Report on Empty Container Management in the Baltic Sea Region

Experiences and solutions from a multi-actor perspective

Hamburg University of Technology
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1 Introduction

There are different aspects calling for a deeper investigation of empty container management in the Baltic Sea Region (BSR). Firstly there is the increasing degree of containerisation in the region\(^1\) with growth rates above the European average. Secondly, there is a strong imbalance of inbound and outbound container volumes\(^2\) and the share of empties demanding for repositioning is quite high for some of the BSR bordering countries.

Worldwide the share of empty containers is estimated to be around 20% at sea and 40% on land of all containers transported\(^3\). This is mainly due to an imbalance of cargo flows and the required compensation of surplus and shortage of empty containers between hubs in the transport chain on a local, regional and global level.

A vast number of players along the container transport chain is facing the empty container problem. In principle, everyone who handles or owns containers is affected: ports, terminal and hinterland operators, shipping lines and other transport operators, shippers and consignees as well as container leasing companies. Thereby, the type and degree of impact varies for each stakeholder. Furthermore regional public authorities (e.g. urban or transport planning authorities) or the port authorities themselves have an influence on issues relevant for empty container management as well as are affected by its effects\(^4\). In summary, the empty container problem primarily emerges in terms of additional transshipment and transport costs as well as in higher requirements for storage facilities\(^5\).

The repositioning of empty containers causes high costs (around $33 billion worldwide in 2008\(^6\)) and ties up transport and storage capacities.

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\(^1\) Breitzmann, 2009, pp. 30
\(^3\) Drewry Shipping Consultants Ltd., 2009, pp.15
\(^4\) Hautau, Hüttmann, & Kasiske, 2008, p.29
\(^5\) Konings, 2005, p.248
\(^6\) Drewry Shipping Consultants Ltd., 2009, p.16
These inefficiencies also lead to negative environmental impacts such as air pollution and land use.

Thus, the main objective of this report is to create a better understanding of the challenges empty container management poses for the different players of the container transport chain in the BSR. In particular the report answers the following questions:

- What is the situation of empty movements like in the BSR?
- Which players are involved in what way in empty container management in general as well as in the BSR?
- How are the different players affected?
- How do the different players deal with potential negative impacts?

Therefore at first, the specific situation of empty containers in the BSR is portrayed in chapter 2. In chapter 0 the main players of empty container management are introduced with their role in the transport chain, their interactions and specific insights with regard to the BSR concluded from the survey. A closer look on the impact empty movements have on the different players’ business is summarised in chapter 4. The final chapter 5 shows measures to overcome potential negative impacts of empty movements.

A three-fold approach has been followed to elaborate this report. To investigate the specific situation in the BSR statistical data from Eurostat has been analysed. A broad literature review has been performed to amend the specific insights for the BSR as well as to provide a general overview on the state of the art of empty container management. Furthermore a survey has been conducted to catch experiences and knowledge of the main players in the region. A detailed portray of the survey results can be found in Annex A.
2 Relevance of empty container repositioning for the Baltic Sea Region

Different arguments call for a deeper examination of empty container management in the Baltic Sea Region. The most important reasons are:

- **Rising trade volume of containerised goods:** All other influencing factors held equal, rising container volumes per se also mean higher absolute numbers of empty containers. In the long run, container flows in the Baltic Sea Region grew above European average. Whether the global economic crisis will have a lasting impact has to be evaluated in the future.

- **High share of empty containers of overall container turnover:** The empty container share in the BSR is above the European average.

- **Strong imbalances of containerised trade flows:** Many countries and ports in the Baltic Sea show large imbalances between inbound and outbound empty container flows. In most cases (predominantly new member states), the outbound share is larger than the inbound share, i.e. those countries import more containerises goods than they export, hence ‘exporting’ excess empty containers.

In the following these key arguments are supplemented with results from detailed evaluations of country and port specific container transport data.

**Development of containerised cargo flows in EU 27 and the Baltic Sea Region**

As elsewhere in the world over the past decades trade in Europe was strongly influenced by a rising degree of containerisation. In 2007 and 2008 this development reached its peak to date with a turnover of around 70 million TEU in European ports. In 2009 due to the global economic crisis the turnover of containerised goods in EU 27 decreased for the first time.
time since the introduction of the container by more than 15% in comparison to the previous year. However, numbers for the first half-year 2010 indicate that the container turnover will be back on its growth course soon (46.5 million TEU in the first half of 2010).\(^9\)

In recent years, the growth of containerised cargo in the Baltic Sea Region exceeded the development in EU. One reason for the above average growth is the growing demand for containerised goods in Russia. Also, in Sweden and Finland traditional bulk and break-bulk cargo such as pulp, paper and sawn wood is increasingly transported in containers\(^11\). In 2007 the container turnover in Baltic ports was around 2.5 times higher compared to the year of 2000, equalling an annual growth rate of more than 13\(^\%\).\(^12\) In 2008, before the economic crisis strongly influenced trade volumes, 6.7 million TEU have been shipped from and to ports in the Baltic Sea. This trend changed dramatically in 2009, when container turnover

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\(^9\) Eurostat, 2010a
\(^10\) Eurostat, 2010a
\(^11\) (BMT, 2006, p.74)
\(^12\) Breitzmann, 2009, p.31
dropped to 4.9 million TEU. Data of the first half of 2010 indicate a recovery however less distinct compared to the overall European development\(^\text{13}\).

![Bar chart showing container turnover and empty share in BSR incl. Baltic Russia (2005-2009).](chart.png)

**Figure 2:** Container turnover and empty share in BSR incl. Baltic Russia (2005-2009) (author’s design based on Eurostat\(^\text{14}\))\(^\text{15}\)

**Development of empty container runs in EU 27 and the Baltic Sea Region**

Until 2008, the share of empty containers in the European Union was rather stable, oscillating around 20% since the eastward enlargement of the EU in 2004, mirroring the global average. Before that, the share varied between 16% and 18% in EU 15. In 2009, the year of global economic turmoil, the empty container share dropped to 18.4%\(^\text{16}\).

The Baltic Sea Region (EU excl. Russia) is characterised by an empty container share above European average, fluctuating between 21% and 26% from 2005 to 2009. On container routes between European countries and

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\(^{13}\) Eurostat, 2010a  
\(^{14}\) Eurostat, 2010a  
\(^{15}\) In contrast to (Breitzmann, 2009, the authors of this study only incorporated the Baltic ports of Sweden, which mainly explains the slightly different numbers.  
\(^{16}\) Eurostat, 2010a
Russian Baltic Sea ports the empty container share is even higher - between 22% and 29% in the same time period (see Figure 3). In the figure also results from the survey are integrated: the average from responding terminal (TOCs) and transport operators (TOPs). The empty shares they recorded in recent years are partially even higher than the averages in the BSR (excl. Russia).

Figure 3: Comparison of the empty container share in Europe, Russia and the BSR (author’s design based on Eurostat\(^\text{17}\))

A major reason for empty container transport is the imbalance of trade flows. Where containerised goods are imported, but less containerised goods are exported, 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, which can be observed in several countries in the BSR. Especially the Baltic countries, Russia and, to less extent also Poland and Finland, show a much higher share of empty containers leaving the country than entering it (see Figure 5). Only for the Baltic ports of Ger-

\(^{17}\) Eurostat, 2010a
many and Sweden, the empty share of inbound container is larger than the empty share of outbound containers or, as in the case of Denmark, is almost equal.

The imbalance of inbound and outbound empty container flows is also observable on port level. Figure 5 presents inbound and outbound container flows in absolute and relative terms for the 15 largest ports in the BSR in 2009. Especially eastern European ports, such as Gdynia, Klaipeda or Tallinn report high shares of outbound empty containers. The port of St. Petersburg as the largest port in the Baltic Sea in terms of total container turnover also represents the port with the highest share of outbound empty containers. This imbalance illustrates the fact that the Russian economy heavily relies on the import of containerised goods,

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18 Eurostat, 2010a
whereas Russian exports are predominantly energy resources, i.e. non-containerised goods\textsuperscript{19}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure5.png}
\caption{Top 15 ports in the BSR with loaded and empty container turnover (2009) (author’s design based on Eurostat\textsuperscript{20})\textsuperscript{21}}
\end{figure}

\textsuperscript{19} Tolli & Le-Griffin H. D., 2008, p.291; Ruutikainen & Tapaninen, 2009, p.7
\textsuperscript{20} Eurostat, 2010a
\textsuperscript{21} A complete overview on container handling ports in the BSR is attached in Annex C.
3 Main players in the (empty) container transport chain and their interactions

When considering the main players of empty container repositioning, there are different perspectives to have a view on this:

- (Empty) container transport chain: considering those players which are directly or indirectly involved in the handling of empties.
- Container ownership: considering those players owning containers.

Empty container transport chain

An exemplified transport chain is portrayed in Figure 6 showing which are the main players involved in the handling of empty containers. The example shows a transport chain for over sea empty container repositioning.

<table>
<thead>
<tr>
<th>Main players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipper/Consignee</td>
</tr>
</tbody>
</table>

Figure 6: Exemplified transport chain for over sea empty container repositioning (author’s design)

The movement of the container starts at the shipper where the container has been unloaded. From there the container is transported via road/rail/IWW to the port by an inland transport operator (rail, road or barge). Depending on the port’s capacity, the depot can be on the port site. At ports where space is limited extra depots for empty containers are situated in proximity to the terminal or in the port’s hinterland (operated by a depot operator). Cleaning, maintenance or repair of the containers very often takes place in these empty depots. From the depot, the empty containers are transported to the terminal where the container is loaded on a vessel (by the terminal operator/stevedore). From the ter-
Containerised products in the BSR are manufactured products, break and break-bulk products.

In the following the main players are shortly portrayed in general and - if applicable - with special regard to the BSR.

Shipper/Consinee

The shippers and consignees are companies (manufacturing, trading or others) demanding for transportation of goods\(^{22}\). In this case (see Figure 6) they are the ones loading and unloading the container.

In the BSR containerised goods are mainly manufactured goods. In some countries, a tendency towards containerisation of bulk and break-bulk products can be observed e.g. pulp, paper and sawn wood in Sweden or Finland\(^{23}\).

Inland transport operator

Inland transport operators are serving the different modes of inland transport: road, rail and inland waterway (IWW).

In the BSR a huge number of road and rail operators is serving the market. IWW does not play any role in the region (the modal share of IWW in the Baltic States Estonia, Lithuania and Latvia as well as in Denmark, Norway and Sweden is zero, in Finland and Poland less than 1%). In contrast to this the countries where the main feeder ports are situated have a significant share of inland water way transport: the Netherlands with a share of 35%, Belgium with around 15% and Germany with approximately 12% (all figures are for 2009\(^{24}\)). Also in Russia inland waterway are of importance.

Empty depot operator

Operators of empty depots are primarily offering a storage service for transport operators, often amended with services like maintenance,

\(^{22}\) Talley, 2009, p.69
\(^{23}\) BMT, 2006, pp. 74
\(^{24}\) Eurostat, 2010b
Empty depot operators only play a passive role in the transport chain.

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cleaning and repair. Either these depots are situated in the sea port area or in the area the port services: the so-called port hinterland. Due to the fact that the shipper - in case of merchant haulage - or the transport operators - in case of carrier haulage - decide how to route empty containers, these depots play a rather passive role in the transport chain. Nevertheless these players have access to important information on empty container shortages and surplus. In times of increasing vertical or intermodal integration of shipping lines, it is not uncommon that they are operating these terminals themselves, what also could be validated by the survey.

Port authorities

The term port or port authority is used in different ways. There are four different port types to distinguish, whereas port authorities play different roles in terms of port management, ownership of infrastructure and superstructure and service provision (see Table 1). In consequence, the involvement of port authorities in empty container management can be very different (see below).

