Final report

Working step 2: Solutions in empty container management - Handbook to solve logistics challenges regarding the imbalances of empty containers and empty container storage

Working step 3: Dialogue events

EUSALP AG4 Activity “Infrastructure for combined transport (terminals)”

Preparatory study and dialogue events with strategic implementation partners to investigate and optimise multi-modal logistic chains

September 2019

Content:

The project is co-financed by the European Regional Development Fund

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0. Executive summary

Introduction

This is the second report that results from the preparatory study that LINKS carried out on behalf of EUSALP to investigate the possibility of action to optimise multi-modal logistic chains in the Alpine region with particular focus on the flows of empty containers due to imbalances in trade in the area.

The content of this report focuses on the outputs of:

Working step 2: evaluation of solutions in empty container management

Working step 3: dialogue events with strategic partners

Intermodal container flows

Following the official definition by UNECE (2001), *intermodal transport is the movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes*. Still UNECE (2001) provides the definition of combined transport, which is most relevant here, as *intermodal transport where the major part of the European journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road are as short as possible*.

Transport by Intermodal Transport Units (ITUs) allows the economies of scale that make intermodal transport economically sustainable and, in turn, enables the environmental advantages that follow from the shift of cargo from road to rail or inland waterway. This is especially relevant as much of the EUSALP area is part of the Alps, where reduction of road transport is particularly important to protect the environment.
It is important to distinguish between maritime and continental unitised transport because the two different flows entail different:

- Containers/loading units (ISO 20ft and 40ft used in maritime transport, vs. 45ft containers, 30ft containers swap bodies, semitrailers used in continental transport). Whether continental or maritime, containers come in different types depending on the cargo they are designed for: e.g. simple boxes, open top containers, flat racks, reefers, and tank containers of different sort.
- Transport chains, and therefore (often):
    - Operators
    - Locations

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Causes of lack or excess of empty containers

Container imbalances may occur for several reasons, and most often due to a combination of them. Lack of containers occurs when exporters from a region cannot find suitable containers in the quantity they need to carry their goods and have to import them empty. Excess of containers occur when containers imported full do not have return loads and have to either be kept in storage until a load is found or sent away empty. In practice, there may be lack or excess of containers or both at the same time in the same area for different traffic flows and different types of containers.

Relevant reason for container imbalances comprise:

- **Trade imbalances**. These may be at global level, such as the East-West trade imbalance affecting maritime flows of empties, or with a regional scope.
- **Containers of the appropriate type not available in sufficient numbers**. For instance, flows in and out of an area may show also imbalances due to inbound heavy cargo transported in 20 ft containers and lighter cargo exported in 40ft containers.
- **Demand variations**. There may be seasonal variations in the flows of goods transported resulting in seasonal variations in the balance, lack or excess of containers.
- **Different operators in charge of different flows**. For instance, when the flow in one direction is, say, largely maritime and the flow in the opposite direction is mostly continental, imbalances in equipment are normal and so are flows of empties.
- **Transport of chemicals in tank containers**, that often have no return flows.
- **Strategies and choices of operators**.

Discussions with stakeholders indicated that imbalances and flows of empty containers pertain mostly maritime traffic whereas continental intermodal transport units typically have return loads although no data is available to support this point.

Stakeholders in container flows

The work has developed schematic representations of the elements of maritime and continental container flows that have allowed to characterise the stakeholder involved in the various transport, as reported in Table 0.1.

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Stakeholder	Maritime Transport chain	Continental Transport chain	Role
Shippers	✓	✓	Send the goods and, depending on the commercial terms subscribed, may choose the MTO/forwarder/carrier carrying the goods. In some cases they also own the containers or the swap bodies
Consignors	✓	✓	Receive the goods and, depending on the commercial terms subscribed, may choose the MTO/forwarder/carrier carrying the goods
MTOs	✓	✓	Organise the transport of goods (in intermodal units) from the shipper to the consignor by using different transport modes, also by subcontracting the actual transport to other specialised parties such as intermodal operators and road or IWW carriers
Freight forwarders	✓	✓	Organise the transport of goods (in intermodal units) from the shipper to the consignor, typically subcontracting the actual transport to other specialised parties such as road carriers
Maritime shipping lines	✓		Transport intermodal units on containerships. Due to strong negotiating power (they control the maritime traffic) and vertical integration with inland partners, they are key in determining movements of maritime containers inland. They own significant shares of maritime containers.
Container leasing companies	✓	✓	Lease containers to maritime companies and other transport operators
Seaports	✓		Locations of transhipments of intermodal units and hubs for the storage of empty containers
Terminals	✓	✓	Locations of transhipments of intermodal units and hubs for the storage of empty containers
Intermodal operators	✓	✓	Provide the transport by railway. They provide the train service (in some cases leasing the wagons). Some intermodal operators provide also further services such as road haulage. In the case of continental transport they sometimes own the intermodal units
Barge operators	✓	✓	Provide transport on inland waterways, also as part of intermodal transports organised by MTOs
Rail operators	✓	✓	Act as subcontractors to intermodal operators by providing traction on the rail infrastructure
Road hauliers	✓	✓	Act as subcontractors to other operators by providing transport along initial or final road leg
Depots for empties	✓		Locations to store empty containers, often providing services such as cleaning and repairs

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Stakeholder	Maritime Transport chain	Continental Transport chain	Role
Customs	✓	(✓)	Provide border controls, along with other public agencies. They require appropriate information for a swift release of the containers subject to import or export regulations
Public authorities	✓	✓	Define policies and issue regulations relevant to intermodal transport, often to foster economic activities and to safeguard their areas from the negative externalities of such activities, including transport

Table 0.1: Stakeholders involved in the maritime and continental intermodal transport chains and their roles

Methods to deal with imbalances of empty containers and empty container storage

A number of solution to container imbalances and issues with space may be characterised as in Table 0.2. Still Table 0.2 provides summary indicator called outlook that is intended to report a general impression of the viability and usefulness of the methods proposed. The outlook indicator has been qualitatively obtained by considering the feedback from stakeholders at dialogue events and the observations reported in the technical and academic literature.

The most promising solutions are triangulation and virtual container yards as well as the effort to balance flows of laden containers if supported by pricing or subsidies. However none of them can be expected to offer a thorough solution to imbalance issues. The attempt to balance flows is likely limited by the type of goods that are transported to and from an area. Therefore part of the imbalance may be structural. Additionally, the effort should be common to several operators since each operator manages its own flow.

Triangulation and virtual container yards will reduce rotation time of containers and save truck trips to reposition empty containers between consignors, depots and shippers. They would also rationalise use of space in terminals. However, they are likely to be implemented within the network of a single operator due to the strict confidentiality with which transport operations are described by shippers. The chances of success of a third party platform, such as those developed in the US, are unclear.

Shared pools of containers do not appear viable due to the practicalities linked to managing containers and to the confidentiality that characterises container transport. Homogenisation of container pools is equally impractical due to the separations in container flows and ownership as well as to avoid transloading of goods. Transloading as a solution itself does not seem useful since in Europe it does not provide the advantages that may provide in the US and Australia due to the marked difference of size between the maritime containers and the continental ones used there.

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Solution/action	Brief description	Outlook
Balance flows of laden containers	The lack of empty containers available for transport in one direction could be solved by increasing containerised flows in the opposite direction, so that ‑once stripped- containers become available for transport. Similarly excess of container availability could be solved by further marketing container transport in the opposite direction.	+
Triangulation/street-turning	Containers just emptied by a consignee are often returned to a depot or terminal where they wait to be re-used. With triangulation containers just released after stripping, if deemed fit for re-use, may be taken directly to a new shipper to be loaded, without going back to a depot/terminal.	+
Virtual container yards	Virtual container yards may be used to link demand by hauliers and the availability at several container depot in an area ‑or at warehouses of consignors that are releasing containers after stripping. The truck is then addressed to the nearest place where the required empty container is available and receives on-line the necessary authorisation to pick it up. Virtual container yards are also used to operationalise triangulation.	+
Grey boxes/shared pools	Containers belong to different shipping lines/leasing companies/intermodal operators. One operator may have excess empty boxes in an area while another may be short of them due to their separate trade flows. By pooling all or part of their containers in a region, operators may cooperate to solve their own container imbalances.	- -
Homogenisation of containers used by combining journeys	Imbalances in empty containers may be due to import and export flows carried out with containers of different types. Excess of a certain type of container could then be exploited to load goods currently travelling on a different kind of containers that has to be imported empty. For instance, goods currently travelling in swap bodies could travelling in 45ft containers.	- -
Transloading	Transloading is a practice in place where continental containers are much larger than maritime ones and goods are moved at ports from the one type to the other in order to save crane moves and truck trips (and related costs).	- -

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Foldable containers	They are general purpose containers that may be flattened onto the base thanks to walls linked to the base and the top by hinges and locks. The idea is that the empty containers may be folded and 3-4 containers may be stacked together and repositioned as a single block reducing room, truck trips or train slots required, and crane moves.	-
Compoundable containers	The concept of compoundable containers entails locking together two small containers to obtain a large one when needed or when empties need to be moved, in order to save crane moves. The only example is the Tworty Box composed by two 20 ft containers with doors at either end that may be linked into a 40 ft container.	-
Subsidies	Subsidies could be used to limit the effect on the shippers of imbalances in containers availability by creating the conditions to balance flows. This could include subsidies to transport laden containers in the direction opposite to that requiring them, with an obligation to pass a part of the sum on to the shippers. They should be temporary and be designed to stop at the latest once the target balance is established. Subsidies may be directed also to mitigate the environmental and economic costs of repositioning containers, as in the case that follows.	:
Mitigation of the environmental and economic costs of repositioning containers	This action does not attempt to change the flows of empties but to shift them on a mode less environmentally and economically expensive, such as the inland waterways.	+

Table 0.2. Summary of solutions to manage empty container imbalances

Foldable and compoundable containers add operations and related costs to container transport that operators seem to note more than the possible savings, plus they are seen as special equipment whereas operators seem to prefer the flexibility of “simple boxes”, thus they are deemed ingenious but –at present- with limited interest. They could have as a starting point of uptake the traffic of a single operator on a particular connection, but this again should be developed by the operator and, possibly, by a large shipper (who could perhaps own the special containers).

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Motivation and position of key stakeholders

The relative position of different stakeholders –focusing only on those that are deemed to have influence on the choices pertaining movements of empty intermodal units - and the possible actions they may undertake with respect to empty container flows are reported in Table 0.3.

Maritime shipping lines have the upper hand in all transactions since they own the traffic: other actors are strongly dependent on their choices. These in turn may be made at a geographical scale much wider than the hinterland of a port or a part of it –also at global level-, and include several decision factors.

MTOs and forwarders have an interest in providing transport services that meet the demand of their customers, therefore they need empty containers ready when requested and at the same time need to limit transport costs, which may be in part related to flows of empties. They may be work to balance flows with their commercial activity, however stakeholders at workshops warned that, in the case of maritime traffic, they have little room for action since they are linked to the indications of the shipping lines. They could also foster the use of ITS, although the tough competitive environment suggests that they would limit ITS solutions to their customer base.

Intermodal operators, aiming for fully laden trains, could be interested to work towards expanding traffic, use ITS to improve train load factor, and set up collaborative environments with ITS. However, their interest in collaborative facilities based on ITS would be limited to their client base. Seaports and inland terminals are in similar situations in terms of strength of their role. They aim to maximise their traffic and may act on charges and waivers for containers stays. Their decisions on using charges to attract empties need to weight the risk that the availability of empties rather than actually generating traffic (thanks to the active customer base of the operators that use the terminal) ends up occupying otherwise useful space, which in ports and terminals comes always at a premium.

Shippers and consignors are the ones that are ultimately charged for the movements of empty containers by the other actors in the chain so they could set up collaboration agreements to get better transport services and conditions.

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Stake-holders	Maritime shipping lines	Container leasing comp.	MTOs / forwarders	Intermodal operator	Seaports	Terminals	Empty depots	Shippers	PA
Aims for	Max usage of ships esp on routes with high rates	Max usage rate of containers (empty or full)	Cost, reliability, time of transport solutions	Fully laden trains	Max traffic	Max traffic (crane moves) with min stay of containers	Use of depot and added value services (repairs)	Ready availability of transport solutions	Favourable economic situation Reduced env.impact (traffic, noise, accidents, landscape)
Strength of role regarding container flows	●●●●	●	●●●●	●●	●	●	-	●	●●
How can they act	Repositioning decisions, location of depots, collab. ITS	-	Commercial activity, triangulation, ITS	Commercial activity, triangulation, collaboration ITS	Tariffs for container stay	Tariffs for container stay	-	Collaboration/grouping	Regulation, subsidies

Table 0.3. Influential stakeholders in intermodal transport, their main aims, a qualitative evaluation of their negotiating position and the possible actions they may take with respect to flows of empties containers

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Dialogue events

The situation and the methods outlined above were discussed at a series of dialogue events with stakeholders that took place between June and August 2019.

One dialogue event was carried out for each study area: Tyrol, Novara and west of Lombardy, Veneto, Basel and Freiburg. Organising dialogue events proved challenging as only a limited number of stakeholders accepted to participate.

The following are some key outputs from the dialogue events.

There are **imbalances in container traffic** in Tyrol (lack of containers for export), the Basel area (mismatch of containers for imports and exports and excess of containers from import), Venice (due to demand forecasts by shipping lines that sometimes prove incorrect). In Novara they expect to have to deal with container imbalances once the maritime flows linked to the Belt and Road Initiative will affect the area. At both workshops in Italy it was stressed that imbalances pertain to maritime traffic whereas continental traffic swap bodies and containers always have return loads. Also for semitrailers there is no movement of empties over long distances since operators make their utmost to find return loads. Operators in Basel noted that customers do not want to pay for movements of empties so they are motivated to keep empty trips to a minimum.

Imbalances in empty containers are seen as normal part of the business due to the kinds of imports and exports required by a particular area or to different directions taken by imports and exports goods from an area. Operators try to mitigate costs (for instance transporting empty containers on barges as to/from Basel) since are concerned by knock-on effects such as extra charges for customers due to the need to move empty containers, unprofitable use of assets such as trains or terminal space.

