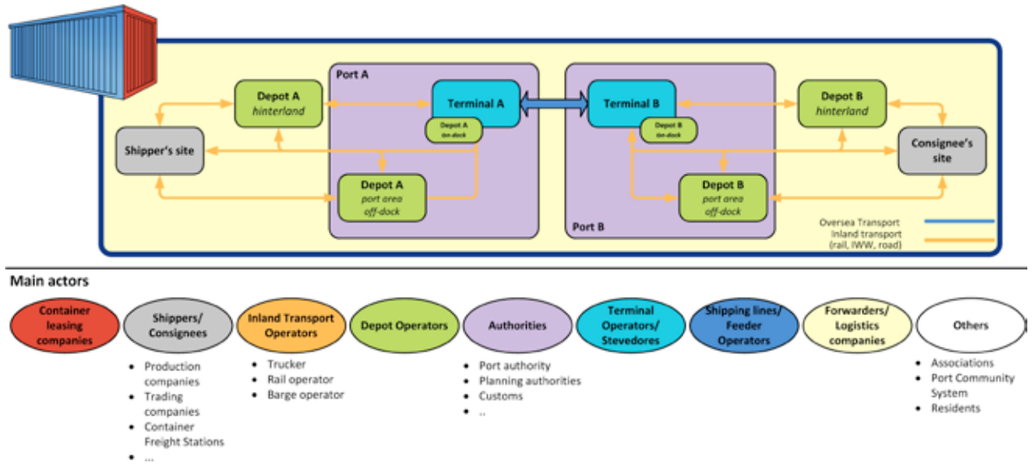

***Figure 2**: Generic actor groups of the (empty) container transport chain (author's design)*

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The place of container unloading is typically the starting point of the empty container chain. In door-to-door and pier-to-door container services, containers are unloaded at the consignee's site whereas in door-to-pier and pier-to-pier container services the unloading happens at container freight stations (CFS). If there is no export cargo at the consignee's site or in its proximity where direct exchange of empty containers between consignee and shipper (so-called street turns) can be realised, empty containers are transported to empty depots or directly to the terminal by an inland transport operator (rail, road or barge). The same applies to empty containers from container freight stations. Empty depots (operated by independent depot operators, or by operators affiliated to sea terminal operators or shipping lines) are located either 'on-dock' inside the port terminal complex or 'off-dock' in the port area as well as in the hinterland. Beside storage and provision of empty containers, other major functions of empty depots are: cleaning, maintenance and repair. If empty container repositioning requires sea transportation, the empty container is transported to the sea terminal and loaded onto a container vessel by the terminal operator/ stevedore and transported to the port of discharge by a shipping line or feeder operator. From here, empty container transport appears to be similar to the pre-haul until the container reaches the point of reloading. The transport chain can either be organised by forwarders (merchant's haulage) or by the shipping line (carrier's haulage). Other involved stakeholders are the owners of containers. Container leasing companies are globally operating companies whose business is to lease containers predominantly to shipping lines. Shipping lines also own a large share of the container fleet. Other stakeholders indirectly involved in empty container logistics are: port authorities through infrastructure and land provision, customs and other inspection authorities or spatial/transportation planning authorities, but also associations, port community system providers, etc.

Also, a survey was conducted as a questionnaire to record the experiences and knowledge of the main players in the region. Regarding measures to mitigate negative impacts of empty flows, it is concluded that there is no one single measure that has a crucial positive impact on empty container management. However, the answers of respondents suggest that a combination of measures is more promising. Also, the success of measures strongly depends on the perspective of the specific player, i.e. the choice of measures has to be related to the players involved. For a comprehensive picture the evaluation of measures is presented in Figure 3, both for terminal operators and transport operators, almost exclusively shipping lines. The measures are clustered into managerial (Mgmt), pricing (Pric), information and communication technology (ICT) and technological (Tec) measures. They are ranked according to their implied success based on the evaluations of the survey respondents.