<table>
<thead>
<tr>
<th></th>
<th>Port management</th>
<th>Ownership infrastructure</th>
<th>Ownership superstructure</th>
<th>Service provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service port</td>
<td>Port authority</td>
<td>Public (government)</td>
<td>Public (government)</td>
<td>Port authority</td>
</tr>
<tr>
<td>Tool port</td>
<td>Port authority</td>
<td>Public (government)</td>
<td>Public (government)</td>
<td>Port authority operates port-owned equipment. Further services (e.g. stevedore) provided by private companies</td>
</tr>
<tr>
<td>Landlord port</td>
<td>Port authority</td>
<td>Public (government)</td>
<td>Private companies or public</td>
<td>Private companies</td>
</tr>
<tr>
<td>Private port</td>
<td>Private companies</td>
<td>Private companies</td>
<td>Private companies</td>
<td>Private companies</td>
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</tbody>
</table>

Table 1: Four types of ports (author’s design based on Talley)

Baltic container ports are almost exclusively served by feeder operators and not directly connected with deep sea ports, even though some ports

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25 Veenstra, 2005, p. 70
26 Talley, 2009, pp. 126
(e.g. Ports of Arhus, Gdansk, Gothenburg are directly connected to ports of the Mediterranean Sea) try to change that. This is the well-known hub and spoke system, where deep sea cargo is transshipped in hub ports in Belgium, the Netherlands and Germany to be further feedered to the BSR. There are around 50 container ports in the region which handled around 4.9 Mio TEU in 2009.

Survey results regarding the port authorities’ perspective on empty container management are rather heterogeneous. Several port authorities answered that containers are not in line with their activities and not in their area of responsibility. They further stated that they simply have no data on empty movements. Thus it can be concluded that for some port authorities this issue is simply not considered as core interest. On the other hand, some port authorities certain interest on that issue could be accounted. Even though port authorities of landlord ports are not actively managing container flows, they are affected in terms of provisioning transport infrastructure and industrial areas in the port. Among the respondents it was reflected, that e.g. in the boom years regarding cargo handling up to 2008 capacities in the port were already saturated. This is also expected to occur again assuming increasing cargo turnover in upcoming years and associated rising demand for space vacancy in the port. Another remarkable comment was a description of shortages of empty containers in the port region and the impact on the economic development. Here this issue was tackled by the port authority in the interest of the regional development. It can be concluded that some port authorities which are affected by the impacts of empty containers are getting involved in its management.

27 Breitzmann, 2009, pp. 25; Matczak, 2009, p.17; Eurostat, 2010a
Terminal operator

The (sea) terminal operator is responsible for moving cargo through a port and thereby creating port throughput. Depending of the port’s size and functions, one or several terminals can be settled in one port\textsuperscript{28}.

In around 50 container handling ports in the BSR\textsuperscript{29} a large number of terminal operators is providing their service. In some smaller ports e.g. in Sweden or Finland it is not uncommon that the (public) port authority is acting as a service port and thus is responsible for all operations in the port.

Based on the survey results the terminal operators’ perspective conveys a clear picture. Several respondents stated that empty container management is not of relevance for them and referred to the shipping lines which are - from their perspective - the ones responsible for it. Also those respondents completing the survey indicated that for them empty containers are mostly a beneficial part of their business.

Shipping lines

Shipping lines provide maritime transportation services. For the purpose of this report, the focus is on container operating shipping lines. Due to vertical or intermodal integration shipping lines are furthermore involved by e.g. owning container equipment, operating terminals etc\textsuperscript{30}. In this context it is important to distinguish between carrier and merchant haulage. Carrier haulage means that one of the transport operators - usually the shipping line - is contracted by the shipper and is thereby responsible to organise the whole transport chain, i.e. to subcontract transport operators of other parts of the transport chain. In the case of merchant haulage the shippers themselves remain in control of organising the transport and subcontract all involved transport operators\textsuperscript{31}.

\textsuperscript{28} Talley, 2009, p. 94
\textsuperscript{29} Breitzmann, 2009, p.28
\textsuperscript{30} Rodrigue & Notteboom, 2007
\textsuperscript{31} Veenstra, 2005, pp.66
In the BSR there is a large number of container feeder operators - around 30 - which can be divided into:

- main Baltic players (Unifeeder and Teamlines) - 36% market share,
- global deep sea players operating regional services to serve feeder routes (like Maersk Line, MSC, OOCL) - 42% market share,
- local feeder lines serving niche routes (like Samskip, FESCO) - 22% market share

Coming from the survey results shipping lines seem to be most affected by empty containers. Firstly the highest response rate among the different group of players mirrors a certain interest in that issue. Furthermore, shipping lines evaluated the impact empty containers have on their business less positive e.g. in comparison to the other players and especially regarding costs. On the other hand, a remarkable amount of answers indicates that empty containers also create benefits for them. Nevertheless, being owner and operator of containers they are the major decision makers in empty container management.

Further parties indirectly involved in empty container management

Finally there are parties being indirectly involved by the impact occurring from empty movement or the impact their decisions have on empty movements respectively. These are e.g. regional authorities which are having an influence on port operations, like spatial or transport planning authorities.

32 Breitzmann, 2009, pp. 25; Matczak, 2009, p.14
33 Hauteau et al., 2008, p.29
Container ownership

The ownership of marine (ISO) containers is mainly shared by shipping lines (62%) and container leasing companies (38%). A very small share is kept by depot operators, large shippers and transport operators.

Shipping lines

Ocean carriers have increased their ownership within recent years ‘following increasing integration tendencies and the use of tight management approaches, like revenue management in their operations’. This phenomenon can be explained by the growing level of ‘intermodal integration’, meaning that shipping lines collaborate closer with terminal operators as well as with operators in the inland. In addition to this some of the main ocean carriers have launched activities in the container manufacturing industry what stresses the argument of intermodal or vertical integration.

Container leasing companies

Container leasing companies’ business is to lease containers (mainly) to shipping lines. Thereby they are offering certain flexibility for the management of containerised assets, in terms of temporal and geographical dynamics in the demand. They are global operating companies. There are five leasing companies controlling about 60% of the leasable container equipment. The 13 largest leasing companies account for about 90% of the global container leasing market equalling 10.7 million TEU.

Coming from the survey results the perspective of container leasing companies regarding empty container management seems to be rather different than from other players. From their perspective all containers are empty. Furthermore it is in the responsibility of their clients to organise container flows and thus during the time the container is used by their clients it makes no difference if the container is loaded or empty, they are paid anyway for the leasing.

34 Theofanis & Boile, 2009
35 Rodrigue, Comtois, & Slack, 2009
36 Rodrigue & Notteboom, 2007
Interaction of main owner groups

The two main owner groups pursue different and in some cases conflicting goals. Carriers consider containers as transportation equipment and their decision making in equipment management focus on facilitating cargo flows and reducing transportation and handling costs. In contrast to this perspective containers are the core competence of leasing companies. In terms of ownership structure of the world container fleet within the years 2005 until 2009 a steadily decrease of the lessor’s ownership can be stated (see Figure 7). This is due to the vertical or intermodal integration of shipping lines. Other reasons are the increase of costs of new containers, the repositioning of empties and partial very low freight rates. In consequence the container leasing business has become less profitable.\textsuperscript{37}

The relationship between shipping lines and leasing companies is obviously very close. There is a significant difference regarding the costs for repositioning of empty containers whether the shipping or the leasing companies bears it, because the latter has to hire container slots from the carrier for these transports. Even though shipping companies may try to pass repositioning costs on to the lessors, it is quite evident, that this is not a long term policy as they are somehow depending on the services of the lessors. In return, leasing companies are closely related to the carriers being their main client.\textsuperscript{38}

\textsuperscript{37} Rodrigue et al., 2009
\textsuperscript{38} Konings, 2004, pp.86
Three different container leasing arrangements can be distinguished.

Master leases are short to medium term and fleet management responsibilities are completely covered by the lessor. Furthermore master leases comprise complex arrangements concerning on-hire and off-hire of equipment, as well as debits and credits depending on the location and the equipment’s condition at the time of interchange. Long term leases or ‘dry leases’ last over 5-8 years. The lessor purchases container but all management activities are performed by the ocean carrier. Short term leases or spot market leases serve acute demands of operators. Normally they only last for a short period like one trip or a round trip.

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39 UNCTAD, 2010, p. 34
40 Theofanis & Boile, 2009
The arrangement’s duration, responsibilities for repositioning as well as for maintenance and repair are crucial factors when choosing a leasing contract.

The differences of leasing contracts mainly occur from the arrangement’s duration, responsibilities for repositioning as well as for maintenance and repair. Crucial conditions are the location to drop off and to pick up the container. To avoid that containers are off-hired at a place which is not favoured by the lessor - particular in a surplus area - drop-off and pick-up charges are part of the leases as well as a specific quota to determine the number of containers which can be off-hired at a certain place.\(^{41}\)

The development of the last years shows an increasing preference of dry leases. This is mainly motivated by the ocean carriers’ intention to integrate leased containers in their own fleet to realise a more efficient fleet management. This vertical integration of ocean carriers affects not only the lessor but also depot operators, serving storage and repair demand of the leasing company.

\(^{41}\) LeDam Hanh, 2003
4 Reasons for empty movements

Several reasons for the transport of empty containers have been identified. As transport is a derived activity, economic developments and resulting trade volumes determine the direction and volume of empty transport.\textsuperscript{42} Trade imbalance is considered as the main cause for the movement of empty containers.\textsuperscript{43} In Figure 8 the global flow of loaded containers on some of the main trading routes is displayed. It becomes evident, that especially between the Far East and Europe (ratio 2.5:1) and the USA (ratio 1.8:1) respectively, the imbalance is very strong. But also on other destinations a notable imbalance can be remarked: overall there seems to be a strong East-West and North-South divide.

\begin{center}
\textbf{Figure 8:} Flow of loaded containers worldwide in mio. TEU (author’s design based on Drewry Shipping Consultants\textsuperscript{44})
\end{center}

Additionally seasonal effects have an impact on the flow of cargo and the flow of empty containers. Another reason is the imbalance of equipment which results from different good types demanding for different equip-

\begin{flushleft}
\textsuperscript{42} Konings & Thijs, 2001, pp. 335

\textsuperscript{43} Theofanis & Boile, 2009, p.51; Boile, 2006, p.56, Rodrigue et al., 2009

\textsuperscript{44} Drewry Shipping Consultants Ltd., 2009, pp.15
\end{flushleft}
ment distinguished by dimension (e.g. 20 ft, high cube, pallet wide) and the specific application possibilities (e.g. reefers, tankers).

Furthermore there are some other aspects having an impact on empty movements\(^{45}\). There are the *repositioning costs* highly depending on the distances to overcome and on the freight rates on the specific route. In case of high costs (for repositioning) this might lead to shortages of empty containers on export markets. From the perspective of shipping lines - being ship and container owners - also *revenue generation* plays a role. Instead of parking the empty container somewhere waiting for an export load, the container is shipped back to e.g. Asia using spare capacities of the own fleet and by this is sooner available for being loaded again. Another reason mentioned is the relation from *manufacturing or leasing costs* and the costs for repositioning. If leasing an existing or buying a new container is cheaper than the repositioning this will lead to an accumulation of empties in the surplus area whereas inverse requirements have a positive influence on the repositioning. Further to mention are the *usage preferences* describing the fact that a specific container is always owned by e.g. a specific shipping line (or leasing company). In consequence, even if a shipper needs an empty container for a shipment with shipping line A, an empty container of shipping line B in direct vicinity would not be of much help. Finally a highly topical subject should be included here. Due to increasing bunker prices and excess capacities (ships and containers) *slow steaming* has been favoured by the shipping lines. This measure leads to tight capacities and reduced availability of containers inland.

This imbalance of trade takes place on a global but also on an interregional/ regional and local level. The global level leads to repositioning over sea from surplus to deficit areas. Repositioning on the interregional level means balancing on the continental level (e.g. repositioning in Europe, North America etc.). The regional and local perspective is very close. Whereas regional empty container patterns balance empty container demands among importers, exporters and marine terminals, the

\(^{45}\) Rodrigue et al., 2009; Boile, 2006
local pattern aims to balance demands from marine terminals and empty depots (see Figure 9)\textsuperscript{46}.

\textbf{Figure 9:} Spatial dimensions of repositioning  
(author’s design based on Theofanis)

\textsuperscript{46} Theofanis & Boile, 2009, pp. 57
5 Impact of empty container repositioning on the business of involved players

The repositioning of empty containers causes high costs and ties up transport and storage capacities. In addition to these potential negative economic impacts, also environmental and socio-economic impacts can be observed. On the other hand empty containers are also a beneficial part of some companies’ business, e.g. for transport or terminal operators as long as there is free capacity.