Limits of terminal infrastructure. In Tyrol, Novara and Basel, discussing empty containers soon led to discussing terminal space. Terminals are set in areas where expansions are not feasible so space is precious. Lack of space to store empty containers requires trains to move them to and from out of the area in Tyrol. In the North West of Italy operators would need more space in terminals to handle overbooking (as their services are always fully booked) and space adjacent to terminals for ancillary activities. In Basel there are several terminals and depots, while this is seen as partly inefficient (due to limited size of some such terminals and the induced road traffic) the development of a new large tri-modal terminal able to cater for the traffic of the whole of Switzerland is seen as a threat by several operators.

Rail and road infrastructure and services. In Innsbruck, Novara and Basel, operators noted that the increasing need of infrastructure slots for passenger traffic and for freight traffic is an important issue also due to the lower priority attached to freight traffic. The increase in intermodal traffic on rail is also pushed by the decreasing numbers of drivers that are expected to reduce further as many will reach retirement soon and there are not enough younger drivers entering the profession.

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Italian operators underlined the need for action to overcome the limits of length and weight of trains currently imposed by the infrastructure and to harmonise operations across borders.

Power imbalance and leeway to work on empty containers. Both in Venice and in Basel operators underlined the decision power of maritime shipping lines that drive the choices made inland also by MTOs and forwarders. In Venice operators suggested that working from outside the market on empty containers could have unintended effects, perhaps also moving traffic away, which goes to underline the sensitivity of power balances in the intermodal trade. When discussing optimisation of logistic choices, operators in Basel also noted that they propose solutions to shippers, who make the final choice based very much on prices. These points seem to leave little room to work on empty containers.

Confidentiality. The one key issue equally stressed at all dialogue event is confidentiality of data, which also hampers collaboration. All operators are very careful not to disclose any data on traffic. This was clear also from the limited response obtained when collecting data for this study. The complete lack of replies for the Basel area was kindly but clearly confirmed during the dialogue event. Competition is fierce and data could reveal useful information to competitors. At one workshop it was suggested that in case subsidies were issued, there should be some data opening in return.

Collaboration. Confidentiality and strong competitive environments hamper the development of collaboration, the only type of measure for managing empty containers that was received with some interest at all dialogue events. Sharing containers is deemed impossible and sharing a depot for empty containers (as it would be useful in Tyrol) would have to overcome competition concerns among operators. Operators are aware of the benefits of collaboration but the competition is too strong and they prefer to consolidate their own markets. Similar points apply to IT platforms to share container availability: they are developed only by single large operators, not among them. Another type of collaboration suggested would be among shippers so as to influence logistics decisions by transport operators.

The **measures to deal with imbalances** requiring collaboration (virtual container yards, shared pools) were deemed interesting and promising but unfeasible. Triangulation was indicated as common in Veneto but having limited application in Basel. Homogenisation of containers used by combining journeys as well as transloading were deemed not possible, whereas operators were sceptical about foldable or compoundable containers.

Conclusions

Intermodal transport is the results of interaction among a large number of stakeholders, each with their own motivation for making choices that impact on trade in regions and on the unintended effects of trade, such as the movement and the storage of empty containers. Storage or repositioning of empty containers is an issue relevant at different geographical scopes and which many operators have a prime interest to minimise, in order to increase their profits. Such operators are especially maritime shipping lines, intermodal operators and freight forwarders. And, more

directly than it may appears, shippers, since they are paying for the transport service. This is so since shippers will ultimately bear the costs of the movement and storage of empty units and therefore of the container imbalances. While this may be a limited issue in the vicinity of ports due to the limited distances that need to be covered by the transports of empty units and the short times required to supply the containers, trade in regions further away from ports may be negatively affected. Further to the effects on trade and manufacturing clusters there are the negative externalities due to the added traffic.

This report surveyed a number of possible actions to tackle, at least partially, container imbalances. Effects are partial since the most promising methods (marketing work/subsidies to balance flows, triangulation, virtual container yards) would deal with some issues possibly within the flows of single operators. A striking element is the fierce competition that, according to the discussions at the dialogue events, hampers the sharing of information and the development of collaborative actions. Another important point is the power position of shipping lines whose decisions have a scope that typically goes well beyond the single regions or port hinterlands affected by container imbalances. This may suggest that regional authorities and other interested stakeholders have limited room for action but, in fact, at least an experience recounted in the literature indicates that it is worthwhile to pursue discussions also with large multiregional or global stakeholders.

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1. Introduction and structure of the report

Introduction

LINKS carried out on behalf of EUSALP a preparatory study to investigate the possibility of action to optimise multi-modal logistic chains in the Alpine region with particular focus on the flows of empty containers due to imbalances in trade in the area.

The project was carried out in four steps:

Working step 1: Desk research

Working step 2: evaluation of solutions in empty container management

Working step 3: dialogue events with strategic partners

Working step 4: identification of a concrete implementation initiative relevant for EUSALP

The present report concerns Working Step 2 and 3, the development of a handbook to solve issues linked to empty container flows (and relevant space used in terminals), and the dialogue events with the stakeholders. These were carried out to validate the results of the desk work, to try and fill information gaps, to get further information on intermodal transport in the area.

Structure of the report

As an introductory step to the work towards classifying possible actions in case of container imbalances and discussions with stakeholders, the report starts with a chapter defining intermodal and combined transport, clarifying that there are separate container transport flows sometimes involving separate stakeholders, whose choice and actions have different weights and effects on the evolution of the container transport chains and on possible empty flows.

Chapter 3 summarises who are the stakeholders and what significance their possible actions would have on the intermodal system.

Chapter 4 indicates which actions can be taken when there are container imbalances causing flows of empties, also incorporating the feedback provided by stakeholders at dialogue events. In other words Chapter 4 is the handbook of solutions to container imbalances.

Other relevant projects concerning intermodal transport are discussed in chapter 5.

Finally, the output of the dialogue events –when not used already as input to the previous sections- is summarised in chapter 6, while the full minutes of the dialogue events are reported as appendices.

Chapter 7 discusses some conclusions from the report.

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2. Intermodal transport, type of containers, container flows and stakeholders involved

Introduction

The present section aims to describe the different container flows pertaining to maritime and continental trade in order to identify the stakeholders involved and the causes of lacks or excess of empty containers.

Intermodal transport

Following the official definition by UNECE (2001), intermodal transport is *the movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes*. Still UNECE (2001) provides the definition of combined transport, which is most relevant here, as *intermodal transport where the major part of the European journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road are as short as possible*.

Intermodal transport, and combined transport, enable the concept of co-modality to transport cargo that is suitable for shipping in intermodal units. Co-modality entails the usage of the best suited transport mode over each journey leg (*e.g.* rail or inland waterway for long distances and road for local distribution). Intermodal units may be containers, swap bodies, semitrailers. Containers may be further divided in maritime containers and continental containers, depending on the traffic for which they are suited and used. Swap bodies are suitable for continental transport only and so are semitrailers (though they are typically used also for short-sea shipping).

Transport by Intermodal Transport Units (ITUs) allows the economies of scale that make intermodal transport economically sustainable and, in turn, enables the environmental advantages that follow from the shift of cargo from road to rail or inland waterway. This is especially relevant as much of the EUSALP area is part of the Alps, where reduction of road transport is particularly important to protect the environment.

Maritime and continental unitised transport

The distinction between maritime and continental unitised transport is important because the two different flows entail different:

- Containers/loading units
- Transport chains, and therefore (often):
    - Operators
    - Locations

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Describing the value chain of intermodal transport is particularly useful to understand which actors are in charge of choices on intermodal units and therefore who should be interested in case policies to deal with container imbalances are devised. The following sections review first the type of containers employed and then the transport chains, for the maritime case focusing only on the inland transport sections of the whole chain.

Types of containers

Maritime containers

Maritime containerised trade refers to containers that are suitable for shipping on containerships and travel a part of their journey –typically the longest part- on the sea. They are carried by truck, rail or barge in the hinterland of the origin or destination port.
Containers suitable for maritime shipping are ISO 20ft and 40ft; the latter containers are becoming increasingly used and may be of normal height or high cube, thus with height 2896 mm (instead of the standard 2591 mm) to carry more voluminous goods.
There are also different types of containers within the categories just mentioned such as general purpose containers (simple “boxes”), reefers (refrigerated containers including refrigeration units and plugs), tank containers (to carry fluids), open top containers, flat racks.

Continental containers and intermodal units

Continental containers are used for transport on trucks, trains and barges. In Europe they include 45ft containers (optimised to fit European pallets), swap bodies, 30ft containers optimised to carry particular goods, the recent 52ft tank containers built for chemical products of BASF and therefore known as BASF class.

In fact, continental containers, as maritime ones, come in different types depending on the cargo they are designed for: *e.g.* simple boxes, open top containers, flat racks, reefers, and tank containers of different sort.

Continental trade is carried also by semitrailers. Due to transit restrictions, transport of semitrailers by train is particularly relevant across the Alps. However, they are not the main focus of his report since they typically travel full either way.

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Container transport chains and stakeholders involved

All intermodal transport involves shippers and consignors, respectively sending and receiving unitised goods. Transport is typically organised by freight forwarders and MTOs, Multimodal Transport Operators, that set up and provide the transport service either with own means of transport or choosing one or more sub-contracting carriers.

For instance an MTO may contract a carrier with transporting a container from the shipper's plant to the intermodal terminal, where the terminal operator checks it in and loads it onto a train, provided by a combined transport operator. At the other end of the rail leg, the container is unloaded by the terminal operator and loaded onto a truck provided by a further carrier that takes it to the consignor's warehouse. There may be alternative scenarios, the most interesting ones are outlined in the following sections.

Maritime containers' transport chain

Figure 2.1 to Figure 2.4 depict the possible land-side journeys of maritime containers.

Figure 2.1 considers maritime containers unloaded from a containership at a seaport, where they clear Customs[1] and may be sent to their final destination directly (often by truck), or via a terminal reached by train or by barge. At the terminal, the containers are moved onto a truck and delivered at destination. A possible further alternative, not depicted, includes trains from the port that enter directly the plant or warehouse of the consignor.

The operations depicted in Figure 2.2 describe the return flows of the containers once stripped. A truck picks up the container and delivers it to an empty depot (inland or close to the port), or to a terminal equipped with an area for empties, or to the port. Typically, locations where empty containers are stored also provide workshops where they can be repaired. Transport of empties between inland terminals and ports (or the other way around) occurs by the cheapest means between barge, rail or truck, also considering that they are not always delivered on strict timelines. Operations and destinations of empty maritime containers are different depending on who is in charge of transporting them, as clarified e.g. by Monios and Wang (2018). In case the road haulage (or more generally the inland leg) is performed by a contractor not acting for the maritime carrier (merchant haulage) the container must be taken back to the port or to the nominated depot. Theofanis and Boile (2009) explained that ocean carriers keep tight control over their containers equipment by reducing the free time they allow before containers are returned and by increasing the daily retention fee that consignee have to pay if they keep the containers beyond the free time.

[1] Customs may alternatively be cleared at an inland terminal, a so-called dry-port, that includes Customs offices and where containers travel under special Customs provision. This arrangement is normally set up to move some of the port operations away from the quays, where space is at a premium.

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In case the road haulier acts for the maritime carrier (carrier haulage), the carrier may decide where to send the container as it is released by the consignor, also re-routing it directly to a new customer. The latter case, with the container going directly to the next shipper, after inspection by the driver of the truck that picks it up, is known as triangulation and is an ideal situation that would noticeably reduce traffic of empty containers. It has different levels of uptake and is further discussed in section 4 among the ways to reduce empty container flows.

A further alternative is that the empty container is re-used by the consignor for shipping its own goods (for instance if the consignor owns the containers and has return flows).

If an empty container to be stuffed cannot be obtained by triangulation, it may be sent to the shipper from one of the possible locations where it is stored according to the steps depicted in Figure 2.3.

Note that movements of containers do not necessarily occur on the demand of customers: transport operators forecast container demand and move them accordingly e.g. from one port to another (Monios and Wang, 2014, recount a case when this would generate extra empty flows). It is also important to note that container requests (and shipments) may be subject to seasonal variations due to the products they are carrying and the supply chains they are part of.

Monios and Wang (2018) note that “if an export load is likely to be available, if the container must sit idle for more than 1-2 weeks then the loss of revenue means that the container owner would rather send the container to a location where a load will be found immediately.” This could involve sending the container to another continent. Theofanis and Boile (2009) also indicate that stripping and stuffing containers in the vicinity of ports is also a way for ocean carrier to control logistics operations and ensure shorter empty container rotation time.

In Figure 2.4 the stuffed container(s) are transported from the shipper to the port, either directly or via a terminal.

A further actor not showing on the sketches is the container leasing company: when containers are not owned by maritime shipping lines (the most common case) or by the shipper (the least frequent case) they are leased by companies whose business is to provide containers to maritime shipping lines and other operators. There are different sort of leases, ranging from long terms ones (lasting years) to very short terms ones, lasting even a single journey. The latter are very convenient for the maritime shipping company when there is no return load since the responsibility to take the container away from an area where it cannot be loaded falls on the leasing company.

The stakeholders most directly involved in the maritime container transport chain are therefore:

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- Shippers
- Consignors
- MTOs
- Freight forwarders
- Seaports
- Maritime shipping companies
- Container leasing companies
- Terminals
- Rail/intermodal/IWW operators
- Empty depots
- Customs

Public administrations are further stakeholders to take into account –though clearly not directly involved in carrying the consignment- since flows, linear infrastructure, and terminals as well as economic clusters are part of regions that are affected by the industrial and transport activities discussed here.

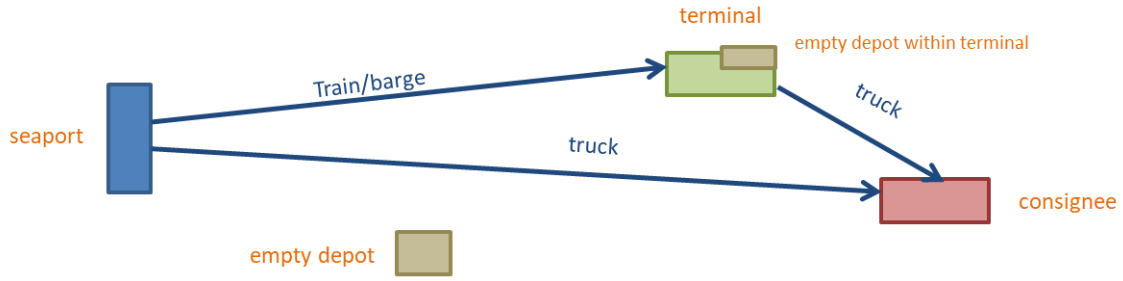

Figure 2.1. Maritime container flows of laden containers, two alternative routes from seaport to consignee.