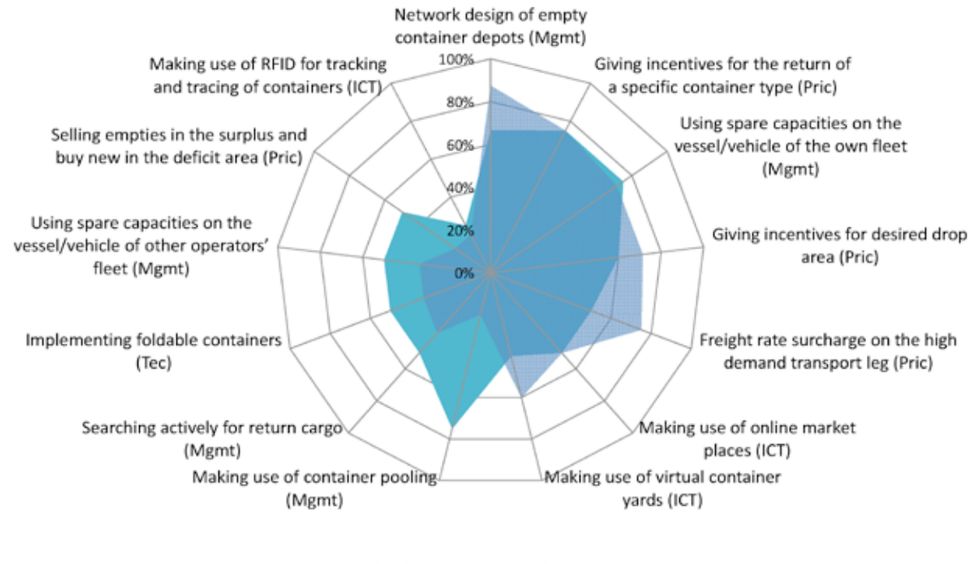

***Figure 3**: Comparison of measures evaluated by terminal and shipping lines (author's design)*

In summary it can be stated that there are remarkable differences between the actors of the container transport chain when it comes to empty container logistics. In particular, strategies and measures to overcome negative impacts of empty containers are highly actordependent and therefore require further investigation to make exhaustive recommendations. In this context, the stakeholder focus should be as comprehensive as possible to de-velop an integrated picture of the stakeholder perspectives in empty container logistics.

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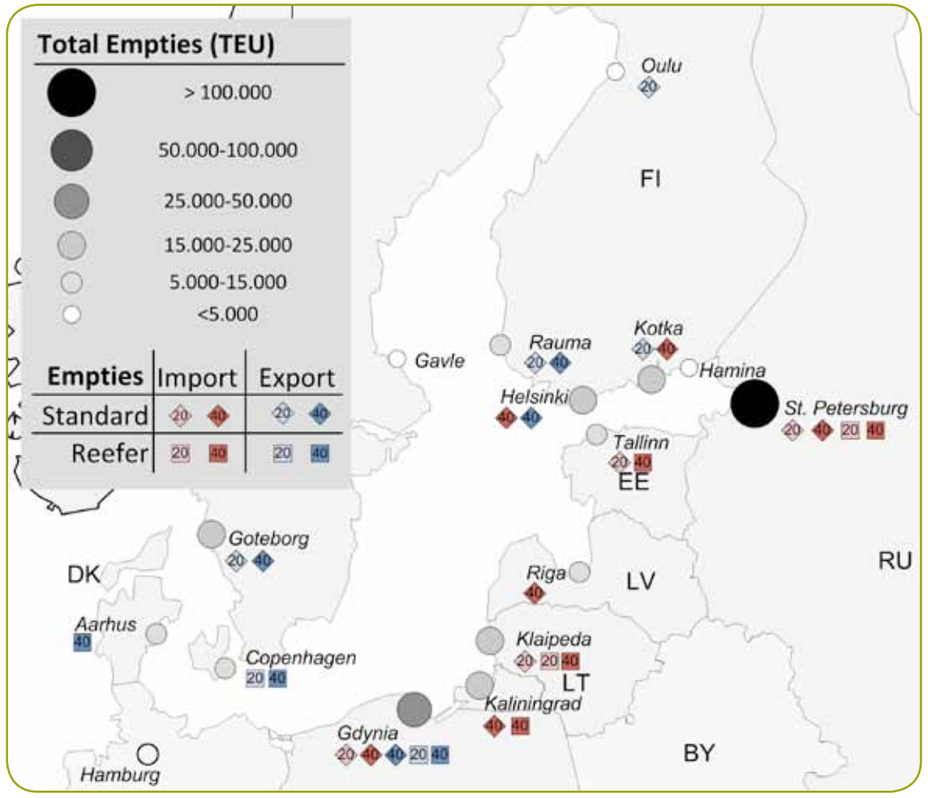