Economic impact

Costs

In the year 2008, from a global view there were 54.5 million TEU seaborne empty container movements, resulting in 109 million TEU empty port movements. According to Drewry Shipping Consultants $400 per movement can be accounted covering terminals, restows, hire, damage, storage transport, administration and agency. That leads to total costs of around $21.8 billion for the seaborne empty container movements worldwide. The costs for landside repositioning by rail, road or barge, have been $11.2 billion. In total, the costs for worldwide empty container repositioning added up to $33 billion in 2008\(^\text{47}\).

The conducted survey gave further insight in terms of the impact of empty containers on costs for different players.

In terms of costs for terminal operators a very positive influence was stated: for them empties equal profit. 50% of responding transport operators (mainly shipping lines) however stated a negative or even harming impact on their business. The same phenomenon can be observed for the impact empty containers have on the revenues of both groups.

Capacities

Furthermore empty containers tie up storage capacities\(^\text{48}\), what might become a serious problem in places of high demand for but limited avail-

\(^{47}\) Drewry Shipping Consultants Ltd., 2009, p.16
\(^{48}\) Vojdani, Lootz, & Rajchowski, S. 149
able space. Around 10% of worldwide container assets are empty and 20.5% of port handling can be accounted for empty movements. In the year 2007 for example one of the container terminals in Port of Rotterdam refused to handle empty containers due to space problems in the terminal area. Likewise empty containers tie up transport capacities. Depending on the transport mode, this might lead to an extra transport process for road transport and to limited number of available container slots on mass compatible modes like sea, rail and IWW.

The survey created further insight on the perspective of terminal and transport operators in the BSR regarding the impact of empty containers on capacities.

![Figure 10: Evaluation of impact on the players' business (author's design based on survey results)](image)

With regard to storage capacities the terminal operators again seem to benefit from storing empties and do not seem to have capacity problems. Even though the majority of transport operators - mainly shipping lines - stated a positive impact more than 30% stated a negative or even harming

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49 Rodrigue, 2011
50 DVZ, 2007
impact on their business. For them empties have a negative impact by blocking their storage capacities. Considering transport capacities the comparison is more balanced, even though the evaluation of the terminal operators is still more positive than of the transport operators.

In general it can be concluded, that the impact of empty containers with regard to the considered economic aspects are evaluated positive or even beneficial from the majority of respondents. Comparing the players terminal and transport operators it can be observed that for the latter empty containers have a more negative impact on their business with regard to all considered aspects.

Environmental and socio-economic impact

Furthermore, these inefficiencies in transport and storage of empties have negative environmental and social impacts. The transport of empties contributes to emissions, such as GHG, air pollutants and noise particular within ports and leads to congestion\textsuperscript{51}. In addition, tied storage capacities generate land use. The land-intensive storage of empty containers comprises additionally a social dimension. In ports whose expansions have reached residential areas or vice versa, containers can become a point of discussion\textsuperscript{52}.

\textsuperscript{51} LeDam Hanh, 2003, p.9
\textsuperscript{52} Boile, Theofanis, & Mittal, 2004, p.4; IBA Hamburg, 2008, p.48
6 Strategies and measures to mitigate negative impacts of empty movements

When it comes to strategies and measures to overcome problems arising from empty container repositioning, the involved player(s) as well as the problem context have to be considered carefully. Some measures may solve the problem for one but leads to further problems for other players. In the following different measures are portrayed.

Information and communication technology (ICT)

Different ICT solutions, including electronic markets to find free slot capacities for empty containers. Such virtual platforms between consignees and consignors focusing on container unit exchange have been developed in recent years\(^{53}\). A special type of this kind of platform is the virtual container yard. The main difference is that it is initiated by a party which is not directly involved in container operations and therefore is rather neutral, e.g. the port authority. The VCY functions as an information platform used by consignee and shipper which facilitates the direct exchange of empty containers between involved parties. The main intention is to reduce the distances travelled by empty containers. So far, there are two pilots implemented and one in the stage of implementation. Another important factor for managing repositioning is the worldwide visibility of equipment\(^{54}\), which is facilitated by information systems (e.g. RFID) enabling tracking and tracing of empty containers.

Managerial and organisational measures

A very simple measure is to reduce imbalances by searching actively for return cargo and by this improve the utilisation rate. This measure is limited by the balance potential of the destination, some are simply imbalanced. The measure is mainly applied by shipping lines or other transport operators. In rare cases it is also used directly by the shipper. There are also different cooperation strategies pursued by shipping companies to reduce the costs of empty transport\(^{55}\). As a very common and obvious op-

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\(^{53}\) Theofanis & Boile, 2009, pp.57
\(^{54}\) Boile et al., 2004, p.11
\(^{55}\) Konings & Thijs, 2001, pp.336
tion, the use of spare ship capacities was named, either of the own fleet or of other shipping lines. Furthermore, the cooperation could also focus on the container itself by making use of container pooling, the so called grey box pools. Usually shipping lines place their brand label on the container with the consequence that the container will be used by only one shipping line, preventing the possibility to apply the pooling concept, which is e.g. very successful applied for pallets. A more sophisticated measure is the optimisation of the network of depots for empty containers. This requires a certain scope for action, as several parties such as deport operators, port authorities and transport operators are affected and have to be motivated and convinced to participate.

Pricing measures

Another possibility for shipping lines to face the challenge of empty container transport is pricing. There are different approaches to use price policy. It is e.g. possible to compensate the high costs on the low demand leg by imposing a surcharge on the freight rate of the high demand leg.

Another option is to introduce price incentives for the flow of equipment, e.g. to give incentives for a desired drop area or for the return of a specific container type to avoid shortages. Finally there is also the possibility for the shipping companies to sell containers in the surplus area and to buy them in the deficit area. This is very much depending on the ratio of current purchase prices and the costs for repositioning.

Technological measures

Most of the applied strategies try to reduce the number of transported empty containers. In contrast to that, the development of foldable containers reduces the volume of empty containers transported. The basic principle seems to be very simple: the container is folded when it is empty. Some types of ‘foldable’ flatracks already use a comparable concept. The idea as such is not new to the market. However, several attempts - the first time in the 80s - trying to introduce the foldable container failed in the past. Nevertheless, the use of foldable containers carries the potential to save transport, transshipment and storage costs.

56 Boile et al., 2004, p.9
even though it still misses the real proof in practice. The idea of a foldable container still has to cope with scepticism concerning economic success, technical performance and reliability, complexity of the folding and unfolding processes, as well as logistical and organizational problems.

Policy measures

A measure for public authorities to limit the amount of empty containers in the port or port region is to install concrete regulations for the time empty containers stay in the port. Argentina for example has passed a punitive law for containers stored longer than a certain number of days\textsuperscript{57}.

Players’ involvement in the implementation of measures

In Table 3 all above mentioned measures are related to the different players of empty container management with regard to their involvement in implementation. A distinction is made between potential initiators, players which are directly involved in implementation and those who only play a minor or no role during the implementation process.

\textsuperscript{57} Boile et al., 2004, p.10
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Table 3: Involvement of different players in the implementation of considered empty container measures (author’s design)

<table>
<thead>
<tr>
<th>Players involved in implementation</th>
<th>ICT</th>
<th>Managerial</th>
<th>Pricing</th>
<th>Technology</th>
<th>Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipper/Consignee</td>
<td>X</td>
<td>O</td>
<td>O</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>Shipping line</td>
<td>X</td>
<td>X</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inland transport operator</td>
<td>X</td>
<td>O</td>
<td>O</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>Terminal operator</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>-</td>
<td>O</td>
</tr>
<tr>
<td>Depot operator</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>-</td>
<td>O</td>
</tr>
<tr>
<td>Container leasing company</td>
<td>X</td>
<td>X</td>
<td>O</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Port authority</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

**Potential initiator**
- X

**Directly involved in implementation**
- O

**Lightly or not directly involved in implementation**
- -
Implications from the survey on considered measures

The survey participants were asked to evaluate different measures dealing with negative impacts of empty containers according to their success. Possible ratings were 'very good', 'satisfactory' and 'poor'. The respondents were also asked to indicate whether they already applied the measure or not and to provide deeper insight by explaining their ratings. Measures have been clustered as before: ‘information and communication technology’ (ICT), ‘managerial and organisational’ (Mgmt), ‘pricing’ (Pric) and ‘technological’ measures (Tec). As some of the measures are promising for one player but at the same time have a rather negative impact on the business of other players of container flows, also the evaluation results have further been clustered by groups of actors. Due to the fact that container leasing and logistics companies did not respond to questions of this part of the survey they are not part of the following remarks. As only one port authority provided their knowledge and experience they were not portrayed separately but have been included in the group of all respondents. In Figure 11 to Figure 14, the evaluation for each measure is portrayed for all respondents, as well as for the terminal operators (TOC) and the transport operators (TOP).

Figure 11: Evaluation of ICT measures (author’s design based on survey results)
In the category *ICT measures*, three measures were evaluated: ‘making use of a virtual container yards’, ‘making use of online market places’ and ‘making use of RFID for tracking and tracing of containers’. The last to measures the assessment has not been very promising. In comparison the measure ‘make use of a virtual container yards’ was assessed rather positive with regard to its potential success by all respondents. Thereby TOPs evaluated the measure more positive than TOCs.

Regarding *ICT measures the Virtual Container Yard is evaluated as the most promising measure.*

<table>
<thead>
<tr>
<th>Measure</th>
<th>All (N= 15)</th>
<th>TOC (N= 6)</th>
<th>TOP (N=8)</th>
<th>All (N= 12)</th>
<th>TOC (N= 4)</th>
<th>TOP (N=7)</th>
<th>All (N= 10)</th>
<th>TOC (N= 4)</th>
<th>TOP (N=5)</th>
<th>All (N= 13)</th>
<th>TOC (N= 4)</th>
<th>TOP (N=8)</th>
<th>All (N= 11)</th>
<th>TOC (N= 4)</th>
<th>TOP (N=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network design of empty container depots</td>
<td></td>
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<td></td>
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<tr>
<td>Using spare capacities of the own fleet</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Making use of container pooling (grey boxes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Searching actively for return cargo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using spare capacities of other operators’ fleet</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tbody>
</table>

*Figure 12: Evaluation of managerial measures (author’s design based on survey results)*

*Most of the managerial measures have been evaluated rather positive.* To ‘optimise the network design of empty container depots’ was rated as ‘very good’ by some respondents and as ‘satisfactory’ by even more, hence the share of ‘poor’ is very small. Thereby TOPs gave a more positive rating than TOCs. A very positive rating was given for the ‘use of spare capacities of the own fleet’. Here the two considered group of players do not deviate distinctively from each other. In contrary, the measure to ‘use spare capacities of other operator’s fleet’ was rated
rather poor. Respondents commented that this measure would probably lead to additional costs for both parties due to a high coordinative effort. To ‘make use of container pooling’ was assessed rather negative and (regarding the different actors) heterogeneous. Among the TOPs this measure is perceived as negative whereas the TOCs gave a rather positive rating. From the comments it becomes evident, that this measure is already applied by some respondents, using it in cabotage of maritime transport in the BSR. One transport operator answered that the main share of their short sea traffic is done with grey boxes. ‘Searching actively for return cargo’ is also evaluated rather negative, especially by the TOPs where a high share already applied the measure.

Among the pricing measures the rating was rather diverse. The measure to ‘give incentives for the return of a specific container type’ was evaluated relatively positive. There seems to be no actor specific difference. The measure to ‘give incentives for a desired drop area’ was assessed rather negative. A remarkable comment here was that these incentives will have a very complicating impact on the routing of empty equipment.

Figure 13: Evaluation of pricing measures (author’s design based on survey results)
Giving incentives for the return of a specific container type seems to be the most promising measure among the pricing measures.

Additionally this will lead to less transparency on freight rates and would thereby enable speculative transaction in this business. The same statement was given regarding the measure ‘selling empties in the surplus and buy new containers in the deficit area’, which was evaluated very negative, particularly by the TOPs. The measure to ‘pose a rate surcharge on the transport leg with higher demand’ was estimated rather positive, again answers of TOPs and TOCs did not differ remarkably.