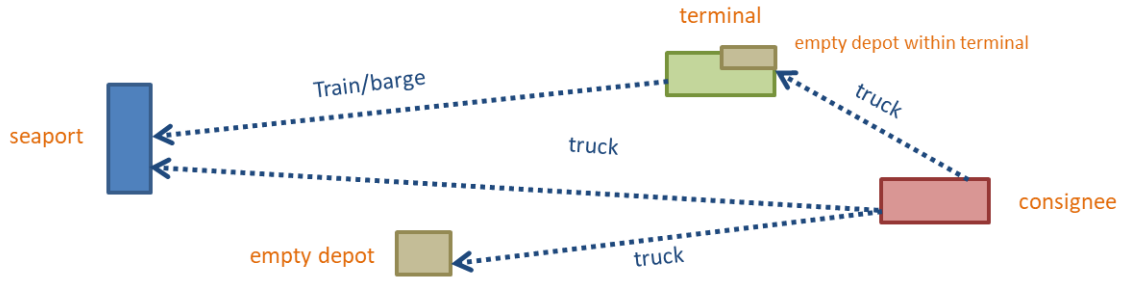

Figure 2.2. Maritime container flows of empty containers, three alternative routes of containers after stripping.

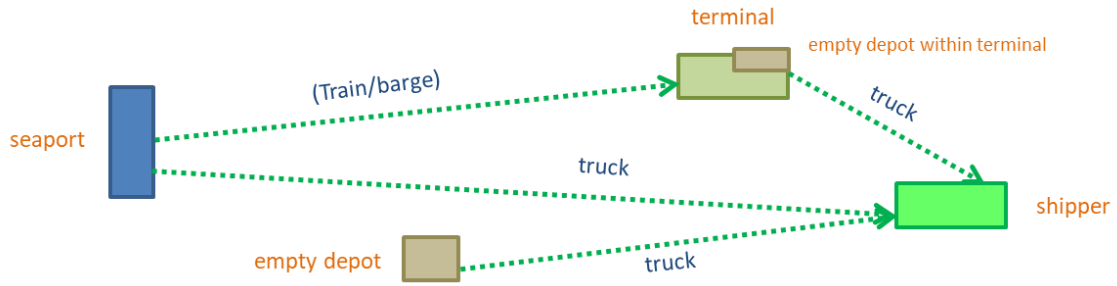

Figure 2.3. Maritime container flows of empty containers, three alternative routes for providing the shipper with containers ready to be loaded.

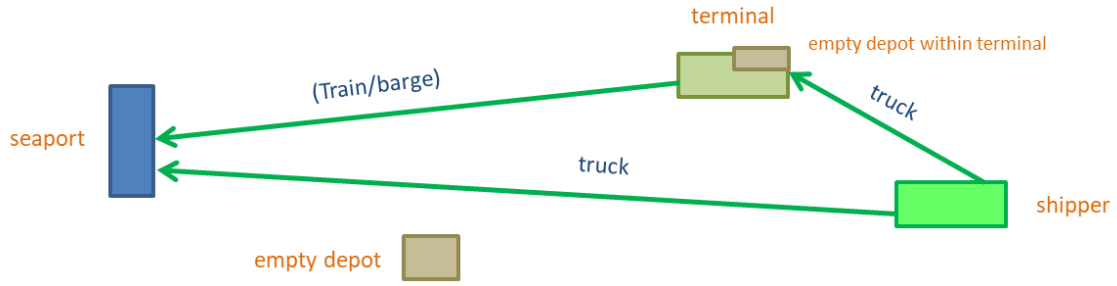

Figure 2.4. Maritime container flows of laden containers, two alternative routes from shipper to seaport.

Continental container transport chain

Figure 2.5 to Figure 2.7 illustrate the possible intermodal journeys of continental containers. The direct transport by truck is an alternative to the transport legs depicted. However it is sometimes not suitable to the transport needs due to distances (too high), volumes (large quantities sent together), transit regulations (e.g. the Swiss effort to transfer goods transport on trains).

Figure 2.5 shows the sequence whereby a shipper stuffs the container or containers, which are then taken to a rail or inland waterway terminal by truck. After the train or barge transport, the containers are taken by truck to their final destination. Alternatively, the loading or unloading point of the intermodal transport units may be directly within the shipper or consignor's plant or warehouse so the initial or final legs are not necessary

Figure 2.6 illustrates the possible journey of an empty continental container after it has been released by the consignor of the goods. It is taken to a depot within a terminal, where it remains available until the next request. Terminals typically allocate areas to key customers managing intermodal transport to temporarily store empty containers. When there is a high rotation of containers, accommodating empties generates traffic at the terminal and therefore crane moves,

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which is the source of income for the terminals. Indeed, stakeholders at dialogue events confirmed that the rotation time of continental containers is typically very fast (even just a day).

Alternatively, as in the case of maritime containers, empty intermodal transport units may be directly re-used by the consignor or re-routed directly to a new shipper without going through a depot.

Figure 2.7 shows the movements opposite to those in Figure 2.6, carried out in order to provide the shipper with the containers they need to send a consignment. When empty containers need to be sent or requested from afar, the movements are unprofitable and resource inefficient: they require transport effort (e.g. slots on a block train) that could be better employed should a different set up of the return and supply of empties be possible.

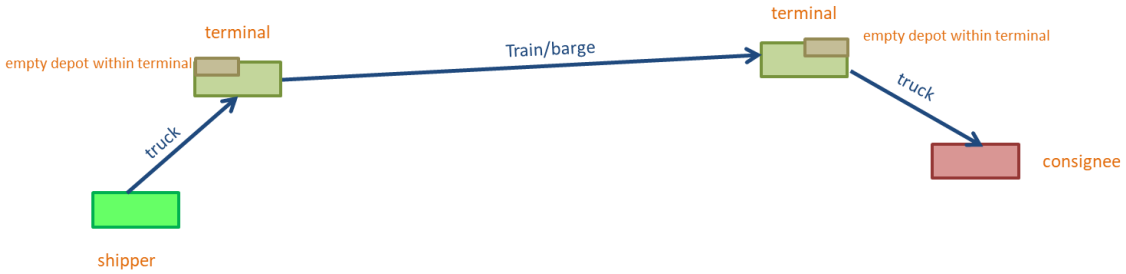

Figure 2.5. Continental container flows of laden containers, from shipper to consignee.

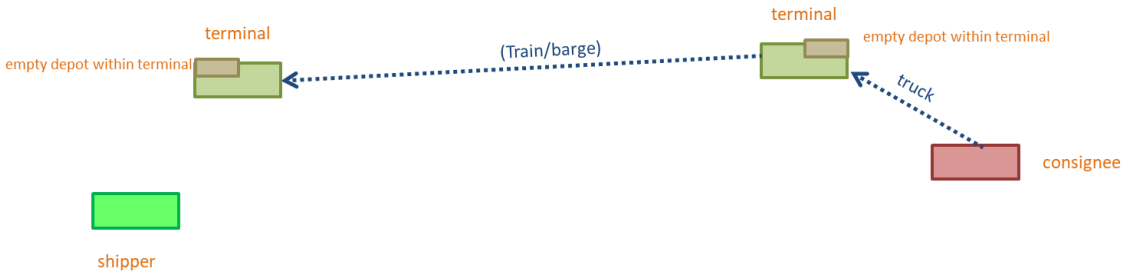

Figure 2.6. Continental container flows, return of empty containers

Figure 2.7. Continental container flows, provision of the shipper with containers ready for loading

The stakeholders most directly involved in the maritime container transport chain are therefore:

- Shippers
- Consignors
- MTOs
- Freight forwarders
- Terminals
- Rail/intermodal/IWW operators
- Rail operators
- Road hauliers
- Customs

Compared to the case of maritime containers there are no seaports and -typically- dedicated empty depots involved. Moreover terminals dealing with continental flows are often different from those working on maritime flows.

Clearly, also in this case public administrations are further stakeholders that must be taken into account –though not directly involved in carrying the consignment- since flows, linear infrastructure, and terminals as well as economic clusters are part of regions that are affected by the industrial and transport activities discussed here.

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Stakeholders involved and their role

Following on from the previous discussion on maritime and continental flows, Table 2.1 summarises which are the stakeholders involved in the transport chains, and therefore relevant to different extents to the discussion about flows of empty containers.

Stakeholder	Maritime Transport chain	Continental Transport chain	Role
Shippers	✓	✓	Send the goods and, depending on the commercial terms subscribed, may choose the MTO/forwarder/carrier carrying the goods. In some cases they also own the containers or the swap bodies
Consignors	✓	✓	Receive the goods and, depending on the commercial terms subscribed, may choose the MTO/forwarder/carrier carrying the goods
MTOs	✓	✓	Organise the transport of goods (in intermodal units) from the shipper to the consignor by using different transport modes, also by subcontracting the actual transport to other specialised parties such as intermodal operators and road or IWW carriers
Freight forwarders	✓	✓	Organise the transport of goods (in intermodal units) from the shipper to the consignor, typically subcontracting the actual transport to other specialised parties such as road carriers
Maritime shipping lines	✓		Transport intermodal units on containerships. Due to strong negotiating power (they control the maritime traffic) and vertical integration with inland partners, they are key in determining movements of maritime containers inland. They own significant shares of maritime containers.
Container leasing companies	✓	✓	Lease containers to maritime companies and other transport operators
Seaports	✓		Locations of transhipments of intermodal units and hubs for the storage of empty containers
Terminals	✓	✓	Locations of transhipments of intermodal units and hubs for the storage of empty containers
Intermodal operators	✓	✓	Provide the transport by railway. They provide the train service (in some cases leasing the wagons). Some intermodal operators provide also further services such as road haulage. In the case of continental transport they sometimes own the intermodal units

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Stakeholder	Maritime Transport chain	Continental Transport chain	Role
Barge operators	✓	✓	Provide transport on inland waterways, also as part of intermodal transports organised by MTOs
Rail operators	✓	✓	Act as subcontractors to intermodal operators by providing traction on the rail infrastructure
Road hauliers	✓	✓	Act as subcontractors to other operators by providing transport along initial or final road leg
Depots for empties	✓		Locations to store empty containers, often providing services such as cleaning and repairs
Customs	✓	(✓)	Provide border controls, along with other public agencies. They require appropriate information for a swift release of the containers subject to import or export regulations
Public authorities	✓	✓	Define policies and issue regulations relevant to intermodal transport, often to foster economic activities and to safeguard their areas from the negative externalities of such activities, including transport

Table 2.1: Stakeholders involved in the maritime and continental intermodal transport chains and their roles

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Causes of lack or excess of empty containers

Container imbalances may occur for several reasons, and most often due to a combination of them[2]. Lack of containers occurs when exporters from a region cannot find suitable containers in the quantity they need to carry their goods and have to import them empty. Excess of containers occur when containers imported full do not have return loads and have to be kept in storage until a load is found or sent away empty. It should be noted that keeping a number of containers in storage is normal, especially at ports, in order to fulfil rapidly the requests of shippers. Indeed, for operators the movement of empty containers is a normal part of the business, even though they are clearly an added cost.

In practice, there may be lack or excess of containers or both at the same time in the same area for different traffic flows and different types of containers.

Relevant reason for container imbalances comprise:

- **Trade imbalances**. These may be at global level, such as the East-West trade imbalance affecting maritime flows of empties, or with a regional scope. The former case brings about issues with empty container accumulation in ports. In the latter case is a key reason for inland flows of empty containers.
- **Containers of the appropriate type not available in sufficient numbers**. Actually, this is also a sort of trade imbalance. For instance, flows in and out of an area may show also imbalances due to inbound heavy cargo transported in 20 ft containers and lighter cargo exported in 40ft containers or exported in 45 ft continental containers.
- **Demand variations**. There may be seasonal variations in the flows of goods transported resulting in seasonal variations in the balance, lack or excess of containers.
- **Different operators in charge of different flows**. For instance, maritime and continental containers are typically part of separate flows, owned and handled by different operators, and often handled by different terminals. Concerning an area, when the flow in one direction is, say, largely maritime and the flow in the opposite direction is mostly continental, imbalances in equipment are normal and so are flows of empties.

[2] Discussions of the issues are present in much academic literature , typically referred to maritime traffic and focused on the maritime side of the container transport chain (see, among the many, Rodrigue (2019), Kuzmicz and Pesch, 2017; Theofanis and Boile, 2009; Boile, 2006) and most often on the related mathematical optimisation formulation. The problem is not much discussed in the technical literature, except when a particular solution is put forward (see Malchow, 2016). Almost no academic paper is concerned with container imbalances inland , Monios and Wang (2014) and Monios and Wang (2018) are exception tough much linked to maritime traffic imbalances as well.

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- **Transport of chemicals in tank containers**, that often have no return flows.
- **Strategies and choices of operators**. Operators, especially maritime operators, may prefer to move empty containers away from a location –even though by waiting there loads could become available- to meet requests elsewhere thus pursuing strategies that are beyond the needs and issues of a region and to keep the whole system of the company profitable. Movement of empty containers occur also following the demand forecasts of the operators.

Imbalances and movement of empty containers may be costly and impacting but are in some cases inescapable, as in the case of trade imbalances.

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3. Stakeholders, their power and their possible actions

The description of the steps of intermodal transport in section 2 characterised the stakeholders involved in maritime and continental transport of containers. That information is used here in order to clarify which is the overall aim of the actions of each stakeholder, how strong is their negotiating position in the intermodal transport chain, what –if anything- they can do to influence flows of empty containers.

Table 3.1 summarises that information and was also submitted to stakeholders at dialogue events to have it validated.

It should be noted that some of the actors of the intermodal value chain previously characterised are not included in Table 3.1. These are:

- rail operators;
- barge operators;
- road hauliers.

They are not considered here because they act on behalf of others (freight forwarders, multimodal transport operators) so they are not deemed to have influence on the choices pertaining movements of empty intermodal units.

Maritime shipping lines have the upper hand in all transactions since they own the traffic: other actors are strongly dependent on their choices. These in turn may be made at a geographical scale much wider than the hinterland of a port or a part of it, and include several decision factors. Decisions on routing of services, location of depots, and repositioning of containers will have an important influence of the intermodal landscape in a region and will be aimed chiefly at maximising the profitability of containerships. Maritime shipping lines own a significant part of the containers for maritime transport therefore they could share their assets as suggested in sections 4 and much in the same way as they share slots on containerships. However this is highly unlikely on account of the strict confidentiality of information flows that would need to be shared along with the equipment.