Figure 4: *Hot spots of empty container flows Hamburg – BSR (authors's design)*

The Port of Hamburg represents a major gateway to the BSR with feeder operators shipping loaded and empty containers to and from the region. Results from a data analysis, mapping empty flows between Hamburg and the BSR, show the diversity of empty equipment handled in the region. Figure 4 presents the type of empty equipment, its scale as well as the direction of flows (imports going to Hamburg, exports leaving Hamburg) for major ports in the BSR. St. Petersburg is by far the largest port in terms of empty move-ments for standard containers as well as for reefers. Thereby, the vast majority of empty containers are imported, i.e. shipped back to Hamburg. Gdynia, the region's second largest port concerning container flows from and to Hamburg, largely receives empty reefers and 40' standard containers from Hamburg and ships back standard 20' and 40' containers. Southern Scandinavian ports such as Aarhus (40' reefers), Gothenburg (20' and 40' standards) and Copenhagen (20' and 40' reefers) are predominantly receivers of empty equipment. The Baltic ports of Tallinn, Riga and Klaipeda, being primarily exporters of empties, ship empties (standard as well as reefers) back to Hamburg. Ports in the Gulf of Finland show a heterogeneous picture. Whereas the Port of Helsinki, which in the main supplies the Helsinki metropolitan region, imports and exports standard containers to and from Hamburg, the Port of HaminaKotka, to the large extent a transhipment hub, ships 40' standard containers back to Hamburg and receives empty 20' standard boxes. The northern Finnish ports of Oulo and Rauma in the first place receive empty standard containers from Hamburg, e.g. for the export of containerised pulp and paper products.

During the interview series, stakeholders of the different actor, such as: shipping lines, feeder operators, terminal, depot and transport operators, container leasing companies, authorities but also associations and other involved stakeholders were interviewed.

Interviewees were asked to report on current issues/hot topics with regard to empty container logistics. This question aimed at identifying the stakeholders' main challenges. Issues applying to logistics optimisation in general and independent of this context, such as: cost reduction, the qualification of human resources and the standardisation of informa-tion flows, were identified during the interview series.

Here, the cost aspect eventually means *reduction of repositioning costs*, which mainly affects the shipping line responsible for repositioning processes. As the exchange of information impacts all actors, the *standardisation of information flow* was mentioned during almost every interview as crucial factor. Related to steering mechanisms of container transport chains and by this addressing the shipping lines as key players in this respect, the following issues were mentioned by almost all interviewed terminal, transport and depot operators. That is the *scheduling of empty flows*, which allows planning in time and by this increases capacity planning and utilisation. Further, the *traceability of containers* and the *visibility of flows* for all actors were referred to by again almost all interviewed terminal, transport and depot operators.

Several issues were named that mainly affect stakeholders involved in port-related operational processes (shipping lines as well as terminal, depot and transport operators). These are: (1) *integrated capacity utilisation* – improving a balanced utilisation of port infrastructure and suprastructure; (2) *increased space efficiency* and (3) *process optimisation at the terminal* and *improved throughput time in the depot*.

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With regard to the port but mainly valid for the Port of Hamburg are the following issues. The *image of empty containers* in terms of imparting the necessity of empty container lo-gistics as an essential factor to enable good full container logistics was mentioned during almost all interviews with stakeholders in Hamburg. Due to the fact that full container handling (but also some other port activities) leads to higher revenues with respect to the required space and that operating empty container depots is a space intensive business, the *space availability for depots in the port* was brought up by almost all port actors. Some of them additionally mentioned the *trimodal accessibility of depots* as an important issue to ensure flexibility and the potential for modal shift. In relation to the bad image of empties another issues was brought up by a few actors involved in associations linking the port business with societal interests. This is the *negative environmental and socio-economic impact of empty flows*. This issue likewise applies more to Hamburg, where port and residential areas are growing close to each other and negative impacts like air pollution, noise and unsightly stacks of containers are affecting local residents directly. Finally, some issues referred to the hinterland area, mainly brought up by transport operators, shipping lines and container leasing companies. One is the increase of the *network density of hinterland container depots*, which in Hamburg is closely related to the *issue of dry port development* in the hinterland. Another issue in this context is the *container availability* in the hinterland, in particular special equipment.