Figure 14: Evaluation of (the) technological measure (author’s design based on survey results)

The technological measure ‘implementing foldable containers’ is evaluated rather positive. This measure is evaluated less positive by the TOPs, whereas among the TOCs some respondents gave a positive evaluation. The comments on this measure also differed: one port authority assessed the foldable container as very promising especially with regard to storage and transport capacities, whereas a shipping line commented that this alternative is not realistic for most of the traffic.
In summary, it can be concluded that there is not one single measure having a crucial positive impact on empty container management. However, it seems to be more promising to combine several measures. Furthermore it has to be considered that the success of measures is highly depending on the perspective of the specific player and thus the choice of measures has to be related to the involved players.

Somehow noticeable from the answers is the fact that those who would be responsible for implementation of the measure gave a rather negative rating, what leads to the conclusion that even though some of the measures are evaluated as being promising the implementation is perceived as an obstacle.

For a comprehensive picture the evaluation of each measure is again presented in Figure 15, both for terminal operators (TOC) and transport operators (TOP). Assuming that the rating ‘satisfactory’ still includes the opportunity for a successful implementation, the ratings ‘very good’ and ‘satisfactory’ have been summed up. The measures are ranked according to their implied success.
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List of Abbreviations

BPO Baltic Ports Organization
BSR Baltic Sea Region
CEP Courier, Express, Parcel
EU European Union
ICT Information and Communication Technology
IICL Institute of International Container Lessors
ISO International Organization for Standardization
IWW Inland Waterway
Mgmt Managerial and Organisational Measures
Pric Pricing Measures
RFID Radio Frequency Identification
Tec Technological Measures
TEU Twenty-foot Equivalent Unit
TOC Terminal Operator
TOP Transport Operator
UNCTAD United Nations Conference on Trade and Development
US United States of America
VCY Virtual Container Yard
Bibliography


DVZ (2007, February 21). Hafen Rotterdam: ECT akzeptiert keine Leercontainer mehr. DVZ Deutsche Logistik-Zeitung,


Annex A

Analysis of survey results

In the following the main results of a survey investigating experiences made with empty container management in the BSR are portrayed. The survey was conducted as a questionnaire (July 2010 - February 2011). The questionnaire is attached in Annex B.

For a concise overview, a summary and the conclusions can be found in chapter A.5

A.1. Background and objective of the investigation

The investigation was conducted by the Institute for Transport Planning and Logistics at the Hamburg University of Technology. The initiative was part of the EU-project TransBaltic - Towards an integrated transport system in the Baltic Sea Region - which is funded by the Baltic Sea Region Programme and is running from June 2010 till June 2012. Furthermore the investigation was supported by the Baltic Ports Organization (BPO).

Its main objective was to increase transparency on empty container management in the Baltic Sea Region. To gain a broad picture, all types of organizations which are dealing with maritime containers were addressed. Thus the anticipated result was a multi-actor analysis on flows of empty containers in the BSR and a summary of the experiences made and strategies applied concerning empty container management. The results of this survey should serve as a basis to initiate actions for a more economically and ecologically efficient empty container management.

A.2. Object and approach of investigation

In the following the object and approach of the investigation are described.

A.2.1 Relevant target groups

Here it is pointed out how the target group which was addressed to take part in the survey was selected.

Setting spatial boundaries

Embedded in the TransBaltic project this survey was from the very beginning focused on the Baltic Sea Region. As this region is very much dominated by maritime transport, it was decided to also include institutions and companies related to the main feeder hubs in the North Sea Region, such as e.g. Rotterdam, Amsterdam, Zeebrugge and Hamburg.
In this context it should be stated, that some of the companies which became part of the distribution list are originally from countries beyond the BSR but as they are operating in the area, were also included.

Setting sectoral boundaries

Based on the findings portrayed in chapter 0 the main stakeholder groups of container flows were identified:

- port authorities,
- shipping lines,
- transport operators (other than maritime),
- terminal operator (sea and inland),
- container leasing companies as well as logistics companies.

In the following for each group it is described how they were selected within the spatial boundaries. The final distribution list was supplemented by relevant personal contacts of the TransBaltic project partners and reviewed by the Baltic Ports Organization.

Port authorities

The selection of port authorities was based on a publication of Breitzmann “Baltic Sea feeder market - Structure and dynamic of container transport on the Baltic Sea“ (Breitzmann, 2009, p. 29). Therein a list of the main container ports in the BSR was presented. This list was cross-checked and amended by those BSR ports reporting data to EUROSTAT. In addition also ports authorities in the North Sea region were included being the main feeder hubs for the BSR: these are Antwerp, Zeebrugge, Amsterdam, Rotterdam, Bremen/Bremerhaven and Hamburg. Also the Russian container ports St. Petersburg and Kaliningrad were included. In total 63 ports were addressed.

Shipping lines

To select the group of shipping lines again the publication of Breitzmann “Baltic Sea feeder market - Structure and dynamic of container transport on the Baltic Sea “(Breitzmann, 2009, p. 24) was taken as a basis. To cross-check this list the “Baltic Container Outlook 2009” which includes a list of the Baltic container lines (from Feb 2009) was taken into account (Matczak, 2009, p.14).

Transport operators (other modes)/ Logistics companies
Concerning the group of transport operators for the remaining transport modes rail, road, IWW as well as for logistics companies the study “TOP 100 in European Transport and Logistics Services - 2009/2010” by Klaus et al has been consulted. Therein a list of the Top 10 transport and logistics service providers for every European country is available. The kind of institution “logistics company” comprises CEP-service provider, forwarder as well as diversified service provider. These lists were taken into account for all the Baltic Sea bordering countries, as well as for those countries of the main feeder hubs: the Netherlands, Belgium and Germany (beyond the Baltic Sea) (Klaus, Hartmann, & Kille, 2009, pp. 118).

**Terminal operators**

For the terminal operators mainly the group of port authorities were taken as a basis. Following that, internet research was done to find out which terminal operator is responsible for the operation in the ports. This list was cross checked and amended by the following literature: Gardiner “Annual review of global container terminal operators - 2009” (Gardiner, 2009, pp. 109) as well as Notteboom et al “The Corporate Geography of Global Container Terminal Operators” (Notteboom & Jean-Paul Rodrigue, 2010, pp.5).

**Container leasing companies**

Considering the container leasing market there are only a few worldwide operating companies (Theofanis & Boile, 2009) owning a big share of the worldwide container fleet. Members of the Institute of International Container Lessors (IICL) have been included into the survey.

**Compiling the distribution list**

Having prepared the list of companies and institutions, nearly all contact data was identified by internet research. Depending on the size and structure of the approached company it always was tried to firstly find a responsible person in the company for either container equipment or for the BSR. If this was not possible, an adequate contact person of the respective company was addressed for providing appropriate contacts for the purpose of this study. In case, that one of the TransBaltic project partners had a personal contact with a specific company this was included as well.

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58 The IICL is the leading trade association of the container and chassis leasing industry. All members own or manage around 90% of the global leased container, what is approximately half of the world’s container fleet (IICL).
In Figure 16 the number of different institutions per country being part of the distribution list is portrayed. There is one particularity which needs to be explained. The number of port authorities as well as of the terminal operators in Sweden and Finland is relatively high due to the fact that there are a lot of ports operating along the countries’ vast coastline.
Figure 16: Number of different institutions per country

- Total per country
- Container leasing company
- Logistics company
- Port authority
- Terminal operator
- Shipping line
- Rail operator

Belgium: 8 institutions
Denmark: 10 institutions
Estonia: 12 institutions
Finland: 17 institutions
Germany: 24 institutions
Latvia: 10 institutions
Lithuania: 10 institutions
Netherlands: 16 institutions
Norway: 13 institutions
Poland: 15 institutions
Russia: 12 institutions
Sweden: 27 institutions
Other European Countries: 10 institutions
Other Countries (Asia, US): 18 institutions

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A.2.2 Approach of the survey

Methodology

The intention of the survey - to receive a comprehensive picture for the BSR - leads to a large number of potential respondents. Due to that, it was decided to conduct the survey as an e-mail based questionnaire.

Additionally, in contrast to e.g. a telephone survey, respondents do not have to provide all the answers at one point in time. By this, other sources of additional information like e.g. company statistics or colleagues can be consulted. Also the time needed for completing the questionnaire can be structured individually.

Respondents could either write their answers into a PDF formula and return it by email or fill it in by hand and return it via fax or mail. In addition, the questionnaire was also made available for downloading on the homepage of the executing institution - especially for those cases, in which files attached to the original mail-out were not transmitted or damaged.

Structure of the questionnaire

The questionnaire was divided into four parts, whose specific intentions are described in the following. The questionnaire is also attached in the separate Annex B.

- Introduction letter
  This part introduces the subject, explains the main objective of the survey and aims to motivate the target groups to take part in the survey.
- Part A Your company and the role of containers in your business
  Within this part it was intended to learn more about the company and about specific information on the container flows handled by them.
- Part B Role of empty containers in your business
  This part was intended to investigate the impact empty containers have on the company’s business and how they face the challenges of empty container management.
- Part C Spatial distribution of your business
  By this part of the questionnaire it was aimed to locate relevant container operations of the organisation/company to receive a comprehensive picture for the whole BSR.
• Part D  *Any other comments*

This part was included to provide the opportunity for participants to include ideas, comments, etc. which could not be placed before.

**Process of the survey**

The first time the questionnaire was sent out to the whole distribution list at the 16th of July 2010. As this is the holiday season, a long time frame for responding was chosen. The target group was asked to return the completed questionnaire by the 10th of September 2010. A reminder was sent out by email on the 15th of September with the possibility to respond until the 30th of September. As the response rate at the beginning of October was still very low (8 responses), it was decided to additionally launch a telephone request. Due to capacity reasons this telephone request was processed from November 2010 until the end of February 2011.

**A.3.  Response rate and statistics**

Overall 218 companies were invited to take part in the survey. Thereof 23 completed the questionnaire. Another 22 companies answered that the issue empty container management is *not relevant for their business*, which was also counted as an answer. The decision to do so was mainly motivated by the impression, that this is also a remarkable statement. Another 11 companies responded that surveys are not desired by the company policy in general.

Summarising that means a response rate of 21% in total, thereof 11% took part in the survey and completed the questionnaire (see Figure 17).
Figure 17: Overview response rates

**Sectoral allocation of responses**

Figure 18 and Figure 19 consider the allocation of responses per participating institutions. Only considering the relative figures, they have had the highest response rate of around 50%. However it has to be kept in mind that the absolute figures show, that only one completed questionnaire plus three companies stating that “empty container management is not of relevance” out of eight requests led to this high response rate. Thus, there are the shipping lines with the most convincing response rate of around 40%. Answers from overall 15 companies were received, thereof nine completed the questionnaire and six stated that the issue is not relevant for their business. Five out of these nine shipping lines are in the Top15 of Baltic container lines (see Matczak, 2009, p.14 for ranking). Considering the terminal operators, a response rate of around 22% can be stated. There are seven companies which completed the questionnaire and four for which the issue seems to be not relevant. Port authorities had a response rate of around 14% including four completed questionnaires and five declaring that the issue is not relevant. Among the requested rail operators a response rate of around 12% was achieved, what means in absolute figures one completed questionnaires and one statement on the irrelevance of the topic. Finally the lowest response rate (9%) can be found among the logistics companies (comprising CEP service providers, forwarders and providers with diversified services), only one company answered to the survey, three stated that the issue is not of relevance for their business.
Figure 18: Relative response rates per kind of institution

Figure 19: Absolute response rates per kind of institution
Spatial allocation of responses

When it comes to the spatial distribution of the received responses, it is Germany achieving the highest response rate with around 46%. Looking further, there also other countries with a convincing response rate like Lithuania (40%), Denmark (30%), Belgium (26%) and Poland (20%). Overall it has to be stated, that there are some countries with a relative low response rate of around 8% like Finland, Latvia, Sweden, Russia or without any response at all like Estonia, the Netherlands, Norway.