Container leasing companies provide containers in case they are not owned by the shipping lines, the shippers or by the MTOs. They aim at maximising the usage of the asset they manage but this is related to the time the containers are leased out to transport companies so they have little reason to intervene on empty flows, therefore no possible action is linked to them and their role is of limited strength when it comes to decisions that are made by their clients.

MTOs and forwarders have an interest in providing transport services that meet the demand of their customers, therefore they need empty containers ready when requested and at the same time need to limit transport costs, which may be in part related to flows of empties. They may be the actors working to balance flows with their commercial activity, however stakeholders at workshop warned that in the case of maritime traffic they have little room for action since they are linked to the

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indications of the shipping lines. They could also foster the use of ITS, although the though competitive environment suggests that they would limit ITS solutions to their customer base.

Intermodal operators, aiming for fully laden trains, could be interested to work towards expanding traffic, use ITS to improve train load factor, and set up collaborative environments with ITS. However, their interest in collaborative facilities based on ITS would be limited to their client base.

Seaports and inland terminals are in similar situations in terms of strength of their role. They aim to maximise their traffic and may act on charges and waivers for containers stays. Their decisions on using charges to attract empties need to weight the risk that the availability of empties rather than actually generating traffic (due to the active customer base of the operators that use the terminal) ends up occupying otherwise useful space, which in ports and terminal comes always at a premium. The reason for the limited bargaining power indicated in Table 3.1 for these actors is due to the inputs by the stakeholders during the dialogue events: they indicated, for instance, that a port or an inland terminal would exercise caution when discussing these items with shipping lines since they risk that the traffic is moved elsewhere.

Empty depots do not really have bargaining power in the value chain related to container flows and actually compete fiercely to get their value added services used.

Shippers and consignors are the ones that are ultimately charged for the movements of empty containers by the other actors in the chain so they could set up collaboration agreements to get better transport services and conditions.

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Stake-holders	Maritime shipping lines	Container leasing comp.	MTOs / forwarders	Intermodal operator	Seaports	Terminals	Empty depots	Shippers	PA
Aims for	Max usage of ships esp on routes with high rates	Max usage rate of containers (empty or full)	Cost, reliability, time of transport solutions	Fully laden trains	Max traffic	Max traffic (crane moves) with min stay of containers	Use of depot and added value services (repairs)	Ready availability of transport solutions	Favourable economic situation Reduced env.impact (traffic, noise, accidents, landscape)
Strength of role regarding container flows	●●●●	●	●●●●	●●	●	●	-	●	●●
How can they act	Repositioning decisions, location of depots, collab. ITS	-	Commercial activity, triangulation, ITS	Commercial activity, triangulation, collaboration ITS	Tariffs for container stay	Tariffs for container stay	-	Collaboration/grouping	Regulation, subsidies

Table 3.1. Influential stakeholders in intermodal transport, their main aims, a qualitative evaluation of their negotiating position and the possible actions they may take with respect to flows of empties containers

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4. Handbook to solve logistics challenges regarding imbalances of empty containers and empty container storage

Introduction

The present section illustrates possible solutions to container imbalances. They resulted from a survey of academic and technical literature (see *e.g.* Rodrigue, 2019, Boile, 2006, Theofanis and Boile, 2009) and were discussed with stakeholders who took part in the dialogue events related in section 5.

The solutions discussed refer both to cases with excess container available and to cases where more containers are required to satisfy export demand.

The possible solution discussed in the following sections are:

- Balance flows of laden containers
- Triangulation/street-turning
- Virtual container yards
- Grey boxes/shared pools
- Homogenisation of containers used by combining journeys
- Transloading
- Foldable containers
- Compoundable containers
- Subsidies
- Mitigation of the environmental and economic costs of repositioning containers

Possible solutions

Balance flows of laden containers

The lack of empty containers available for transport in one direction could be solved by increasing containerised flows in the opposite direction, so that –once stripped- containers become available for transport. Therefore, lack of empty container to export goods may be solved by increasing containerised imports.

A similar action could be taken to deal with the excess of containers in an area (and the space they require).

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This results should be obtained by marketing activity by the MTOs and freight forwarders to increase the quantity of goods they transport in containers. Of course the goods targeted by that action should require the same type of containers, therefore this possible action refers mostly to simple boxes or reefers.

It would be even possible to think of favourable prices for shipments to foster incoming traffic or usage of excess empty containers since they would anyway take part of the costs off the shipments in the opposite direction.

However, while theoretically appealing this solution may be complex to apply since it may contrast with the kind of imports and exports that are often found at manufacturing clusters. For instance imports may be heavier and come in 20' maritime containers whereas exports are lighter and require 40' maritime containers (this is the case in the Basel area). There are also cases where import and export flows are along different directions thus bringing about the balance of containers at a location may generate imbalances elsewhere. Alternatively, import flows may be unsuitable for container transport. In other cases import flows come in maritime containers, whereas export flows leave in continental containers and the two are not exchangeable since they differ is size, are in charge to different companies, are part of separate flows, and such flows are managed by separate companies and terminals, sometimes in competition among one another.

Notwithstanding the points above, this a viable solution to balance container flows.

Triangulation/street-turning

Containers just emptied by a consignee are often returned to a depot or terminal where they wait to be re-used. With triangulation (also called street-turning) containers just released after stripping, if deemed fit for re-use, may be taken directly to a new shipper to be loaded, without going back to a depot/terminal. This saves distance travelled, idle moves and use of space in terminals, provides for better use of equipment, reduced energy use and emissions. Containers may be declared fit for re-use after inspection by the carrier (in practice, the driver clears the containers for re-use) provided they do not need maintenance or cleaning.

In case triangulation is not performed, the typical minimum turnaround time of a container is one day for the next: on day A the container is picked up empty from the consignor and taken to a depot/terminal. On day B the container is available for pick up from the terminal.

It is noteworthy that triangulation is common in road transport: hauliers look for return loads available close to their delivery location.

While the concept of triangulation can be operationalised manually, it is much more effective and efficient when carried out with a virtual container yard, an IT platform that optimises the dispatch of trucks and containers (see the next paragraph). Indeed the IT platform enables the transparency of the system required to obtain efficiency when multiple stakeholders are involved such as road hauliers and container owners (as noted by Ericksrud, 2016).

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During the dialogue events , stakeholders offered different views of street-turning, in some cases indicating that it is common (in Veneto) and in other that it is not (Basel, where it was indicated that only 5% of containers are re-used immediately after stripping). It should be noted that the Basel region is rather compact and that there are several container yards, thus the issue is less pressing.

During the dialog event in Tyrol it was noted that in case this measure is coupled with container sharing (see the section on grey boxes), there should be a third party checking the containers to ensure they are fit for re-use.

Virtual container yards

Triangulation is now commonly operationalised with virtual container yards, therefore this section is complementary to the previous one.

Virtual container yards may be used to link the demand by hauliers and the availability of containers at several depots in an area –or at warehouses of consignors that are releasing containers after stripping. The truck is the addressed to the nearest place where the required empty container is available and receives on-line the necessary authorisation to pick it up.

Examples of virtual container yards have been developed in the USA by the ports of Oakland, the port of New York/New Jersey, and the port of Los Angeles/Long Beach. The latter developed the virtual container yard as part of its Clean Air Action Plan and on its Ports Community System thus providing a third party platform for it. There it is estimated that, prior to the Virtual Container Yard, 30-40% of intermodal trucks were carrying empty containers from/to depots (POLB, no date).

An example application in the maritime container sector is the Avantida platform by Maersk, available also in Europe. The use of the platform comes at a cost but the ocean carrier, following the availability of the IT platform, charges more for triangulations performed manually (in Italy a triangulation is charged 80 euro if performed via the platform whereas a manual street-turn is charged 200 euro; see Maersk 2019). The platform optimises pick-ups of containers just made available and provides immediate confirmation of the effective availability of an empty container in a port hinterland. This is especially useful in a port-hinterland situation where access to the port is through congested roads.

At the dialogue events there was only one report of experience with virtual container yards. An operator noted that they are working internally with a virtual container yard across several terminals, thus using the concept to optimise their operations related to containers already at terminals by pooling the availability at several locations.

It should be noted that the Maersk platform and the platform mentioned at one of the dialogue events concern the assets of a single operator whereas those proposed in the US are supported by a Port Community System that is provided by a neutral party and is aimed at more operators. The unwillingness to share information about container flows and a number of administrative issues led Theofanis and Boile (2009) to be initially sceptical of the feasibility of such systems.

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Grey boxes/shared pools

Containers belong to different shipping lines/leasing companies/intermodal operators. One operator may have excess empty boxes in an area while another may be short of them due to their separate trade flows. By pooling all or part of their containers in a region, operators may cooperate to solve their own container imbalances. In practice this means that the containers pooled are managed by a third company that dispatches them according to requests. The name grey boxes come from the possibility of implementing the idea with containers that do not carry the logo and name or one operator or the other. The concept has also been put forward for reefers (Van Marle, 2013).

Van Marle (2012) reported past successful pool shares by Global Equipment Management, a group of Scandinavian lines, and Interlogistica, group of Italian lines. In all cases attempted, the pool shares were within a single group of operators and did not last once the companies belonging to the groups were acquired by other, larger ones.

This solution was commented with scepticism by operators at dialogue events (and sceptical remarks are present in the literature too, see e.g. Fwd News, 2017).
At one dialogue event a participant recalled a situation where a company bought by another one kept on managing its container pool separately from that of the buyer company, as if they were still separate enterprises.
Participants to dialogue events generally stressed the confidentiality of information and operations thus firmly excluding the possibility of sharing pools of containers. The general impression is that the high level of competition that characterises the sector hampers any form of collaboration.
In any case, containers typically carry the name and logo of the transport company that owns them and participants to dialogue events noted that transport companies would want to remain visible that way.

It should further be noted that, in case the seasonal peaks of demand for different lines were concurrent, pooling containers would not solve entirely container imbalances.

Homogenisation of containers used by combining journeys

Imbalances in containers availability may be due to import and export flows carried out with containers of different types. Excess of a certain type of container could then be exploited to load goods currently travelling on a different kind of containers. For instance goods currently travelling on 45’ continental containers could travel in 40’, or goods currently travelling in swap bodies could travel in 45’ containers.

An example of journey combination was suggested as part of the LoPINOD Interreg project in the UK (Monios and Wang, 2014). In that case semitrailers were used to carry imports from English distribution centres to Scotland while 40ft containers were used to carry Scottish exports via English ports but the containers had to be imported empty. However, neither using semitrailers instead of containers for the land leg and then transloading the goods into maritime containers, nor

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carrying Scottish imports in 40ft containers were deemed feasible due to a number of different issues. Those included: demands not matching, frequent change of land transport companies due to re-tendering of services, value of goods advising against transloading from semitrailers to containers.

The possibility of combining journeys was excluded by stakeholders that provided a feedback on the matter at workshops. They remarked that flows of different type of containers are separate and there is no scope for exchanges. They also recalled that, for instance, it would be impossible to have goods transported in 20ft containers when they fit into 40ft ones since that would double the handlings for the same cargo thus markedly increasing transport costs.

Additionally it should be noted that if combining journeys were possible, shippers and consignees should be able to handle the alternative containers (e.g. swap bodies have legs, containers do not) and that the change in capacity needs to be acceptable also in terms of packaging of goods (45ft containers are optimised for Europallets whereas 40 ft are not).

An additional element requiring attention would be the seasonal differences of the different flows as well as their peaks, that may be concurrent.

Transloading

Transloading is a practice in place where continental containers are much larger than maritime ones and at ports goods are moved from one type of container to the other in order to save crane moves and truck trips (and related costs). In the USA this is used since two 53 ft continental containers may in some cases accommodate the cargo traveling in three 40 ft maritime containers thus saving a third of truck trips, and container moves at terminals. This practice is in use also in Australia.

Theofanis and Boile (2009) also remark that returning the maritime containers to the shipping lines immediately after the transloading operation at the port avoids the costs of incurring in penalties for late returns of empties.

Transloading in Europe would not be advantageous since there is no significant difference in size between maritime and continental container as it is the case elsewhere. No such practice in Europe is known at the time of writing to the study team and the operators at the dialogue also knew of no such practice in Europe.

Foldable containers

Several types of foldable containers have been proposed over the years. They are general purpose containers that may be flattened onto the base thanks to walls linked to the base and to the top by hinges and locks. The idea is that the empty containers may be folded, and 3-4 flattened containers may be stacked and repositioned together as a single set reducing room, truck trips or train slots, and crane moves required.

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Use of such containers requires that trained staff is present where they are to be folded or unfolded and that time necessary for those operations is limited.

An example of recent foldable container is the 4FOLD by Holland Container Innovations, a spinoff from the Delft University of Technology. The concept was developed as part of an Horizon 2020 co-funded project. The 4FOLD containers have received ISO certification and four of them can be staked together to take the space of one standard container. Folding/unfolding is claimed to require two people plus the crane and a time of 4 minutes per container. Holland Container Innovations is proposing to supply foldable containers as a service thus providing its own trained staff at the location where folding/unfolding is necessary.

In the quest to save more space when the containers are folded, the US based company Compact Container Systems, that also developed containers that may be stacked in groups of four when folded to take the space of a normal container, is now developing foldable containers that may be stacked in the same volume in groups of five.

The idea of foldable containers was considered impractical by stakeholders at dialogue events. Points made and doubts raised related to the sturdiness of the foldable containers, to their water-tightness (even though it should be noted that they do have ISO certification), to their extra cost compared to standard ones, to the need of having a team on the yard able to fold or unfold them, to the need of tracing them carefully especially overseas to be certain they would come back since they are special equipment.

One stakeholder had attended a demonstration of a foldable container, but their company did not look further into the matter.

Another stakeholder related that the Austrian company, Montan, uses open top containers for bulk material transport between Austria and Turkey that are designed to be stacked when empty in order to save space. These containers are operated within the traffic of a single company thus readily meeting the need to track equipment to obtain actual space savings.