Another focus of the interview series was to derive influencing factors with respect to the design of empty container logistics. At first, interviewed parties were asked to name key players in this respect and factors constituting their power. They mentioned the shipping lines first due to the fact that they *control container assets*. This applies both to the half of the worldwide container fleet they own directly and to the other half that they lease from container leasing companies. Resulting from this control of container assets and their functioning as carrier's haulage, shipping lines are furthermore *controlling strategic steering processes* regarding the worldwide flow of (empty) containers. Thereby, main drivers are: the repositioning - due to the imbalance of trade and the imbalance of container equipment (due to different requirements regarding sizes and types) but also: labour costs (for e.g. maintenance and repair), quality of service in certain ports and container production costs.

Interviewed partners were further requested to name their scope of action and underlying influencing factors to design empty container logistics.

The factor: *control of operational processes*, which is closely related to *pricing*, was named very often, especially in relation to terminal and depot operators who are the ones handling the containers and have a big influence of the throughput time in the port. They are also the ones serving short term demands of shipping lines as they are optimising the utilisation of ship capacities by filling it with empties for repositioning if there are no loaded containers available or weight limits of the ship have been reached. This also applies for train operations in the hinterland where due to capacity optimisation ad hoc demands can emerge.

The *market situation* also plays a big role, as in a somewhat fragmented market, like the road transport market, operational processes can more easily be substituted in the short term by competitors, even though road transport operators with a high share of loadings can also exert influence.

Some factors relating to interrelations between different stakeholders were mentioned such as: the pressure that one party exerts due to contractual relations. In this context vertical and *horizontal integration* was also named as an important influencing factor. Regarding horizontal integration some shipping lines are organised in alliances or other kinds of collaboration to create synergies with respect to empty container repositioning, e.g. they have agreements on cabotage, which in this context is a one-way spot lease of the container owning shipping line to a shipping line, which has a loaded container on that specific relation. Also, other stakeholders are integrating horizontally, e.g. terminal operators to develop their common hinterland as well as almost all actor groups joining associations.

The *vertical integration*, in turn, appears very often among considered stakeholders, in particular as regards: the triangle shipping lines, terminal operators (over sea and hinterland) and depot operators. In case of the cargo owners, *the shipper's specific demand* was named as an influencing factor, in particular, but not exclusively, if they transport big volumes. Their specifics exert influence on the quality requirements regarding the empty container. That triggers requirements along the whole transport chain. The shipping line has to monitor not only the container size and type when repositioning, but also different quality levels for a cargo range from scrap metal to units of stored blood. This further leads to the necessity of sorting the container in the depot (sometimes also at the terminal) not only by shipping line, size and type but likewise by up to sometimes five quality criteria. That is one reason for the space intensity of this business. Another factor mentioned is the *degree of integration in the port community*. Many agreements and orders rely on trust and informal

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relations or personal contacts, which sometimes are built up over years. *Knowledge and competence* of empty container patterns was also mentioned frequently as an influencing factor. Also, *political framework setting* was named by a few interview partners. Especially in ports, urban and transport planning authorities can exert influence by decisions they take with regard to e.g. transport infrastructure or general port development. In particular, the *control of space resources*, which is the case in land-lord ports, was named as a very important influencing factor for designing empty container logistics.

In a next step it is planned to cross-check the findings from the interviews with the different stakeholder groups by presenting the comprehensive, actorspecific findings to them for a final comparative evaluation. This evaluation will serve as a basis for deriving adequate stakeholder involvement strategies for possible later undertakings in empty con-tainer logistics by the Port of Hamburg as well as actors in the Baltic Sea Region.

[i] Drewry Shipping Consultants (2011) Container Market Annual Review and Forecast 2011/12; 1st ed. London: Drewry Publishing.

[ii] Eurostat (2012). Database Maritime Transport (Table: goods, main ports, container). Re-trieved July 1, 2012, from http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database.

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