Figure 20: Relative response rates per country
Figure 21: Absolute response rates per country
In total, 23 completed questionnaires were the basis for the investigation, even though some were completed only partially. Figure 22 displays the response rates per question. Part A - collecting relevant structural and organisational information - was completed by almost all respondents, only the last two questions have low response rates. To explain this, question A6 was only for those companies owning or leasing containers. Additionally questions A6 as well as A7 asked to fill in concrete figures, what requires some efforts and is very often perceived as an obstacle for companies which do not want to share sensitive data and information. In part B - investigating the impacts and experiences in empty container management - the response rates were satisfying. The lower response rates in questions B2 and B3 can be explained, as B2 only should be completed if there is any impact from empty container management on the company’s business and B3 required some know-how on concrete measures dealing with the issue. Within Part C - trying to catch the spatial dimension of the company - the response rates for the first two questions are quite high whereas the last questions were not answered by many companies, but here again very concrete figures were requested. In Part D - offering the opportunity to share any kind of information which could not be placed before - some companies add in some ideas and comments.
Within this subchapter the results of the survey are presented.

### A.4.1 Company characteristics relevant for empty container management (Part A)

In Part A of the questionnaire the respondents were asked to provide general information on their company and to answer specific questions to clarify the role containers have in their business.

#### Business division of respondents

The respondents were asked to specify the kind of institution they work for. This was already somehow known from the sectoral determination of the distribution list. Additionally the respondents were asked to specify their business and multiple entries were possible to...
provide the opportunity for companies with several business divisions to further specify their activities. Figure 23 mirrors the core business of the company.

**Figure 23:** Allocation of the respondents regarding the kind of institution

Furthermore, two of the respondents are operating within several business divisions: one of the terminal operators is also operating rail transport inside the port and one port authority is also responsible for terminal operations.

To have a closer look on the company’s business, in the following the specification of the respondents is portrayed. Within the group *terminal operator* all seven respondents are operating sea port terminals. Thereof five companies also operate container depots. One company is also operating a hinterland terminal (see Figure 24).

**Figure 24:** Terminal operators specified

The group *transport operator* contains one rail operator and nine shipping lines. Among the shipping lines, one deep sea operator and eight short sea and/or feeder operator were
recorded. Three from the latter are also operating hinterland transports (local/ regional as well as distant hinterland).

Figure 25: Transport operators specified

For the further analysis it was decided to cluster the respondents according to their core activity. In further diagrams of this analysis some results will be presented clustered by these five different kinds of institution or groups:

- Container leasing company
- Logistics company
- Port authority
- Terminal operator
- Transport operator

Concerning the group transport operator, please note that shipping lines and rail operator were summarised in this group, as only one rail transport operator took part in this survey.

**Container related activities of respondents**

The respondents were asked to specify their container related activities. Here again multiple entries were possible. In Figure 26 and Figure 27 it is illustrated which institution is involved in which activity. Container leasing and logistics companies are not part of this diagram, as there is only one respondent within each of the two groups.

The results are not very surprising. The terminal operators are involved in terminal related container tasks like storage, handling and management of container depots. Some are also offering cleaning, repair and maintenance. Concerning transport operations the focus among the terminal operators is more on inner port transportation, whereas the transport operators are operating local/regional hinterland transportation as well as distant hinterland and international transportation. Also management of repositioning is a task performed by them. The main focus among the port authorities is on the provision of
industrial areas and transport infrastructure in the ports. The port authority which also responds to be responsible for operating the terminal (see above) also performs terminal related tasks.

Figure 26: Operational container related activities per kind of institution

Figure 27: Managerial container related activities per kind of institution
**Container ownership among the respondents**

Regarding the ownership of containers the respondents were asked to declare if they are owning and/or leasing containers. Again the results are not very surprising. It is well known that the worldwide container fleet is mainly owned by the shipping lines and container leasing companies (see chapter 0).

![Figure 28: Share of container owning/leasing companies for each kind of institution](image)

Furthermore they were asked to name the size of their container fleet and to enumerate the share of owned and leased containers. Nearly all the responding transport operators owning and/or leasing containers provide information (see Figure 29). The responses received are very heterogeneous. No connection between the size of the container fleet and the allocation of owned and leased containers becomes evident. This could be because of the size of the sample (six respondents). It is also possible, that the decision how the container fleet is built up, is one possibility to differ from each other in the market and is more a question of company policy than the consequence of the fleet size.
Figure 29: Size of total container fleet and the share of owned resp. leased containers among responding transport operators (TOP)

Empty shares of handled containers

The respondents were asked to provide concrete figures on the number of loaded containers handled by the companies and the share of empty containers in recent years. Among the responses, also one from the container leasing company and two from the group port authority could be included. The container leasing company was simply stating an empty share of 100%, what is normal in their business. The (two) responses from the port authorities are not portrayed as these figures are provided comprehensively in chapter 2 based on an investigation of EUROSTAT data. Thus in Figure 30 and Figure 31 the results are only portrayed for transport and terminal operators for the years 2005 until 2010 and the average numbers for the reported years. Among the transport operators the empty share varies between 16% and 33%. For most of them the shares change from year to year, with annual differences often exceeding 5%. The empty shares of the terminal operators vary even stronger: from 9% up to 50%. This might be due to the fact that the location of a terminal is very crucial for that number, e.g. if the terminal functions as a hub for the repositioning of empty containers, the share will be automatically higher. In summary, it can be stated that apart from the fact, that both groups have remarkably high empty shares the figures are very heterogeneous.
Figure 30: Share of empty containers handled by different transport operators (TOP)

Figure 31: Share of empty containers handled by different terminal operators (TOC)
A.4.2 Impact and measures of empty container management (Part B)

Impact of empty containers on the respondents’ business

Regarding the general question if there is an impact of empty containers on the business of the responding companies nearly all (91%) of the respondents indicated that there is an impact. Only two companies (9%) stated no impact. These two companies both were port authorities.

![Figure 32: Evaluation regarding the impact of empty containers on business](image)

In the further questions the respondents indicating an impact were asked to rate this impact with regard to the aspects listed below.

- Storage capacities in general and specified for the following aspects:
  - Container storage area(s) at the terminal
  - Container depot(s) in the port
  - Container depot(s) in the hinterland
- Transport capacities in general and specified for the following aspects:
  - Vessel
  - Truck
  - Railwaggon
  - Inhouse vehicles
- Costs in general and specified for the following aspects:
  - for transportation
  - for storage
  - for handling
  - for environment
- Revenues in general and specified for the following aspects:
  - for transportation
  - for storage
  - for handling
- Absence of empty containers when needed
To answer the respondents could choose among the following statements for each of the aspects:

- “Very beneficial impact on business”
- “Little positive impact on business”
- “No impact on business”
- “Little negative impact on business”
- “Impact harms business”

For a general overview the results are summarised in Figure 33. It can be seen that for most of the aspects the majority of the respondents indicated a little positive or even a very beneficial impact on their business. Only the aspects costs and especially absence of containers were rated with a more negative or even harming impact.

![Figure 33: Rating of the impact empty containers have on different aspects](image)

Figure 33: Rating of the impact empty containers have on different aspects

Figure 34 provides a more detailed view on the subject’s sub aspects.

Considering the impact of empty containers with regard to different storage areas, it can be stated, that container depot(s) in the hinterland have a slight tendency for less positive impact on business. Nevertheless the difference to storage areas at the terminal or container depots in the port is not outstanding.
Figure 34: Rating of the impact empty containers have on different sub aspects
Considering the impact empty containers have on the capacity of different transport vehicles it can be observed that positive or no impact was stated by nearly all respondents for railwaggons and inhouse vehicles. Even though a predominately positive impact for vessels and trucks a negative or harming impact of empty containers on capacities seems to be an issue for some respondents.

When it comes to the impact empty containers have on costs and revenues, the field of evaluation is rather positive for both aspects and their sub aspects, although costs are estimated slightly more negative in comparison to revenues. In contrast to that, the impact of empty containers on costs for environment is distinctively rated with “no impact for business” by the majority of respondents.

To have a closer look on the interconnections of the respondents and their answers the response behaviour of each kind of institution for every aspect (and sub aspect) is portrayed in the following. Please note the number of respondents per kind of institution which is included in each diagram (N=X) for better evaluation of the illustrated results.

**Storage capacities**

Summarising the response behaviour with regard to the impact of empty containers on storage capacities - in general and considering different areas for storage - the following conclusions can be drawn.

For the groups leasing company and logistics company there is only one respondent per group, thus the results should not be generalised. For all sub aspects the logistic company stated no impact at all. The container leasing company considered the impact as little positive or very beneficial for all aspects except the storage area in the terminal, where was also stated “no impact”. The response behaviour of the group port authority should also be considered with care, as there have been only two respondents. Their answers complete the whole range from very beneficial up to no impact depending on the different storage areas. The impact on container depots in the hinterland is considered slightly less but still positive. No negative or harming impact at all was observed from these three groups. From the perspective of the group terminal operator the evaluation is still very positive - very beneficial impact and little positive impact - when it comes to storage capacities in general and the storage area at the container terminal. Although the positive impact is still dominating regarding the impact on container depots - in the port and hinterland - the answers also comprise negative or even harming impacts. Finally, there is the group transport operator which shows the most heterogeneous picture. All possible evalu-
tions have been chosen for all different types of storage areas. The only thing which can be observed is that the share of negative/harming impact is a bit lower for the container depots in the port compared to storage sites in the hinterland.

![Figure 35: Storage in general - evaluation per institution](image1)

![Figure 36: Container storage area(s) at the terminal - evaluation per institution](image2)

![Figure 37: Container depot(s) in the port - evaluation per institution](image3)
Regarding transport capacities the group *container leasing company* answered in general with “no impact” on transport capacities, the sub aspects were neglected. This is similar to the group *logistics company* which stated no impact for all different transport vehicles. For both groups only one response was counted. From the perspective of the group *port authority* the answers were also consistent for all different transport vehicles, half a very beneficial/little positive impact of empty containers on transport capacities was observed and half no impact at all. The evaluation among the group *terminal operator* is rather positive, especially the impact on vessel and truck capacities was rated very beneficial. Impact on other transport vehicles - railwaggons and inhouse vehicles - seem not to play a major role for this group, even though half of this group estimated a beneficial impact, the other half stated “no impact”. From the group *transport operator*, the only negative or harming impact was stated with regard to transport capacities. This evaluation affects vessel and truck capacities (around 20%), even though the beneficial and little positive impact still predominates with regard to vessel capacities, regarding trucks the evaluation “no impact” predominates. For railwaggons and inhouse vehicles, this issue seems to be rather relevant.
Figure 39: Transportation Overview - evaluation per institution

Figure 40: Vessel - evaluation per institution

Figure 41: Truck - evaluation per institution
Costs

Considering the impact empty containers have on costs for the group container leasing company the response is quite positive as it contains very beneficial impact for costs for storage and handling, some positive impact for transportation and no impact on costs for environment. For the group logistics company the impact on costs seems to be an issue with regard to transportation, where a little negative impact was observed. For other cost aspects no impact at all was stated. It should be kept in mind, that only one response was portrayed here for each of the two groups. From the perspective of the group port authority (still two responses) one half observed a very beneficial impact on costs for storage and transportation, a bit less but still little positive impact on costs for handling and no impact at all considering costs for environment. The other half stated no impact at all for all cost aspects.
Figure 44: Costs Overview - evaluation per institution

Figure 45: Costs for transportation - evaluation per institution

Figure 46: Costs for storage - evaluation per institution
Considering the terminal operators the picture is dominated by a very beneficial or little positive impact on all costs aspects, only the costs for environment were evaluated with “no impact”. The only thing to mention is that regarding costs for storage and handling some respondents (but still less than 20%) stated a negative or even harming impact. The perspective of the group transport operator is rather negative with regard to the impact empty containers have on costs. Starting with the estimation of the impact on costs in general it can be seen that around 10% of respondents state a harming impact and another 40% a little negative impact. Considering costs for transportation and storage still a share of 40% is estimating a harming or little negative impact, although here also the share of beneficial and little positive impact is around 40%. Regarding costs for handling and environment “no impact” is prevailing, although even here a share of 20-30% is stating a harming or little negative impact. In comparison to the other groups this is rather unique response behaviour.
Revenues

Considering the impact empty containers have on the revenues of the different kinds of institutions, the groups container leasing company and logistics company stated no impact at all. Also the group port authority answered accordingly, except for revenues for handling which was evaluated with a little positive impact by 50% of the respondents. Regarding the group terminal operator, the impact on revenues for storage and handling are estimated as very beneficial and little positive (together more than 80%). For revenues for transportation, the statement “no impact” is predominating, only around 25% state a very beneficial impact. The picture of the group of transport operators is again very heterogeneous in their response behaviour. With regard to revenues for transportation the share of positive answers is above 60% but also a share of around 40% stated a little negative or harming impact. Concerning revenues for storage and handling, the statement “no impact” is prevailing, but also a distinctive share of positive as well as negative evaluation can be observed.