Compoundable containers

The concept of compoundable containers has been operationalised by the German company Tworty Box that developed at the beginning of the present decade the Tworty container. This is composed by two 20ft containers with doors at either end that may be linked into a 40ft container so as to meet different needs. Malchow (2016) describes the idea, the operations, and the economics of the Tworty box. The idea could cater for situations where trade in one direction requires 40ft containers and 20ft in the opposite direction. Interestingly it would also be useful in case empty 20ft need to be taken back to a port because coupling them into a 40ft would require half the crane moves, thus cutting such costs. However, compatible 20ft boxes need to be tracked and coupling and uncoupling is to be carried out manually: the two smaller boxes are placed end to end and the locks are operated from within the containers so that the coupled set cannot be opened from the outside.

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The tworty boxes were tested in actual operations by DHL in 2013; however there is no information of actual further use and operators attending the dialogue events were not aware of compoundable containers in operations.

Subsidies

Subsidies could be used to limit the effect on the shippers of imbalances in containers availability by creating the conditions to balance flows. This could include subsidies to transport laden containers in the direction opposite to that requiring them, with an obligation to pass a part of the sum on to the shippers. It would have an effect similar to special pricing applied on commercial terms.

Subsidies should be temporary (since they shift the burden of the extra cost for the consignment from the shippers to the taxpayers) and be designed to stop at the latest once the targeted balance is established. Subsidies could be warranted on the basis of the carbon footprint of alternative freight transport arrangements. However, they should include a follow up assurance that the change effected by the subsidies would last once they are terminated. This could be set up similarly to the ferrobonus and the marebonus rebates in Italy whereby the services concerned by the subsidies must be kept in operation for at least three years after the subsidies end.

No example of subsidies for container flows was related by the participants to the dialogue events. However, there exist subsidies applying generically to intermodal transport, to encourage modal shift, but they are not aimed specifically at flows of empties. These include the marebonus and ferrobonus mentioned in the previous paragraph.

Mitigating the environmental and economic costs of repositioning containers

Acknowledging that some areas have necessarily unbalanced flows due to their manufacturing inputs and outputs, the environmental and economic costs of repositioning containers may be mitigated by using the least expensive transport mode in both economic and environmental terms. This is the action taken by some transport operators in Basel that ship empty container by inland waterway whereas they ship laden ones by rail or truck.

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Summary of handbook of solutions to empty imbalances

The following Table 4.1 provides a summary of the solutions discussed in the previous section.

Solution/action	Brief description	Outlook
Balance flows of laden containers	The lack of empty containers available for transport in one direction could be solved by increasing containerised flows in the opposite direction, so that ‑once stripped- containers become available for transport. Similarly excess of container availability could be solved by further marketing container transport in the opposite direction.	+
Triangulation/street-turning	Containers just emptied by a consignee are often returned to a depot or terminal where they wait to be re-used. With triangulation containers just released after stripping, if deemed fit for re-use, may be taken directly to a new shipper to be loaded, without going back to a depot/terminal.	+
Virtual container yards	Virtual container yards may be used to link demand by hauliers and the availability at several container depot in an area ‑or at warehouses of consignors that are releasing containers after stripping. The truck is then addressed to the nearest place where the required empty container is available and receives on-line the necessary authorisation to pick it up. Virtual container yards are also used to operationalise triangulation.	+
Grey boxes/shared pools	Containers belong to different shipping lines/leasing companies/intermodal operators. One operator may have excess empty boxes in an area while another may be short of them due to their separate trade flows. By pooling all or part of their containers in a region, operators may cooperate to solve their own container imbalances.	- -
Homogenisation of containers used by combining journeys	Imbalances in empty containers may be due to import and export flows carried out with containers of different types. Excess of a certain type of container could then be exploited to load goods currently travelling on a different kind of containers that has to be imported empty. For instance, goods currently travelling in swap bodies could travelling in 45ft containers.	- -

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Transloading	Transloading is a practice in place where continental containers are much larger than maritime ones and goods are moved at ports from the one type to the other in order to save crane moves and truck trips (and related costs).	- -
Foldable containers	They are general purpose containers that may be flattened onto the base thanks to walls linked to the base and the top by hinges and locks. The idea is that the empty containers may be folded and 3-4 containers may be stacked together and repositioned as a single block reducing room, truck trips or train slots required, and crane moves.	-
Compoundable containers	The concept of compoundable containers entails locking together two small containers to obtain a large one when needed or when empties need to be moved, in order to save crane moves. The only example is the Tworty Box composed by two 20 ft containers with doors at either end that may be linked into a 40 ft container.	-
Subsidies	Subsidies could be used to limit the effect on the shippers of imbalances in containers availability by creating the conditions to balance flows. This could include subsidies to transport laden containers in the direction opposite to that requiring them, with an obligation to pass a part of the sum on to the shippers. They should be temporary and be designed to stop at the latest once the target balance is established. Subsidies may be directed also to mitigate the environmental and economic costs of repositioning containers, as in the case that follows.	:
Mitigation of the environmental and economic costs of repositioning containers	This action does not attempt to change the flows of empties but to shift them on a mode less environmentally and economically expensive, such as the inland waterways.	+

Table 4.1. Summary of solutions to manage empty container imbalances (an outlook with a + sign indicate a general viability of the solution; a : sign indicate an unclear outlook; the – sign indicates a negative outlook)

Table 4.1 also provides summary indicator called outlook that is intended to report a general impression of the viability and usefulness of the methods proposed. The outlook indicator has been qualitatively obtained by considering the feedback from stakeholders at dialogue events and the observations reported in the technical and academic literature.

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The most promising solutions are triangulation and virtual container yards as well as the effort to balance flows of laden container if supported by pricing or subsidies. However none of them can be expected to offer a thorough solution to imbalance issues. The attempt to balance flows is likely limited by the type of goods that are transported to and form an area to the set of areas with which it has exchanges. Therefore part of the imbalance may be structural. Additionally the effort should be common to several operators since each operator manages its own flow.

Triangulation and virtual container yards will reduce rotation time of containers and save truck trips to reposition empty containers between consignors, depots and shippers. However, they are likely to be implemented within the network of a single operator due to the strict confidentiality with which transport operations are described by shippers. The chances of success of a third party platform, such as those developed in the US, are unclear.

Shared pools of containers do not appear viable due to the practicalities linked to managing containers and to the confidentiality that characterises container transport. Homogenisation of container pools is equally impractical due to the separations in container flows and ownership as well as to avoid transloading of goods. Transloading as a solution itself does not seem useful as in Europe it does not provide the advantages that may provide in the US and Australia due to the marked difference of size between the maritime containers and the continental ones used there.

Foldable and compoundable containers add operations and related costs to container transport that operators seem to note more than the possible savings, plus they are seen as special equipment whereas operators seem to prefer the flexibility of “simple boxes”, thus they are deemed ingenious but –at present- with limited interest. Operators. They could have as a starting point the traffic of a single operator on a particular connection, but this again should be developed by the operator and, possibly, by a large shipper (who could perhaps own the special containers).

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5. Other relevant projects concerning intermodal transport

Introduction

This sections considers a set of projects concerning intermodal transport in order to explore the scope for synergies.

AlpInnoCT

Alpine Innovation for Combined Transport (AlpInnoCT) is an Interreg project aiming at improving the efficiency and the productivity of combined transport with the introduction of methods used in manufacturing (e.g. lean methods, not necessarily used in combined transport). The project runs until the end of October 2019 and over its three years' duration has produced studies and pilots (the latter are on-going at the time of writing this report).

A number of reports were produced since the beginning of the project in 2016, taking stock of the current situation and of the strengths and weaknesses in combined transport. Although much of the focus of the project is about how to suitably incorporate lean production methods and new technologies in combined transport, one of the main objectives is also the reinforcement of participation possibilities for each stakeholder in freight transport.

The project highlights a number of issues affecting combined transport in the Alpines Space, among which several pertaining to rail infrastructure and operations, some about operations within the combined transport infrastructures (e.g. terminals), and a few about the coordination of actors ("lack of coordination between actors", "non-effective communication between actors", see Božičnik *et al.*, 2018). Lean production methods are suggested to tackle lack of actors' effective collaboration. It is noted here that in applying those methods it would be key to look at the motivating factors driving the actions of each actor, some of which are not necessarily in direct contact.

AlpInnoCT also notes the lack of statistical data about combined transport that was encountered also in this project.

AlpInnoCT tackles several aspects of combined transport and looks into matters making it more attractive as a choice for the shipments; the issue of managing empty intermodal units is mentioned only in passing in one of the reports noting that "The availability of empty ready-to-load containers is a significant competitive factor. The supply and handling of empty containers therefore gains more and more importance, especially with respect to situations of unbalanced export and import" (Klemenčič and Burg 2018).

The AlpInnoCT report providing recommendations on an ideal CT model concept and discussing the needs of players along the supply chains indicates several bottlenecks (or issues) that were stressed also during the dialogue events for this project (see section 5), among which: shortage of qualified personnel, issues with train handover at borders, IT interface problems.

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The AlpInnoCT report depicting a Vision for Alpine combined transport in 2030 (Fürst *et al.*, 2018), based on a survey and interviews with stakeholders, includes a number of recommendations some of which are interesting also for this report and concern, among others:

- The need to upgrade and/or expand rail and terminal infrastructure
- The need for international cooperation on infrastructure projects and the harmonisation about operational rules, especially concerning maximum train lengths and weights
- The need to deal with the mix of passenger and freight traffic, and the low priority typically given to the latter

AlpInnoCT acknowledges that combined transport results from the combined efforts of several stakeholders but it also stresses the need for them to collaborate to introduce the innovation it suggests.

As one of the conclusions of the present work is that it is necessary to take a wide look at combined transport and that empty container flows should not be taken in isolation, the need to establish collaboration among actors could be an element of synergy across the projects. Indeed it is striking that transport services obtained with the collaboration of several actors seem to have very limited communications among them, although this can be explained by the high level of competition. A collaboration/information platform for stakeholders in the Alpine area that would benefit the further development of the elements piloted by AlpInnoCT, could be the same as suggested by this project with the involvement of public authorities that could have a better feel and continuous for the situation.

SMARTLOGI

The SMARTLOGI project is co-financed by the INTERREG V-A Italy-Austria programme and runs between January 2018 and December 2019. It is focused on shifting freight from road to rail and reducing the environmental impact of cargo transport. The project pilots ICT applications between the port of Trieste and the freight centre of Fürnitz via the Tarvisio Alpine crossing to solve administrative and Customs issues. One final aim is to build upon the pilot and the studies carried out during the project to develop a freight corridor also along the Brenner axis. A further, wider, aim is to develop a freight transport strategy for this part of the EUSALP area that would be taken forward by the two relevant EGTCs, therefore laying the foundation for work well beyond the duration of the project.

SMARTLOGI has found that in its work area:

- Measures to support multimodal transport are not harmonised or integrated.
- Governance at regional, national, international levels is not integrated, both in terms of managing intermodal infrastructure and coordinating actors.

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Additionally, for some SMARTLOGI areas there are infrastructures and terminals that do not meet the needs of the operators and at the same time there little or no knowledge of cargo flows in terms of origins and destinations, and quantities. Those would be critical to define strategies.

The project therefore recommends to:

- Promote coordinated measures fostering intermodality, thus improving efficiency and effectiveness of incentives.
- Improve the governance of transport across nodes of the network (ports and freight centres) and across stakeholders, so as to improve competitiveness and use of capacity. The networking of freight centres and ports is indicated as a key action towards improving combined transport.
- Harmonise methods to monitor intermodal transport in different States.

Additionally, SMARTLOGI indicates as strategic work the solution of last mile bottlenecks and the integration and standardisation of IT/ICT solutions.

One particular ICT system mentioned by SMARTLOGI is the Port Community System (PCS) of the port of Trieste, that operators use administrative, tax and Customs procedures. Its use has allowed the reduction of the preparation times of trains. More generally, a PCS is interesting in terms of the present report as a neutral collaborative platform for operators as noted also in the section on the methods.

LoPINOD

LO-PINOD - Logistics Optimisation for Ports Intermodality: Network, Opportunities, Development was a project developed under the Interreg Northsea Region IVb during 2010-2013. The aim of the project was to put forward practices able to enhance the accessibility of ports of regional importance, so as to make them more competitive, and promote more sustainable freight transport. The project looked at the seaside connections of the ports, at the ports themselves and at the links with the hinterland. It is worth mentioning this project here because a part of it concerned Scottish port and issues with empty containers (see Monios and Wang; 2014). It is in fact a rare project tackling explicitly the issue.

The part of the project analysing issues with empty containers was developed linking the results of a desktop study with the interviews to different stakeholders including shipping lines, ports, public sector actors and industry associations as well as shippers. The involvement of the latter group is particularly significant in terms of assessing the feasibility of the solutions put forward. Scottish ports experience lack of empty containers and the project understood that it is due to routes of maritime services linking supply and demand ports. The interviews allowed to find out that some services moved empty containers form Scottish ports to the hub ports of the continent and then back to Scotland. It was then the occasion for talks with the shipping lines which modified the

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routings of their services to reduce distances travelled by empty containers. Talks and schedule changes were also the way to solve a case where a maritime service had too little time allocated to pick up empty containers left on the quay of an Irish port. These results are interesting as they show the unintended effects of decisions taken as a high level (maritime shipping lines) on local systems and how they may be tackled through lobby action.

The project explored the effect of where empty containers are stored inland (and the cost of moving them) and mentioned the use of grey boxes (unsuccessfully tested). It mentioned the possibility of attracting empty containers to ports lacking them by lowering storage charges, which some ports would already do, but not just to solve empty container imbalances: it was also a way to get the laden container transport via the port.

Another solution explored is the sharing of transport equipment for complementary flows. In that case the empty semitrailers used for a north bound flow would be used southbound for Scottish exports and transhipped into ISO containers for maritime shipping once at the base of the semitrailers in England. Alternatively, northbound transports would be carried by the otherwise empty maritime containers required by Scottish exports. The idea was put forwards by shippers but it would encounter a number of practical obstacles: demands not matching, frequent change of land transport companies due to re-tendering of services, value of goods advising against transloading from semitrailers to containers.

Subsidies were also discussed but, in that case, empty containers are moved by sea, the cheapest and most environmentally friendly transport mode so there would be no modal shift and the subsidies would have the taxpayer covering costs pertaining to the shippers. In fact, the project indicates that the role for public authorities and other supporting actors is to “lobby shipping lines and ports and influence their decisions where possible” (Monios and Wang, 2014).

The conclusions of the study were pessimistic in terms of feasibility of the methods discussed to solve container imbalances due to the number of items hampering practical implementation. In fact the project suggested that the only real way to solve empty container repositioning issues is to get to balanced flows, which depends on production geography. The report noted however that useful action can be taken by public authorities and local organisation to try and influence decisions otherwise taken by maritime shipping lines at their own scope, with no particular concern for local conditions.

Chemmultimodal

Chemmultimodal was an Interreg Central Europe project run between 2017 and 2019 that concerned fostering the shift of transport of chemical goods towards modes that would reduce the current carbon footprint of such transport. Since chemicals are special and, sometimes, dangerous goods, the project developed a set of guidelines to indicate which could be the multimodal transport solutions suitable for each type of chemical goods as an alternative to road transport. The

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guidelines were used, along with a CO_2 calculator and a platform displaying intermodal links as support tools to put forward to the chemical industries multimodal transport solutions. This were actually explored by logistics service providers and the manufacturing companies as part of meeting events promoted by the project and made possible by local and regional associations of operators. On such occasions the manufacturing companies were able to meet several logistics operators, explain their needs in detail and discuss solutions, with the possibility to receive shortly after the meeting a quote to switch from the current solution (typically all road) to a multimodal one (involving for a leg: train transport, containers on trains, short sea shipping). The meetings were successful in that allowed manufacturing companies to explore solutions that would not be considered otherwise. Some such solutions were actually taken up as pilot actions, testing the viability of the modal switch with a view to maintain the new solutions as meeting the transport needs of the chemical company (also in terms of price, quality and time) beside being less impacting in terms of carbon footprint.

Conclusions

The key conclusion from this brief overview of relevant projects is that there seems to be a need for actors in the cargo logistics business have a contact point with the local administrations and between themselves to discuss and, where possible, find solutions to local issues that may be tackled by joining forces and discussing openly, even though the general environment is competitive. Participation and, to some extent, collaboration may pay back also in such an environment. Issues highlighted by the projects reviewed are similar to those discussed with stakeholders of intermodal transport at dialogue events held for this study: infrastructure, operational rules, lack of priority for freight transport on rail, practices resulting from decisions made elsewhere, lack of integrated international governance when flows and infrastructures are, in fact, international.

The Chemultimodal project used meetings between logistics operators and manufacturers as a way to improve the logistics situation in the areas involved, with a view to reduce the carbon footprint of chemical transport. The same idea here could be taken up to the same aim and to improve the efficiency of logistics with regard to empty containers.

The experience from LoPINOD is noteworthy to stress that even when choice are made elsewhere (by a maritime shipping line, in that case) discussions may happen and may also be productive, improving the local logistics situation without detriment to the operations of an actor working on a much wider geographical scale.

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6. Dialogue events

Introduction

The project included identifying a set of focus areas located along TEN-T corridors to study and discuss in depth with local event the issue of empty container flows .

The case study areas characterised and the relevant Corridor are listed in Table 6.1 and identified in Figure 6.1.

Case study area	TEN-T Corridors intercepted
Tyrol	- Scandinavian-Mediterranean
Novara and west of Lombardy	- Rhine-Alpine - Mediterranean
Veneto area	- Mediterranean; - Baltic- Adriatic; - Scandinavian-Mediterranean
Basel and the Freiburg area	- Rhine-Alpine - North Sea-Mediterranean

Table 6.1. Case study areas and TEN-T Corridors on which they are located.

The Tyrol area was chosen since it was known from the outset that issues with container imbalances were present. The Novara and west Lombardy area was chosen since it serves an important area of the North of Italy and connects two key Alpine crossings for freight. Additionally it is the reference area for Genoa, which is the main Italian container port. Veneto was chosen since it is on several corridors and has two main terminals with distinct roles: Verona for continental cargo, and Padova for maritime freight flows, and it also includes the port of Venezia. Basel and Freiburg were expected to have an imbalance due to extra containerised inflows, and are also a key freight gateway to Switzerland, for all three inland modes: road, rail, and inland waterway.

A dialogue event was held in each case study area in order to present the study and obtain feedback from operational stakeholders on the real issues concerning empty containers and on the possible methods to tackle them, with the final aim to identify possible actions to put forward at the end of the exploratory study.

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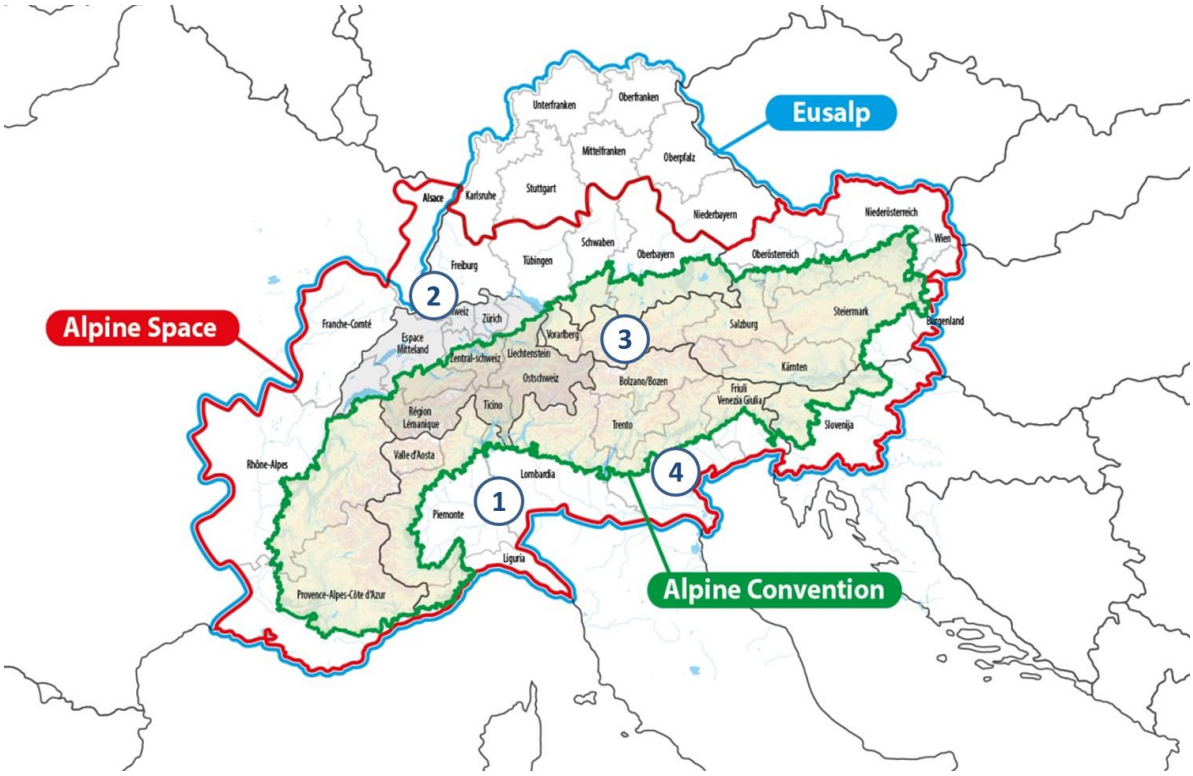

Figure 6.1. Location of dialogue events and relation to the EUSALP area 1) Novara and west Lombardy; 2) Basel and Frieburg; 3) Tyrol; 4) Veneto (Verona/Padova)

Location and dates

Organising dialogue events proved challenging as only a limited number of stakeholders accepted to participate. Actual location and dates of meetings are reported in Table 6.2.

Case study area	Meeting location	Date
Tyrol	Innsbruck, hosted by Land Tirol	03/06/2019
Novara and west of Lombardy	Novara, at conference room of local hotel	14/06/2019
Veneto area	Venice, hosted by the Port Authority	27/06/2019
Basel and the Freiburg area	Basel, at conference room of local hotel	09/08/2019

Table 6.2. Dates and locations of dialogue events.

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Agenda of dialogue events

Dialogue events were facilitated informally with the following agenda:

1. Introduction and *tour de table* so that people attending knew each other.
2. Description of outcomes sought: a) an understanding of logistics of containerised goods at the location and b) understanding on who and how could act to improve supply chains and sort issues with imbalances of empty containers.
3. Presentation of the study and its motivation (see the introductory slide in Figure 6.2).
4. Short presentation of data from port and terminals in the area.
5. Illustration of container transport chains (see the full slide deck used in Innsbruck as an example, reported as appendix).
6. Presentation and request for feedback on table of who can act and with what motivation (based on the table discussed in this report in section 3) chains see also full slide deck used in Innsbruck as an example, reported as appendix.
7. Presentation and discussion of methods to deal with container imbalances (methods discussed are explained in section 4).

Each dialogue event lasted approximately 1.5 hours.

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Figure 6.2. Introductory slide for the Innsbruck dialogue event describing the aims of the study (the figure depicts a master slide: the actual slides were in German and are reported in the Appendix)

Figure 6.3. Introductory slide for the discussion on who are the stakeholder in containerised transport and which are their motivations (the figure depicts a master slide: the actual slides were in German and are reported in the Appendix)

Key outputs

Minutes of each dialogue events are reported in the appendix. This section summarises the key outputs. Part of the information obtained was also included in the previous sections of this report when useful to clarify the items discussed.

There are **imbalances in container traffic** in Tyrol (lack of containers for export), the Basel area (mismatch of containers for imports and exports and excess of containers from import), Venice (due to demand forecasts by shipping lines that sometimes prove incorrect). In Novara they expect to have to deal with container imbalances once the maritime flows linked to the Belt and Road Initiative will affect the area. At both workshops in Italy it was stressed that imbalances pertain to maritime traffic whereas continental traffic swap bodies and containers always have return loads. Also for semitrailers there is no movement of empties over long distances since operators make their utmost to find return loads. Operators in Basel noted that customers do not want to pay for movements of empties so they are motivated to keep empty trips to a minimum.

Imbalances in empty containers are seen as normal part of the business due to the kinds of imports and exports required by a particular area or to different directions taken by imports and exports goods from an area. Operators try to mitigate costs (for instance transporting empty containers on barges as to/from Basel) since they are concerned by knock-on effects such as extra charges for customers due to the need to move empty containers, unprofitable use of assets such as trains or terminal space.

Limits of terminal infrastructure. In Tyrol, Novara and Basel, discussing empty containers soon led to discussing terminal space. Terminals are set in areas where expansions are not feasible so space is precious. Lack of space to store empty containers requires trains to move them to and from out of the area in Tyrol. In the North West of Italy operators would need more space in terminals to handle overbooking (as their services are always fully booked) and space adjacent to terminals for ancillary activities. In Basel there are several terminals and depots, while this is seen as partly inefficient (due to limited size of some such terminals and the induced road traffic) the development of a new large tri-modal terminal able to cater for the traffic of the whole of Switzerland is seen as a threat by several operators.

Rail and road infrastructure and services. In Innsbruck, Novara and Basel, operators noted that the increasing need of infrastructure slots for passenger traffic and for freight traffic is an important issue also due to the lower priority attached to freight traffic. The increase in intermodal traffic on rail is also pushed by the decreasing numbers of drivers that are expected to reduce further as many will reach retirement soon and there are not enough younger drivers entering the profession. Italian operators underlined the need for action to overcome the limits of length and weight of trains currently imposed by the infrastructure and to harmonise operations across borders.

Power imbalance and leeway to work on empty containers. Both in Venice and in Basel operators underlined the decision power of maritime shipping lines that drive the choices made inland also by MTOs and forwarders. In Venice operators suggested that working from outside the

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market on empty containers could have unintended effects, perhaps also moving traffic away, which goes to underline the sensitivity of power balances in the intermodal trade. When discussing optimisation of logistic choices, operators in Basel also noted that they propose solutions to shippers, who make the final choice based very much on prices. These points seem to leave little room to work on empty containers.

Confidentiality. The one key issue equally stressed at all dialogue event is confidentiality of data, which also hampers collaboration. All operators are very careful not to disclose any data on traffic. This was clear also from the limited response obtained when collecting data for this study. The complete lack of replies for the Basel area was kindly but clearly confirmed during the dialogue event. Competition is fierce and data could reveal useful information to competitors. At one workshop it was suggested that in case subsidies were issued, there should be some data opening in return.

Collaboration. Confidentiality and strong competitive environments hamper the development of collaboration, the only type of measure for managing empty containers that was received with some interest at all dialogue events. Sharing containers is deemed impossible and sharing a depot for empty containers (as it would be useful in Tyrol) would have to overcome competition concerns among operators. Operators are aware of the benefits of collaboration but the competition is too strong and they prefer to consolidate their own markets. Similar points apply to IT platforms to share container availability: they are developed only by single large operators, not among them. Another type of collaboration suggested would be among shippers so as to influence logistics decisions by transport operators.

The **measures to deal with imbalances** requiring collaboration (virtual container yards, shared pools) were deemed interesting and promising but unfeasible. Triangulation was indicated as common in Veneto but having limited application in Basel. Homogenisation of containers used by combining journeys as well as transloading were deemed not possible, whereas operators were sceptical about foldable or compoundable containers.

It is worth noting that the dialogue events confirmed the diagrams and tables used to synthetize the steps in intermodal transport and the motivation and strength of actors in the value chains.

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7. Conclusions

Intermodal transport is the results of interaction among a large number of stakeholders, each with their own motivation for making choices that impact on trade in regions and on the unintended effects of trade, such as the movement and the storage of empty containers. Storage or repositioning of empty containers is an issue relevant at different geographical scopes and which many operators have a prime interest to minimise, in order to increase their profits. Such operators are especially maritime shipping lines, intermodal operators and freight forwarders. And, more directly than it may appears, shippers, since they are paying for the transport service. This is so since shippers will ultimately bear the costs of the movement and storage of empty units and therefore of the container imbalances. While this may be a limited issue in the vicinity of ports due to the limited distances that need to be covered by the transports of empty units and the short times required to supply the containers, trade in regions further away from ports may be negatively affected. Further to the effects on trade and manufacturing clusters there are the negative externalities due to the added traffic.

This report surveyed a number of possible actions to tackle, at least partially, container imbalances. Effects are partial since the most promising methods (marketing work/subsidies to balance flows, triangulation, virtual container yards) would deal with some issues possibly within the flows of single operators. A striking element is the fierce competition that, according to the discussions at the dialogue events, hampers the sharing of information and the development of collaborative actions. Another important point is the power position of shipping lines whose decisions have a scope that typically goes well beyond the single regions or port hinterlands affected by container imbalances. This may suggest that regional authorities and other interested stakeholders have limited room for action but, in fact, at least an experience recounted in the literature indicates that it is worthwhile to pursue discussions also with large multiregional or global stakeholders.