Figure 49: Revenues Overview - evaluation per institution

Figure 50: Revenues for transportation - evaluation per institution
Concerning the impact of absence of empty containers has on the respondents business, the group container leasing company stated a little positive impact, whereas the responding logistics company estimated a harming impact. Regarding the port authorities the picture is a diverse; here both extreme ratings can be observed in the same group: a very beneficial as well as a harming impact. The range of answers which is covered by the group terminal operator is also very broad, even though a share of 40% which stated a little negative impact is prevailing. Among the responses within the group transport operators the negative responses are also predominating, especially a share of 75% estimated a harming impact.
In context of this part of the survey the respondents also were asked to name other aspects which might be affected by empty containers. The relevant responses were not very numerous, but additionally space and infrastructure were mentioned by a port authority.

**Measures to deal with negative impacts of empty containers**

In this part of the survey it was required to evaluate a list of measures\(^{59}\) in a qualitative way according to their success to face negative impacts occurring from empty containers for the specific company. The range of potential answers comprises “very good”, “satisfactory” and “poor”. To also include experiences made by the respondents they were asked to indicate if they had already implemented this measure or not. However, even if they have not made their own experiences it was aimed to catch their knowledge and intention. Furthermore the respondents were also asked to explain their rating. Within the survey the measures were listed without any specific order. The intention was to ask for a single evaluation of each measure and not a general judgement of a cluster of measures. For the purpose of this report, the measures were then clustered as displayed in Table 4 for better reading.

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\(^{59}\) The list of measure was derived based on chapter 0.
| Information and Communication Technology (ICT) measures | • Making use of RFID (Radio Frequency Identification) for tracking and tracing of containers  
• Making use of online market places/container capacity exchange systems  
• Making use of virtual container yards |
| Managerial and organisational measures (Mgmt) | • Optimising the network design of depots for empty containers  
• Balancing out the imbalances by searching actively for return cargo  
• Using spare capacities on the vessel/vehicle of the own fleet  
• Using spare capacities on the vessel/vehicle of other operators’ fleet  
• Making use of container pooling (grey boxes) |
| Pricing measures (Pric) | • Selling the empty container in the surplus area and buy containers in the deficit area  
• Giving incentives for the return of a specific container type to avoid shortages of this type  
• Giving incentives for desired drop area to avoid shortages of empty container there  
• Imposing a freight rate surcharge on the transport leg with higher demand for compensation of repositioning |
| Technological measures (Tec) | • Implementing foldable containers |

Table 4: List of measures evaluated within the survey

Figure 54 provides an overview on the evaluation of all measures clustered as displayed before. Beside the potential for each measure’s success, additional information is given whether the respondent has already applied the measure or not. In the written analysis below, also the comments of the respondents as well as the explanations of their rating are included.
Starting with *ICT measures*, there were three measures evaluated: “making use of online market places”, “making use of RFID for tracking and tracing of containers” and “making use of a virtual container yards”. For the first two measures a very low share (around 10%) of respondents evaluated the success very good, whereas some more assessed the measures to be satisfactory: around 20% for the tracking and tracing with RFID, and around 45% for the use of online market places. The share of respondents evaluating the measures as poor, are rather high: there were ca. 45% stating this for the market places and around 70% for the RFID tracking and tracing. Overall it can be said, that both measures are estimated as not being very promising. The share of responding companies which have the measure already applied is very low. In contrast the measure “making use of a virtual container yards” was assessed very positive with regard to its potential success: more than 30% evaluated this measure very good, another 25% estimated a satisfactory and around 45% a poor success.
Figure 54: Evaluation of measures - Overview

- Making use of online market places
- Making use of RFID for tracking and tracing of containers
- Making use of virtual container yards
- Making use of container pooling (grey boxes)
- Network design of empty container depots
- Searching actively for return cargo
- Using spare capacities on the vessel/vehicle of other...
- Using spare capacities on the vessel/vehicle of the own fleet
- Freight rate surcharge on the transport leg with higher...
- Giving incentives for desired drop area
- Giving incentives for the return of a specific container type
- Selling empties in the surplus and buy new in the deficit area
- Implementing foldable containers

Legend:
- Very good (measure applied)
- Very good (not applied)
- Satisfactory (measure applied)
- Satisfactory (not applied)
- Poor (measure applied)
- Poor (not applied)
Also, **managerial and organisational measures** have been evaluated. Some of them have been evaluated relatively positive. A very positive rating was given for the “Use of spare capacities of the own fleet”: around 35% of the respondents rate it as very good plus another 40% with the judgement satisfactory. Only around 25% think the measure has a poor success. In contrast to this the cooperation with other operators i.e. the measure to “use spare capacities of other operator’s fleet” was rated rather bad: less than 10% estimated this to have success, another 25% estimated satisfactory and around 65% responded answered with poor. For the latter measure, it was stated in one comment that this measure probably would lead to extra costs and to extra efforts for both parties to coordinate what both would rather hamper the measure to be successful. This measure is already applied by some respondents. To “make use of container pooling” was estimated rather positive: from around 30% as very good, another ca. 20% assessed it as satisfactory. Nevertheless around 50% only stated a poor success. Additionally, this measure is already applied by some respondents, from the comments it becomes evident, that they use it in cabotage. One transport operator answered that even the main share of their short sea traffic is done with grey boxes. “Searching actively for return cargo” is also evaluated rather positive. More than 20% responded with very good success, another 25% with satisfactory but still 50% estimated only poor success. To “Optimise the network design of empty container depots” was rated by some respondents as very good (around 20%) and by even more (another 55%) as satisfactory, so that the share is very low evaluating the measure as only having poor success.

Among the **pricing measures** the rating was rather diversified. The measure to “impose the transport leg of higher demand with a rate surcharge” was estimated by 25% as very good plus another 40% with the assessment satisfactory. Here a rather small share in comparison to the others - around 35% - evaluated the success as being poor. Similar positive evaluated was the measure to “give incentives for the return of a specific container type”. The measure to “give incentives for a desired drop area” was assessed rather negative, only less that 10% stated a “very good” another ca. 50% a “satisfactory” and nearly 40% estimated this measure to only have poor success. A remarkable comment on this measure was the statement, that these incentives will have a very complicating impact on the routing of empty equipment. Additionally this will lead to less transparency on freight rates and would thereby enable speculative transaction in this business. The same statement was put regarding the measure “selling empties in the surplus and buy new containers in the deficit area”, which was evaluated very negative. Around 30% of the respondents evaluated this
measure to have satisfactory and the remaining 70% to only have poor success, what is the worst evaluation within this survey.

The technological measure “implementing foldable containers” is evaluated rather positive but also diversified: nearly 30% of respondents estimated the foldable container to be successful, in addition 20% stated a “satisfactory”. Nevertheless still 50% evaluated the measure as poor with regard to its success. The comments placed regarding this measure also were diversified: one port authority estimated the foldable container as very promising especially with regard to storage and transport capacities, whereas a shipping line commented that this alternative is not realistic for the majority of the traffic. One remarkable point in the context of this measure is the fact that around 25% of respondents specified to already have applied the measure even though none of the attempts to implement foldable containers in the past was successful.

Finally it has to be admitted, that none of the measures is distinctively evaluated as overwhelmingly positive. This might be due to the fact, that some of the measures are promising for one player but at the same time have a rather negative impact on the business of other players of container flows. Thus, for further analysis also the evaluation clustered by the kind of institution is portrayed in Figure 55. Due to the fact that container leasing and logistics companies did not respond to this part of the survey and it was only one port authority providing their knowledge and experience, these three groups have not been part of this further analysis. For each measure evaluations for terminal operators (TOC) and transport operators (TOP) are displayed, ranked according to the overall share of positive ratings.
### Figure 55: Evaluation of measures - Clustered by terminal operators (TOC) and transport operators (TOP)

<table>
<thead>
<tr>
<th>Measure</th>
<th>TOC (Very good)</th>
<th>TOC (Very good, not applied)</th>
<th>TOC (Satisfactory)</th>
<th>TOC (Satisfactory, not applied)</th>
<th>TOC (Poor)</th>
<th>TOC (Poor, not applied)</th>
<th>TOP (Very good)</th>
<th>TOP (Very good, not applied)</th>
<th>TOP (Satisfactory)</th>
<th>TOP (Satisfactory, not applied)</th>
<th>TOP (Poor)</th>
<th>TOP (Poor, not applied)</th>
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<td>Implementing foldable containers (Tec)</td>
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<td>Network design of empty container depots (Mgmt)</td>
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<td>Making use of RFID for tracking and tracing of containers (ICT)</td>
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</table>
Starting again with ICT measures - “online market places” and “track and trace with RFID” - are both evaluated rather negative and similar assessments can be found among TOCs and TOPs. The measure “making use of virtual container yards” is assessed more positive by the TOPs than the TOCs. This might be because the TOCs would much more be involved in implementation than the TOPs.

Regarding the managerial and organisation measures some differences can be remarked. To “use spare capacities of the own fleet” is estimated a bit more positive by the TOCs as by the TOPs which would be the implementing player. The same is true for the measure “using space capacities of other operator’s fleet”. Here, again the evaluation of the TOCs is a bit more positive. Regarding “container pooling”, the share of very positive evaluation is nearly the same for both players, but the share evaluating the measure to only have a poor success is distinctively higher among the TOPs. Again they would be the ones implementing this measure. The differences regarding the measure “searching actively for return cargo” might be due to the same reason. Here again the evaluation of the TOCs is more positive than of the TOPs which would be the ones pursuing this measure. Regarding the measure “network design of empty container depots” the TOPs made a very positive estimation for this measure whereas the TOCs answered with “satisfactory” and “poor”.

Concerning pricing measures the evaluation of the different players is quite similar for the majority of measures. A difference can be remarked for the measure “giving incentives for a desired drop area” which is evaluated more positive by the TOCs. As already stated above that might be because of the complicating impact on the coordination of container flows, which is within the responsibility of the TOPs.

Finally there is the technological measure to “implement the foldable container”. This measure is estimated less positive by the TOPs, whereas among the TOCs some gave a positive evaluation.

Summarising it can be stated, that those implementing the measures are evaluating rather negative what leads to the conclusion that the success of a measure would be perceived positive but the implementation is rather complicated.

Finally, the respondents also were asked to propose and to evaluate other measures they apply or know. The responses here were not numerous, but nevertheless one should be mention: “good communication with client to make real time delivery possible”.


A.4.3 Spatial distribution of companies’ business (Part C)

Within this part of the survey the respondents were asked to provide an overview on the spatial distribution of their business.

Storage areas of empty containers

To get a better impression on the storage conditions of empty containers, the respondents were required to specify how they are storing empty containers. Responses to choose from were:

- In a dedicated area at the container terminal.
- In one depot dedicated for empty containers
  - in the port (or port area).
  - in the hinterland.
- In several depots dedicated for empty containers
  - in the port (or port area).
  - in the hinterland.
- No specific storage area/depot for empty containers.

Due to the fact, that there were no responses from the logistics company and only one response each for the groups container leasing company and port authority the results are only portrayed for terminal and transport operators. Not to exclude their responses: the container leasing company specified to store empty containers in several depots in the port as well as in the hinterland; whereas the port authority is storing empty container directly at the container terminal.

![Figure 56: Specified storage areas for terminal and transport operators](image)

In Figure 56 the difference between the two groups becomes evident. Whereas the majority (more than 40%) of terminal operators are keeping their storage areas directly at the terminal, half of transport operators are storing their empties in several depots in the port but also in the hinterland. To have a closer look on this, in Figure 57 it is additionally dis-
tied where the depots are situated: either in the port, in the hinterland or - for sev-
eral depot - at both locations. Those terminal operators having a depot/depots for emp-
ties outside the terminal are operating this in the port or port area. In contrary, the
majority (more than 80%) of transport operators are operating in the hinterland or at least
in the port and hinterland.

![Figure 57: Detailed specification of the storage location for terminal and transport operators
operating a depot/several depots]

These results are not very surprising as they are reflecting the hub-focus of the terminal
operators and the transport chain focus of the transport operators respectively and thus it
is a consequence of their business.

In this part of the survey respondents were also required to provide data on their depots:
the number of TEU handled in this depot in the years 2007 and 2009 as well as the share of
empty containers. Unfortunately only three responses were counted here and thus the re-
sults are not portrayed further. The same is true for the last questions asking (the trans-
port operators) for transport relations with the highest share of empty containers.

A.5. Summary and conclusion
Background and objective of the investigation

The main objective of this investigation was to create more transparency on empty con-
tainer management in the Baltic Sea Region (BSR). It was anticipated to gain a comprehen-
sive picture from all types of organizations dealing with maritime containers. This picture
comprise a multi-actor analysis on flows of empty containers in the BSR and a summary of
the experiences made and strategies applied concerning empty container management.

Sectoral and spatial boundaries were set to pursue the anticipated objective and to de-
termine the distribution of the questionnaire. Based on preliminary research the following
types of institution were chosen for sectoral determination: port authorities, shipping
lines, transport operators (other modes), terminal operator, container leasing companies
as well as other logistics companies (comprising forwarders, CEP service providers and providers with diversified services). The spatial boundaries were derived according to the BSR focus of the project context thus all countries bordering the Baltic Sea were considered. As in the BSR and for empty container management maritime transport is the predominating mode, also those countries/regions were included that host the main feeder ports of the BSR: Germany (North Sea), the Netherlands and Belgium.

Response rate

On the whole 218 companies were asked to complete the questionnaire. Thereof 23 companies - equalling 11% - completed the questionnaire. Another 22 answers - equalling 10% - were recorded stating that the issue empty container management is not relevant for their business. Thus the response rate reached 21%. Furthermore 5% of the companies explained that surveys are not desired due to their company’s policy. The remaining 74% did not respond at all.

Having a closer look on the response behaviour of the different kinds of institution, it can be observed, that the groups terminal operator and shipping lines are very well presented. As there was (only) one rail transport operator taking part in the survey, shipping lines and rail transport operator are summarised to the group transport operator for further investigation. Furthermore four port authorities completed the questionnaire. From the container leasing and logistics companies one respondent per group was counted. Thus for the two latter groups, results should be understood as not being representative but rather as a mirrored insight. In consequence, they will be skipped in this executive summary.

Also the spatial allocation of answers is rather imbalanced but due to the fact that maritime transport is an international business this is considered as less relevant.

Company characteristics relevant for empty container management

The respondents were asked to provide some insight into company characteristics relevant for (empty) container management such as:

- their business division,
- container related activities
- the ownership of container fleets and
- the empty share of handled containers.

Results for the first two aspects were not very surprising. Considering the company’s business division along with their container related activities, it can be stated that most of the
respondents are in line with the typical profiles the different groups have. Skipping container leasing and logistics company (due to the fact of being underrepresented) port authorities are mainly responsible for the provision of transport infrastructure and industrial areas in the port. Among the responding terminal operators, all are operating sea port terminals and most of them are also responsible for container depots. Only one among them also operates a terminal in the hinterland. Thus the container related activities they are responsible for are predominantly hub-related such as storage and handling. Some also offer cleaning, repair and maintenance services. Regarding transportation the focus is - if at all - on inner port transportation. The majority of transport operators are covering the whole range from local to international transportation. Among them the majority are short sea and/or feeder operators.

Also, the results regarding the ownership of containers among respondents were not very surprising. Like already described in chapter 0, the containers are owned by container leasing companies and the shipping lines. Having a closer look on the total container fleets and the shares of owned and leased containers, the picture was very heterogeneous, hence no deeper explanations could be derived from this survey.

Having a closer look (see Figure 58) on the empty shares of the handled containers of responding terminal and transport operators (other groups are left out here for described reasons) it can be observed for both that the majority has a high share of empties in comparison to e.g. the worldwide or European share of empties which is in average around 20-22%.
In the investigations portrayed in chapter 2 empty shares are accounted for container handling ports (what is equal to summarised data from the terminal operators) in EU27 and the BSR (excl. Russia). The values of empty shares for the EU27 (between 12% and 20%) are distinctively lower than the provided figures from the survey. Also in comparison to the figures for the BSR excl. Russia (between 20% and 25%) the empty shares mirrored by the survey are a bit lower, but due the size of the survey sample, this might be accidentally. Considering the average empty shares of the transport operators, the decline of empty shares in the years 2009 is very striking. Although a similar decline could be accounted for the ports in EU27 and the BSR excl. Russia, it seems surprising that the survey results from the terminal operators are not reflecting that but the figures from the transport operators. For both an explanation of the decline is not obvious and has to be investigated further.

**Impact of empty containers on the business of transport and terminal operators**

By this part of the survey it was intended to investigate what exactly the *impact of empty containers* means for the business of the different groups of respondents.

---

60 Please note that figures for EU27 and BSR (excl. Russia) only cover the first two quarters in 2010.
Firstly the respondents were required to state if there is an impact of empty containers on their business or not. Overall 91% of respondents answered that there is an impact, whereas the remaining 9% (all port authorities) answered that there is no impact.

The ones indicating an impact were further asked to specify this impact regarding to the aspects portrayed in Figure 59. It can be seen that for most of the aspects the majority of respondents is stating a little positive or even very beneficial impact on their business. Particularly noticeable is the impact empty containers have on costs as here a distinctive share of a little negative impact can be accounted. The only aspect where negative or even harming impacts were predominating is the absence of empty containers.

Figure 59: Impact empty containers have on different aspects of the company’s business (overview)

For further clarification results were also analysed according to the response behaviour of different groups of actors. In Figure 60 this is portrayed for terminal and transport operators (the others groups are again left out for described reasons).

With regard to storage capacities the terminal operators seem to see a more positive impact of empty containers in comparison to the transport operators where the majority stated a positive impact but also more than 30% stated a negative or even harming impact on their business. Considering transport capacities the comparison is more balanced, even though the evaluation of the terminal operators is still more positive than of the transport
operators whose share of stating negative impacts is around 10%. Regarding costs the picture is quite different. Here the terminal operators again see a very positive connection whereas 50% of responding transport operators state a negative or even harming impact for costs on their business. The same phenomenon can be observed for the impact empty containers have on the revenues of both groups. Only for the absence of empty containers the terminal operators are stating a negative impact at all. However another 40% of TOCs also see a very beneficial or a little positive impact in the absence of empty containers. Conversely, more than 80% of the transport operators see a harming impact of the absence of empty containers on their business.

![Comparison of the impact empty containers have on the business of terminal (TOC) and transport operators (TOP)](image)

In general it can be concluded, that the impact of empty containers with regard to the considered aspects are evaluated positive or even beneficial from the majority of respondents. Comparing the groups terminal and transport operators it can be observed that for the latter empty containers have a more negative impact on their business with regard to all considered aspects.

**Measures to deal with negative impacts of empty containers**

The respondents were asked to evaluate different measures to deal with negative impacts of empty containers according to their success. Different types of measures have been
evaluated: information and communication technology (ICT) measures, managerial and organisational measures (Mgmt), pricing measures (Pric) and technological measures (Tec). Possible ratings were “very good”, “satisfactory” and “poor”.

In summary, none of the measures got a distinctive rating to have “very good” success. But due to the fact that the rating “satisfactory” still provides the opportunity to be successful, the ratings very good and satisfactory have been summed up in Figure 62. The measures are ranked according to their success for the groups terminal and transport operators.

Furthermore it can be remarked, that the share of answers with the evaluation “very good” based on specific experiences made within the company (the applied measures) is rather high (ca. 65%), whereas it is quite the contrary for the evaluation “poor”. Here most of the answers (80%) are based on the respondents’ knowledge gained outside the own company context and not of experiences from having applied the measure (see Figure 61).

Figure 61: Comparison of the amount of respondents which have applied the evaluated measure (or not)
Figure 62: Comparison of measures according to the sum of evaluations very good and satisfactory for terminal and transport operators.

- Network design of empty container depots (Mgmt)
- Giving incentives for the return of a specific container type (Pric)
- Giving incentives for desired drop area (Pric)
- Freight rate surcharge on the high demand transport leg (Pric)
- Making use of online market places (ICT)
- Making use of virtual container yards (ICT)
- Making use of spare capacities on the vessel/vehicle of the own fleet (Mgmt)
- Selling empties in the surplus and buy new in the deficit area (Pric)
- Using spare capacities on the vessel/vehicle of other operators’ fleet (Mgmt)
- Implementing foldable containers (Tec)
- Making use of container pooling (Mgmt)
- Searching actively for return cargo (Mgmt)
- Making use of RFID for tracking and tracing of containers (ICT)

Terminal operator
Transport operator
Noticeable from the answers is the fact that those who would be responsible for implementation of the measure gave a rather negative rating, what leads to the conclusion that even though some of the measures are evaluated as being promising the implementation is perceived as an obstacle.

Finally, from the ratings it can be concluded, that there is not one single measure having a crucial positive impact on empty container management. It seems to be more promising to combine several measures. In this context it is also striking that according to the transport and terminal operators the most promising measure is to optimise the network design of the container depots.

**Summary of survey insights**

The picture drawn by the survey is quite diversified regarding the question what the impact of empty containers means for the different players of container flows. Starting with a view on the response rate, 10% responded that the issue is not relevant for their business. In addition, it can be assumed that some of those who did not response at all are sharing this intention. Furthermore the response behaviour with regard to the impact empty containers have on the respondent’s business, most of the respondents indicated a rather positive or even beneficial impact on storage and transport capacities as well as on costs and revenues. On the other hand, results show that the respondents see some room for improvement concerning empty container management and in some cases also see serious problems occurring for their business because of that issue.

In this context it can be stated that there are remarkable differences between the players of container flows. Thus it is worth to divide the conclusions also by the different groups of players. In the following conclusions also some general remarks made by the respondents were taken into account. These remarks are taken either from the respondent’s answers per email, from the telephone request or from Part D of the survey where the respondents could place their ideas and comments on empty container management openly in an unconstrained way.

Starting with the *container leasing companies*, their perspective regarding empty container management seems to be rather different compared to other players. For them all containers are first of all empty. Furthermore it is in the responsibility of their clients to organise container flows and thus during the time the container is used by their clients it makes no difference whether the container is loaded or empty, they are paid anyway for the leasing.
Regarding *logistics companies* (comprising forwarders, CEP service providers and other providers with diversified services) the amount of responses was very low. From those responding the impression revealed that empty containers are not in their area of responsibility and thus the issue not relevant for their business.

From the perspective of the *port authorities* the picture is rather heterogeneous. Several answers - especially from those stating that the issue is not relevant for them - indicate that containers are not in line with their activities and not in their area of responsibility. They further stated that no data on empty movements is known to them. Thus it can be concluded that for some port authorities this issue is simply not considered as core interest. On the other hand, for some port authorities a certain interest on that issue could be accounted. Even though port authorities are not actively managing container flows, they are affected in terms of provisioning transport infrastructure and industrial areas in the port. Among the respondents it was reflected, that e.g. capacities for cargo handling in the ports were already fully utilized in the boom years until 2008. This is also awaited to occur again assuming increasing cargo turnover for upcoming years. Clients of port authorities will then again have an increasing demand for space vacancy. Another remarkable comment was a description of shortages of empty containers in the port region and the impact on the economic development. Here this issue was tackled by the port authority in interest of the regional development. It can be concluded that some port authorities who are affected by the impacts of empty containers are getting deeper involved in that issue. For future research, the question remains how such an involvement could look like.

The perspective of *terminal operators* is a bit clearer compared to the port authorities. Several respondents stated that empty container management is not of relevance for them and referred to the shipping lines which are - from their perspective - the ones being responsible. Also respondents indicated that for them empty containers are mostly a beneficial part of their business.