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Appendix with minutes from dialogue events

The present appendix report the minutes of the dialogue events held as reported in section 5 that also reports the key outputs.

Minutes of the Innsbruck dialogue event

Aim of the meeting was to discuss the interim research findings of the study that LINKS was carrying out for EUSALP with the key stake-holders of multimodal transport in Tyrol. The discussion started at 2 pm with a presentation of key figures and hypotheses on the state of the art and specific dynamics in the region.

In particular the participants were asked to provide feed-back and suggest courses of action regarding 3 main issues:

1. The current imbalance in freight flows and the resulting impact on traffic caused by an excess of empty containers;
2. Specificities and coping mechanisms of different logistic chains and networks (container and swap bodies);
3. Role and relevance of the different players in the logistic network.

Concerning the first issue, at national level, data show a general increase in flows (in line with European and global trends). In addition to that, regarding Austria export exceeds import in the relationship towards the majority of neighboring countries. The effect of these trends produce an increase in trips of vehicles travelling without any load (both containers and swap bodies).

The participants were therefore asked to explain if the issue is perceived as relevant from their perspective, if they put in place measures to overcome it and what actions could contribute to minimize the problem.

The following discussion allowed to highlight the subsequent topics:

- Concerning imbalances in flows, the main issue is the lack of a terminal for empty containers in the region. The existing terminal in Hall does not provide this service and it is difficult to find the right location for this kind of facility: it should be very well connected to both railway and motorway, be big enough to efficiently respond to the demand and far from settlements in order to avoid impacts on the population. It seems quite difficult to identify a solution embedding all 3 features. Depot terminals are currently in Salzburg, München and Wolfurt.
- With a new terminal it could be possible to allow triangulations that nowadays are hindered: Hall – München – Hamburg as well as Brenner - Bolzano/Trento – Padova. The nearest terminals in Italy are also quite far: the first available destination is Padova; Verona is working on increasing its available surface but at the moment is at the limits of its capacity.
- The existing terminals and connected services furthermore do not provide direct connections to European and world harbors: this limits the capacity and potential market of

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the whole regional system. There used to be a direct rail connection to Hamburg, but the company operating it significantly increased prices; the service became therefore not competitive and was subsequently cancelled.

- A way to reduce the existing gap in flows could be to increase commercial/trade relationship to other European and intercontinental regions. This would imply a marketing strategy at a regional level to promote the local productive system and establish new commercial partnerships. In order to allow this all regional actors and stakeholders should be able to work as a network, but this is a complex task due to the secrecy and conservative attitude of firms acting in the sector.

- At the moment the solution in view is a shuttle service taking empty containers to a depot in Salzburg; this should reduce impacts on traffic and contain the problem;

- The possibility of a partnership between local operators has also been discussed as a possible solution to optimize the management costs; a sharing platform able to show available containers and putting them on the market could be an efficient way to re-place them on the market before sending them to Salzburg. Nevertheless this would imply sharing critical and sensitive information among the different firms and the necessary trust and willingness have to be developed.

- The management of containers after usage is also a critical point: an independent and trusted third body should provide the necessary checkup on the state of the containers in order to certify their fitness to be re-used after each trip. This is a necessary condition that is now provided by each single operator and in order to be centralised it would require a challenging management shift.

- Time is another key issue: better efficiency could be achieved by reducing the steps required to re-use containers. The opening time of the terminal is also a critical issue: it would help if they could work on the 24 Hrs.

- The region is showing a general problem concerning the capacity of the transport system: the road network is on the limit of its capacity; the railway system is challenged: there is a need to increase the frequency for passenger routes and add high speed connections but this reduces the slots available for freight trains. The local government should work as an interface to create consensus on policies increasing the efficiency of the system: policies should focus on norms and funding as good tools to promote a modal shift and a better coordination between all players.

- A different strategy should be thought of for swap-bodies. Differently from containers they are not leased but belong directly to the operators. This means that firms are even more reluctant to share them and information regarding them.

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- Concerning the role of the different stakeholders, the participants suggested that shippers could play a much more relevant role. They act as micro entities while building partnership they could become an industry. Investments to optimise the system, also about terminals, are difficult for a single operator, but could become feasible for bigger players.

In general it seems that operators try to find solutions to the issues raised during the workshop with own measures and management resources. Resulting costs are not considered critical and do not threaten the operational capacity of the companies. They see chances for an upgrade and more efficient regional network but the costs and perceived risks connected to a new management system are hindering solutions that focus in this direction. Firms think the region should act in order to enable this process with regulations and incentives as the reduction of negative impacts and the increase of regional export are mostly an interest and concern of local authorities.

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Minutes of the Novara and West Lombardy dialogue event

The dialogue event concerning the area of east Piedmont and west Lombardy took place in Novara on 14 June 2019 and started at 10.30 am.

Participating stakeholders were asked to offer their views on:

- The possible issues with empty containers and swap bodies in the area
- The ways such issues are/can be managed
- The importance and strength of different stakeholders in this area

The operators in attendance indicated that the significance of empties at their terminals is negligible and noted that they deal with continental transport and that issues with empties may pertain more to maritime traffic than to continental one. One of them works on semitrailers and indicated there is no empty rail transport of semitrailers. Attendees specified that moving empties is too expensive and that their job is precisely to avoid that there are empties and make sure that ITUs (Intermodal Transport Units) moves are profitable. They prefer to wait for a load for the empties rather than moving them, even though storage space is limited.

The following pressing issues were discussed:

- the need for space to make intermodal operations easier and faster. More space next to the operational tracks is required (intended for loading/unloading of ITUs) to deal with overbooking.
- More areas for ancillary services such as weighting, cleaning, repair, are required and such areas should be immediately adjacent to the terminal. Ancillary operations need to be out of the terminals; the operators note: terminals must be dedicated to loading/unloading otherwise they would not be exploited to their full capacity. However, having ancillary services in areas away from the terminals ‑even at moderate distances- would not be suitable since they would imply additional movements of ITUs and trucks. This is also bad for the area itself. There is also the risk of having semitrailers with containers left waiting along the roads due to working hours finished.
- Rail is really competitive here and trains are always fully loaded because travelling through the rail terminals in this area allows to “jump” Switzerland, which is an issue for road transport also due to winter weather conditions and resulting crossing closures.
- Data of demand increases shown during the event are confirmed and operators expect higher demand as a result of the BRI (Belt and Road Initiative) and new maritime flows. In view of those, they reckon that the “Terzo Valico” new rail line across the Apennines to

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Genoa will be an important improvement in infrastructure available. They also note that with flow to/from Genoa and the BRI they will need additional space to manage the empties resulting from the maritime flows.

- the availability of infrastructure and its features. For instance in Busto Arsizio they experience the limits of the P386 intermodal gauge which is not the case for Novara. Future operations require the P400 intermodal gauge to be on the market.
- The need to align operating procedures and timetables. Domodossola is at the end of Swiss operations, precise in terms of arrival and departure times and providing for 2000 t trains. On Italian infrastructure to Busto Arsizio the maximum traction effort is 1400 t so trains need to be divided and put together. Additionally a change of locomotive requires up to 4-5 hours and a change of train staff requires up to 2 hours. Operators at the event argue for European wide alignment of procedures and rail infrastructure management.
- Sharing of container pools is deemed unfeasible by operators, both due to sharing rental costs and to confidentiality.
- Confidentiality is key: each operator wants to keep their traffic for themselves so there is little, if any, chance of sharing information and resources.
- Foldable containers are considered impractical. One operator attended a demonstration but thinks folding/unfolding requires too much time and resources.
- They have not seen or heard of compoundable containers in actual operation.

When asked about which could be a project supporting the optimisation of logistics involving PAs and operators, participants remarked the need to develop infrastructure. They find it difficult to interface with the rail infrastructure manager and would like that process to be easier. They consider that out of the 30 shunting tracks at Domodossola, half are out of use, and wonder how much better the working of the system would be if those were in operation too, given the surge in traffic they are experiencing.

Operators would welcome the idea of a project for the development of the infrastructure since that is the base of their work, and is managed by public entities. They would then develop logistics with their services.

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Minutes of the Veneto dialogue event

The dialogue event organised for the Veneto region to discuss container imbalances and the possible optimisation of logistics in the area started at 10.30 on 27 June 2019.

The attendees were asked to discuss the following three main items:

- The flows of containers in the region and the possible peculiarities of the area, recalling that Venice is the key regional port, Padua is a container terminal dedicated to maritime traffic whereas Verona is almost exclusively for continental traffic
- The maritime and continental container flows and the stakeholders involved, with their role and contracting position
- The possible actions to solve container imbalances

Attendees note that imbalances and empties are linked to maritime traffic, not to continental traffic. Also, they note that container imbalances may be due to seasonal variations and changes in excess containers may occur even on a weekly basis. Often container demand forecasts made by maritime shipping lines are wrong and the results is that the empty containers that have been sent to cover that forecast demand sit idle and occupy space.

Continental traffic refers mainly to Verona and the Brenner axis and is balanced. In the experience at Verona, turnaround times for containers are very short. Besides they have a bonus malus system whereby, if operators do not take containers away within 22 hours, they have to pay fees that increase with time. This to manage the space in the terminal, which is normally at capacity.

Attendees explain that trips of empties depend on who is transporting the containers: if a maritime line needs a container and does not have a depot where close to the loading point, they get it from the nearest terminals. Forwarders, instead, get empty maritime containers always directly from the port.

Items discussed included:

- Containers are owned by maritime shipping lines, that are very powerful compared to container terminals since they own the traffic. Maritime shipping lines have the upper hand in this business.
- Prices for container services in the area are very low due to tough competition among operators and lack of collaboration. For instance, repair services are less than half the price than in Central Europe, which puts local businesses at risk. If operators were able to form an alliance their prices could be more sustainable.

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- Also prices for empty storage are very low due to high competition. In fact, it is not always necessary to make operators pay for the storage of empties. If the empties have a short turnaround time they generate traffic and revenue for the terminal. If the turnaround times are uncertain and typically long (say a month), empties are a burden. It is a matter of managing the relationship with the maritime shipping line.
- Maritime shipping companies have a clear view of where their containers are, whether they are at their clients, in transport, in storage. They get updates every two hours.
- On the other hand there are cases of empty maritime containers left in storage for years and terminals buying and re-selling them in order to remove them and get back the space they take.
- Maritime shipping companies have no intention of sharing data with competitors since the competition is too harsh. A participant recalls a case of a company acquiring another one and the two container pools remained separate.
- Movement of empties on trains in this area is not economically sustainable: distances are too short to have intermodal transport of empties. Besides, with the increasing share of 40' (as compared to the share of 20'), empty containers would require a lot of space on trains and there is generally a shortage of train paths. Even if empties movements were on longer distances (longer than the 150-200 km in this area) the limited length that trains may have in Italy at present compared to other Countries, suggests against transporting unprofitable empties by train.

Discussing stakeholders, attendees stressed the power of maritime companies and the fact that MTOs act on their instructions. In fact, the power of maritime shipping companies is perceived as a problem since they end up not paying for parking empties and move them when and where they want with no other stakeholder able to have a say.

Discussing a possible project to follow up from the meeting, operators stress that sharing data is impossible, as no operator wants it. It is noted that in the US samples of data on publicly subsidised air trips are available (such samples are significant in statistical terms); the competition is tough also in US air transport but the subsidies come with the obligation to open part of the data publicly. In maritime traffic concerning Italy, instead, there are always provisions for absolute data confidentiality. During the discussion it is suggested that data regulation for Europe should mimic what already in place in Asia.

Some notes on the methods to solve imbalances of containers suggested in the slide deck:

- Attempting to homogenise containers used is seen as unfeasible since containers are different for import and export and for maritime and continental flows.

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- Using containers instead of swap-bodies (or the other way around) is deemed unfeasible since swap-bodies are payed by the day whereas containers are paid by journey.
- Operators shared sceptical views about foldable containers and prefer rigid boxes.

Some operators noted that the idea of working on empty containers in a way that is not in line with the strategies of the maritime shippers may be cause unintended effects, since the issue is difficult to gauge and there is a risk that traffic is then taken somewhere else.

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Minutes of the Basel and Freiburg dialogue event

The meeting was organized by LINKS as part of the study for EUSALP to discuss research findings with the key stakeholders of multimodal transport in the region comprising the city of Basel and the Freiburg area. The discussion started at 10 am with a presentation of key figures and hypotheses on the state of the art and specific dynamics in the region.

In particular the participants were asked to provide feedbacks and suggest courses of action regarding 3 main issues:

1. The current imbalance in freight flows and the resulting impact on traffic caused by an excess or lack of empty containers;
2. Role and relevance of the different players in the logistics network;
3. Feasibility of a list of the technical solutions identified as means to reduce impacts generated by flows of empty containers.

At continental level, data show a unceasing increase in flows (in line with global trends). In addition to that, regarding the region of Basel import significantly exceeds export in the relationship towards the majority of neighboring countries. As a result, in the area there are several vehicle trips without any load (mostly containers).

The participants were therefore asked to explain if the issue is perceived as relevant from their perspective and if they put in place measures to overcome deriving impacts (time, costs of transport and management, acceptance by regions affected by heavy traffic). In particular the focus of the discussion has been on which actions and means could be implemented to minimise the problem.

During the discussion it was possible to investigate in depth the following topics:

- In the participants' view current unbalances are due to three main related causes:
  - Differences in import/export flows: historically the region shows a limited export capacity also connected to the size and numbers of the Swiss productive clusters. The region hosts world leader companies, but export numbers are not able to compensate the incoming flows.
  - Differences in type of vectors demanded by local operators/costomers and those required by long-distance/maritime operators;

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- Differences in size and specialization between big maritime operators and fragmented and small-scale regional shippers, forwarders, etc.

- In particular, different routes are usually used for import and export, which also means different operators:
  - Rotterdam is usually the gateway of import flows and from there a tailored organization of continental trips (trimodal) is managed by the operators; this is because Rotterdam is most often the first port of call for ocean containerships arriving in northern Europe;
  - Antwerp, in most cases, is the port terminal for export flows and the final destination of continental traffic (mostly by truck or railway); this is because Antwerp is most often the last port of call for ocean containerships departing from northern Europe;
  - The port of Hamburg works mainly with east European inland routes.