*Transport operators* particularly the *shipping lines* seem to be the most affected ones regarding empty containers. Firstly the highest response rate among the different group of players mirrors a certain interest on that issue. Furthermore, transport operators evaluated the impact empty containers have on their business less positive as e.g. in comparison to the others; especially in terms of costs. On the other hand, a remarkable amount of answers indicated that empty containers are also creating benefits for them. Nevertheless, being owner and operator of containers they are the decision makers in context of empty container management.
When it comes to the potential strategies and measure to overcome negative impacts of empty containers the impression revealed that some deeper investigations have to be done to sharpen the picture and conclude comprehensive recommendations.
Annex B

Questionnaire

Empty Container Management - Report June 2011

Institute for Transport Planning and Logistics

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Juris Hutt
Anita Hutt

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Fax: +49(0)40 42 876 2276
transbaltic@tuHH.de

Empty Container Management in the Baltic Sea Region

Empty Container Management in the Baltic Sea Region

Survey on Empty Container Management in the Baltic Sea Region

Dear Sir or Madam,

On the following pages, you will find a questionnaire concerning empty container management in the Baltic Sea Region (BSR). We would kindly ask you to complete it.

This survey is conducted by the Institute for Transport Planning and Logistics at the Hamburg University of Technology in order to provide clarity and transparency for this issue in the BSR. The initiative is part of the EU project TransBaltic - Towards an Integrated transport system in the Baltic Sea Region, which is funded by the Baltic Sea Region Programme and is running from June 2010 to June 2012. For more information, see www.transbaltic.de. Furthermore the Baltic Ports Organisation (BPO) is supporting this investigation.

We are addressing all actions of container flows such as port authorities, shipping lines, terminal or transport operators, container leasing companies etc. to get a comprehensive picture. Thus the result will be an multi-actor analysis on flows of empty containers in the BSR and will also overcome the experiences made and strategies applied concerning empty container management. Finally, it is intended to initiate actions for a more economically and ecologically efficient empty container management based on the results of this survey.

Your benefit will be a report on the results which will be sent to you, if you indicate your interest at the end of the questionnaire.

The questionnaire is divided into four parts, whose specific intentions are described in the following:

Part A: Your company and the role of containers in your business: Within this part we want to learn more about your company and about specific information on the container flows handled by your organization/company.

Part B: Role of empty containers in your business: This part is intended to investigate the importance of empty containers for your business and how your organization/company faces the challenges of empty container management.

Part C: Spatial distribution of your business: By this part of the questionnaire it is aimed to locate relevant container operations of your organization/company to receive a comprehensive picture for the whole BSR.

Part D: Other comments: This part provides the opportunity for you to express your ideas and opinions.

We very much hope that you will find the time to respond to our questions or, if many of them are useful, you will also appreciate partially completed questionnaires.

Naturally, all your answers will be treated as confidential and it will not be possible to identify individual persons or institutions in the report. If you are not the right contact person, please let us know and forward the questionnaire to the appropriate person who is responsible for the subject.

Please return the completed questionnaire by the 28th of January, 2012.

With many thanks and kind regards,

Prof. Dr. ing. Helga Hägg, Juris Hutt and Anna Hutt
Institute for Transport Planning and Logistics, Hamburg University of Technology

Instructions to complete the survey:

Please fill in the answers as best or figures.

Please tick off the relevant box.

You can fill in your answers directly in the PDF-file on your computer or a printer (the file is also available from www.transbaltic.de/TransBaltic).

Here you can download it: Add File Below.

Please return the completed questionnaire by the 28th of January, 2012:

By email: transbaltic@tuHH.de
By fax: +49(0)40 42 876 2716
By mail: Hamburg University of Technology, Institute for Transport Planning and Logistics

2017 Hamburg
Germany

For questions, please call Juris Hutt +49(0)40 828 2276 - 2113 or Anna Hutt + 3003
### Part A: Your company and the role of containers in your business

**A.1 What is the name of your organisation/company?**

### Part B: Role of empty containers in your business

**B.1 Is there an impact of empty containers on your business?**

Yes, there is an impact  
No impact at all (then continue with question B.2)

**B.2 How would you rate this impact on your business regarding the following aspects?**

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<tbody>
<tr>
<td>Storage capacity</td>
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</tr>
<tr>
<td>Container storage costs</td>
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<td></td>
</tr>
<tr>
<td>Container handling costs</td>
<td></td>
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<tr>
<td>Other (please specify)</td>
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<tr>
<td>Transport costs</td>
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<td>Other (please specify)</td>
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<td>Costs</td>
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<td>Other (please specify)</td>
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<tr>
<td>Wrecks</td>
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<tr>
<td>Other (please specify)</td>
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<tr>
<td>Abnormal transport costs</td>
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<tr>
<td>Other (please specify)</td>
<td></td>
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</tbody>
</table>

---

**A.2 What kind of organisation/company do you work for?**

- Port authority
- Container line company
- Terminal operator (please specify)
- Sea port terminal
- Inland terminal
- Container depot
- Other (please specify)

**A.3 What is your position in your organisation/company?**

- Manager/organisational
- Specialist
- Other (please specify)

**A.4 Which container-related activities are part of your organisation/company?**

- Operational
- Managerial/organisational
- Other (please specify)

---

**A.5 Does your organisation/company own or lease containers?**

- Yes, with the following share (please specify, if possible)
- No (then continue with question A.7)

---

**A.6 How many TEU are owned and/or leased by your organisation/company at the moment?**

**A.7 How many TEU were handled/handled over by your organisation/company in recent years and how many of them were empty?**

<table>
<thead>
<tr>
<th>Year</th>
<th>TEU handled</th>
<th>thereof</th>
<th>% empty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010 (Jan-Mar)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Survey on “Empty Container Management in the Baltic Sea Region”

**8.3 How do you or would you deal with negative impact of empty containers?**

Which measures have you taken to face the challenge of empty containers and how would you rate the success of measures taken by your organization/company? Even if your company did not make its own experience with a specific measure, how would you evaluate the potential for success of the measures below for your kind of organization/company?

<table>
<thead>
<tr>
<th>Measures</th>
<th>Please rate the success/potential success for described measures</th>
<th>Did you apply this specific measure in your organization/company?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Optimizing the network design of depots for empty containers</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>2. Scheduling out the imbalance by matching activity for return cargo</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>3. Selling the empty containers in the surplus area and buy containers in the deficit area</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>4. Implementing refillable containers</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>5. Using incentives for the return of a specific container type or to avoid shortages of empty container type</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>6. Using incentives for decreased drop areas to avoid shortages of empty container type</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>7. Making use of RFID (Radio Frequency Identification) for tracking and tracing of containers</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

---

### Survey on “Empty Container Management in the Baltic Sea Region”

<table>
<thead>
<tr>
<th>Measures</th>
<th>Please rate the success/potential success for described measures</th>
<th>Did you apply this specific measure in your organization/company?</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Making use ofvirtual container yards</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>9. Making use of on-board market places/container capacity exchange systems</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>10. Using spare capacities on the vessel/vehicle of the own fleet</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>11. Using spare capacities on the vessel/vehicle of other operators/fleet</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>12. Making use of container pooling (gray boxes)</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>13. Improving freight rate exchange on the transport leg with higher demand for compensation of repositioning</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>14. Other (please specify)</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>15. Other (please specify)</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>
Part C: Spatial distribution of your business

C.1. In which of the following container ports are you operating, i.e. handling or transporting containers?

If this question does not affect your company please continue with question C.2.

<table>
<thead>
<tr>
<th>Country</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>Antwerp</td>
</tr>
<tr>
<td></td>
<td>Zeebrugge</td>
</tr>
<tr>
<td></td>
<td>Other (please specify)</td>
</tr>
<tr>
<td>Denmark</td>
<td>Aalborg</td>
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<td></td>
<td>Aarhus</td>
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<td></td>
<td>Copenhagen</td>
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<tr>
<td></td>
<td>Kolding</td>
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<tr>
<td></td>
<td>Fredericia</td>
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<tr>
<td>Estonia</td>
<td>Tallinn</td>
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<td></td>
<td>Other (please specify)</td>
</tr>
<tr>
<td>Finland</td>
<td>Helsinki</td>
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C.2. How do you deliver your goods?

Please select the most appropriate option:

- By road
- By rail
- By sea
- By air
- By other mode (please specify)

C.3. What are your main destinations?

Please list the main countries in the table. You can add more columns if necessary.

C.4. How long have you been using this mode of transport?

Choose the most appropriate period:

- Less than 2 years
- 2 to 5 years
- 5 to 10 years
- More than 10 years

C.5. Other (please specify)
Part D  Any other comments
Do you have any other comments on empty container management?

Thank you very much for taking the time to complete this survey!

Please return it by the 28th of January, 2012 to the Institute of Transport Planning and Logistics at the Hamburg University of Technology, where the results of the study will be analyzed. [transbaltic@unit.btech.de]

Naturally, all your answers will be treated confidentially and it will not be possible to identify individual persons or institutions in the report.

Please provide your e-mail address, if you wish to receive a copy of the results.

Name: ________________________  E-mail address: ________________________
## Annex C  BSR container ports: total container turnover and empty share

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<td>15%</td>
<td>43.862</td>
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<td>38.103</td>
<td>6.677</td>
<td>18%</td>
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<td>8.501</td>
<td>2.051</td>
<td>24%</td>
<td>9.206</td>
<td>2.260</td>
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<td>Rauma</td>
<td>118.557</td>
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<td>31%</td>
<td>168.650</td>
<td>62.014</td>
<td>37%</td>
<td>174.866</td>
<td>57.733</td>
<td>33%</td>
<td>171.064</td>
<td>55.531</td>
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<td>168.438</td>
<td>62.014</td>
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<td>4.511</td>
<td>2.211</td>
<td>49%</td>
<td>151</td>
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<td>17%</td>
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<td>332.075</td>
<td>24%</td>
<td>1.503.001</td>
<td>389.962</td>
<td>26%</td>
<td>1.671.007</td>
<td>421.459</td>
<td>25%</td>
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<td>37.005</td>
<td>9.684</td>
<td>26%</td>
<td>42.781</td>
<td>13.492</td>
<td>32%</td>
<td>37.292</td>
<td>12.177</td>
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<td>Svinoujcie</td>
<td>3.769</td>
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<td>8%</td>
<td>4.560</td>
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<td>1%</td>
<td>6.331</td>
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<td>5.744</td>
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<td>50.144</td>
<td>10.972</td>
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<td>61.194</td>
<td>14.514</td>
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<td>Tallinn</td>
<td>189.418</td>
<td>39.068</td>
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<td>227.378</td>
<td>44.797</td>
<td>20%</td>
<td>265.369</td>
<td>71.061</td>
<td>27%</td>
<td>269.413</td>
<td>74.371</td>
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<td>Turku</td>
<td>18.324</td>
<td>3.662</td>
<td>20%</td>
<td>20.429</td>
<td>3.728</td>
<td>18%</td>
<td>21.955</td>
<td>5.106</td>
<td>23%</td>
<td>23.009</td>
<td>5.469</td>
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<td>Umea</td>
<td>11.213</td>
<td>5.152</td>
<td>46%</td>
<td>14.094</td>
<td>7.155</td>
<td>51%</td>
<td>11.914</td>
<td>5.645</td>
<td>47%</td>
<td>12.370</td>
<td>6.175</td>
<td>50%</td>
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</table>

Empty Container Management - Report June 2011
## Empty Container Management - Report June 2011

### Table 1: Total Container Turnover in TEU, Absolute Empty Containers and Empty Shares (author’s design based on Eurostat)

<table>
<thead>
<tr>
<th>Port</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010 (Q1+Q2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Empty</td>
<td>Empty Share</td>
<td>Total</td>
<td>Empty</td>
<td>Empty Share</td>
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<tr>
<td>Varberg</td>
<td>14,051</td>
<td>5,780</td>
<td>41%</td>
<td>21,565</td>
<td>7,165</td>
<td>33%</td>
</tr>
<tr>
<td>Vasteras</td>
<td>33,454</td>
<td>7,598</td>
<td>23%</td>
<td>40,458</td>
<td>11,356</td>
<td>28%</td>
</tr>
<tr>
<td>Ventspils</td>
<td>552</td>
<td>28</td>
<td>5%</td>
<td>15,288</td>
<td>1,962</td>
<td>13%</td>
</tr>
</tbody>
</table>

**Figure 63:** All container handling ports in the BSR: total container turnover in TEU, absolute empty containers and empty shares (author’s design based on Eurostat)\(^{61}\)

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\(^{61}\) Eurostat, 2010a