- Customers usually decide which combination of means they want and which route they prefer (with the aim of minimising costs). Operators can suggest solutions, but they mostly plan accordingly to the customer requests. In general, clients are not willing to pay for trips of empty containers, therefore operators are motivated to reduce those kinds of trips to a minimum.

Typically, when there is enough demand, empty containers are brought in the region from maritime ports using barges and then, once used, taken back via road.

Participants were also asked to comment the map of the region including all existing terminals, provide estimates of throughput data, and rank them according to their importance:

- As a general attitude, operators do not wish to share data on throughput produced in their terminal. As most important terminals in terms of traffic and TEUs they mentioned:
  - Wail am Rhein DUSS (maritime traffic)
  - Wolf (maritime and inland traffic)
  - Frenkendorf (maritime traffic)
- They also added two input to the list of regional terminals:
  - Weil am Rhein (30 km north of Basel) it is relevant as access to the Rhein inland water network;

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- Niederglatt (in the Zurich area) serves the eastern part of Switzerland.

Concerning the issue of logistics induced traffic, spatial development and relationship with local authorities and citizens:

- The issue of empty containers and freight routes in general is often debated in Switzerland and in the Region: there are no big terminals, but a landscape of small terminals connected mostly via road, which means motorway congestion and impacts on settlements and inhabitants.
- Shipping lines are the ones who should deal with the issue. They own the containers and do not allow them to be shared among the operators.
- Shipping companies could also be important because they could use their strength and power to play a political role and advocate for an improvement of the overall efficiency of the logistic chain. At the moment they do not seem interested in the potential benefits and aim just at consolidating their role against the competitors.
- The competition between operators is a key issue: companies do not share information; they do not share boxes, containers, means, etc.; they fear the realization of new terminals, routes, services because any variation is potentially dangerous for their market share.
- The custom system is also relevant: procedures and taxation can affect the efficiency and smartness of the logistic cluster.

Regarding the possible strategies and solutions to be implement in order to optimize multimodal transport, the participants provided the following feedbacks:

- Triangulation is less feasible than it might seem: less the 5% of the containers are immediately re-used after unloading;
- In the Basel Region there are approximately 250 forwarders: they mostly provide services according to the customers' request. Few customers are able to organize shipments so that each trip is fully loaded. Most of them do not have the capacity to manage their route planning so that no empty containers need to be moved from one terminal to another.
- The realization of regional hub and depot could be a turning point. Nevertheless the project of a new terminal in Basel North is opposed by several operators. It is feared to be a perturbing factor in the regional and interregional logistic system. At is full capacity (implementation phase 3) Basel North should be able to host a traffic of about 320/350.000 TEUs per year, which is the actual traffic for the entire Country. Local players fear the

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impact of such a big competitor and also the EU expressed some concerns in terms of regional balance. Nevertheless, a high-capacity hub could be a crucial resource for the region, it would relieve other terminals and allow trains longer than 600 m to be assembled and circulate on the Swiss network.

- Foldable containers do not provide the needed reliability and are too expensive: they need expert workers to be folded and unfolded; they are not water resistant; they are not sturdy enough; they are not easily trackable. It is possible that some operator risks using them, but it is unlikely that they become mainstream.
- There is a company (Montan) which operates its own stackable containers between Austria and Turkey.
- It is very difficult to think of a regional strategy balancing the present imbalances by increasing export in other sectors. Basel is a powerful pharmaceutical cluster which needs to send light, voluminous, high added-value products. In order to balance this, the entire economy of the region would need to change, which seems unlikely. It is instead possible to think of some operators providing new services to optimise containers routes by collecting and moving them according to real-time requests of customers. This would however mean collaboration, agreements and knowledge sharing between maritime companies and forwarders.

A specific trait of the Basel-Freiburg regions seems to be the competition among a constellation of small operators, which highly depend on and operate according to policies directed by big shipping companies. This makes it extremely difficult to devise measures able to produce systemic change. The pressure put by the Swiss Federal Government and regional authorities on minimizing impacts does not seem to produce relevant change in consolidated practices. Nevertheless the realization of new regional hubs and the test of new services seem to slowly point in the direction of a different attitude and awareness on unexploited potential to be further explored.

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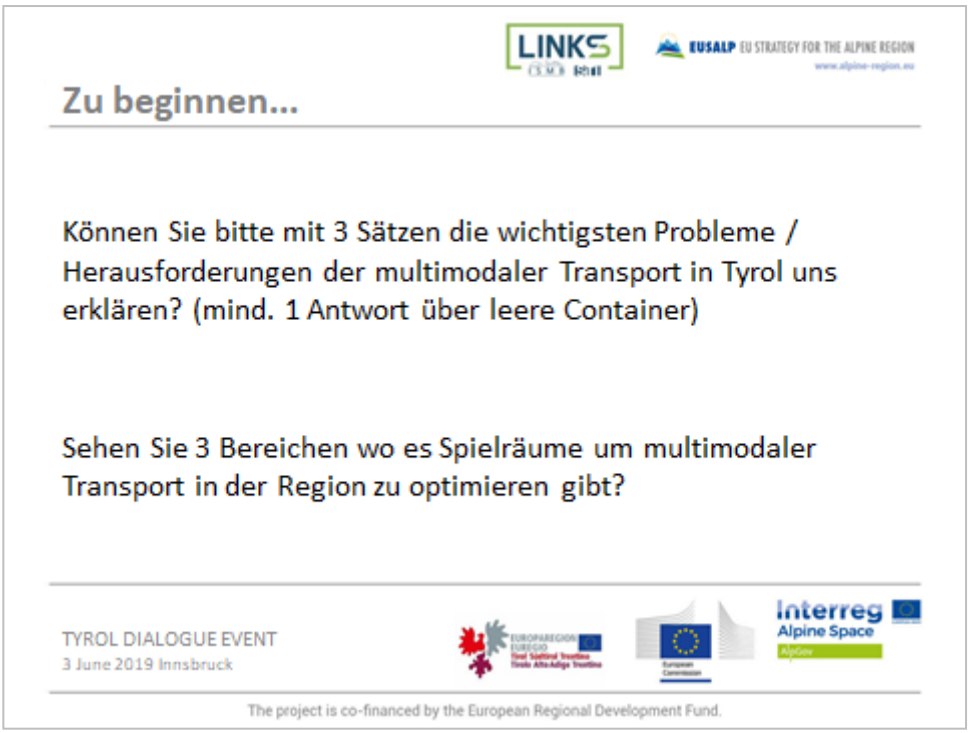
Presentation delivered at the Innsbruck dialogue event



Inhalt

- Was wir vom heutigen Treffen erwarten

- Die Studie
- Intermodal / Containerströme, Hall in Tirol

- Ströme von leeren Container
- Maritime und kontinentale Containertransportketten

- Wie kommen leere Container wieder in den Warentransport?

- Was wäre die ideale Situation?
- Wer kann handeln und warum?
- Lösung zur unausgeglichene Containerströme

TYROL DIALOGUE EVENT
3 June 2019 Innsbruck

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Was wir vom heutigen Treffen erwarten

Dieser Workshop ist Teil einer Studie zur Optimierung von Logistik und Lieferketten in der EUSALP-Region

Wir suchen nach zwei Hauptergebnissen:

- ein gutes Verständnis der Logistik von Containerwaren in Tirol

- Ein gutes Verständnis darüber, wer und wie handeln könnte, um:
  - Lieferketten verbessern
  - Probleme mit Ungleichgewichten bei leeren Behältern lösen

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The study

EUSALP wies das Problem der Ungleichgewichte in Containerströme aus → Mangel / Überschuss an leeren Container

LINKS wurde von EUSALP beauftragt, die Angelegenheit zu untersuchen und praktische Lösungen und Hinweise für die Entwicklung eines Projekts vorzuschlagen

Studienziele

- eine Auswahl von Standorten in der EUSALP-Region zu untersuchen;
- wo Probleme mit leeren Containern bestehen und deren Relevanz zu verstehen,
- gebrauchte Lösungen sammeln, zusätzliche Praktiken vorschlagen und diese in Workshops mit Stakeholdern validieren
- weitere Maßnahmen zur Optimierung der Logistik vorschlagen, insbesondere in Bezug auf das Leercontainermanagement

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Untersuchungsgebiete

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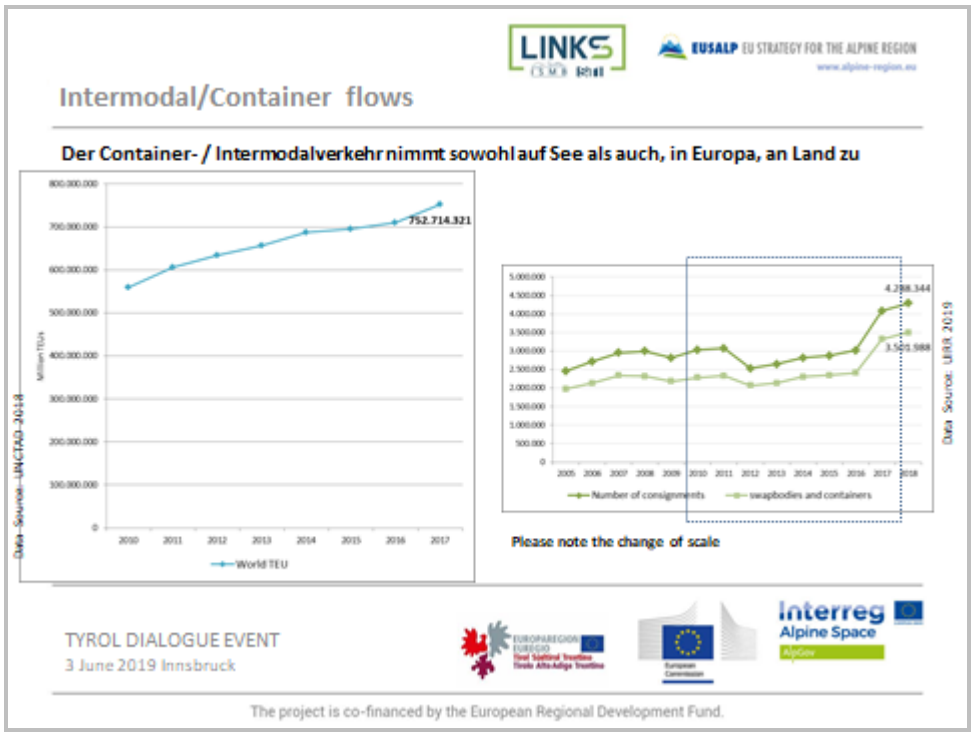
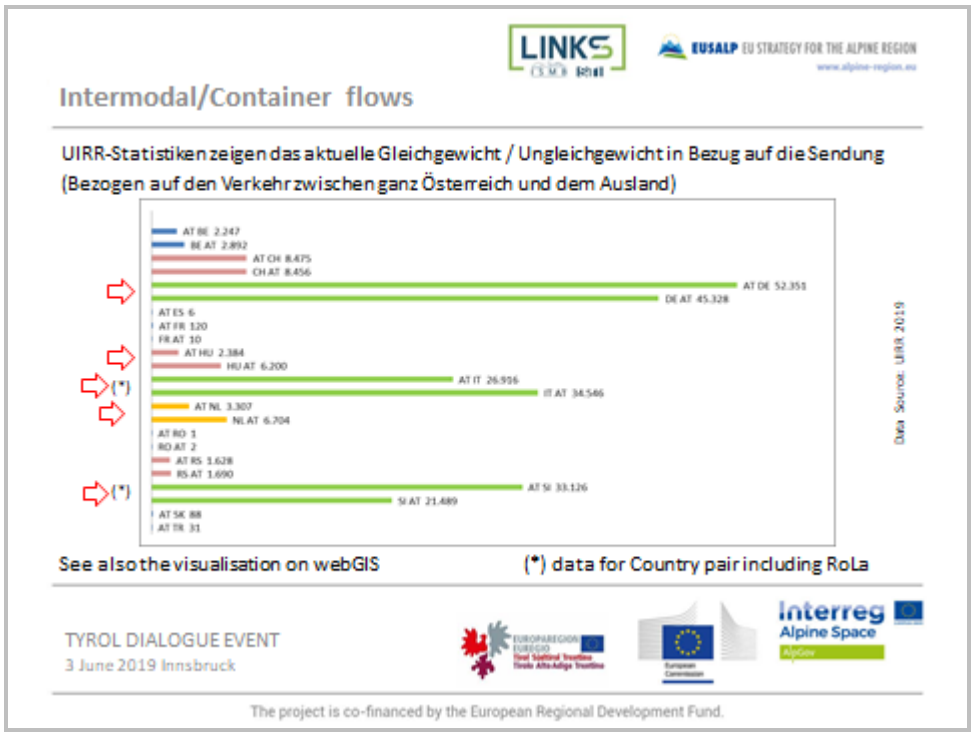


Trade lane	TEU			Tonnes		
	2015	2017	change	2015	2017	change
Germany - Italy	1.488.080	1.553.328	4.4%	19.501.043	19.915.267	2.1%
Czech Republic - Germany	693.702	756.729	14.7%	6.000.182	7.640.439	27.5%
Belgium - Italy	580.173	714.694	23.2%	7.401.498	9.156.448	23.7%
Germany - Netherlands	667.378	581.379	-12.9%	6.215.813	6.686.219	7.6%
Italy - Netherlands	288.632	468.025	58.7%	3.394.024	6.118.486	80.3%
Austria - Germany	**268.860**	**358.729**	**33.4%**	**3.603.502**	**3.896.851**	**8.1%**
Slovakia - Slovenia	258.921	339.922	23.6%	1.887.370	2.552.178	35.2%
Germany - Sweden	193.878	256.746	32.4%	2.067.542	2.813.600	36.1%
France - Italy	194.123	247.682	27.6%	2.371.238	3.293.281	37.5%
Hungary - Slovenia	179.215	217.777	21.5%	1.597.440	2.122.831	32.9%
Germany - Spain	174.383	214.290	22.9%	2.312.509	2.567.637	11.0%
Germany - Hungary	241.296	209.436	-13.2%	2.322.884	2.321.643	-0.1%
France - Luxemburg	178.766	205.087	14.7%	2.281.597	3.127.385	37.1%
Germany - Switzerland	148.188	168.742	13.9%	1.871.791	1.662.626	-11.2%
Germany - Poland	160.475	161.026	0.3%	1.274.739	1.284.398	0.8%
Belgium - France	131.878	152.626	15.7%	1.128.225	1.299.600	15.2%
Belgium - Spain	104.198	143.817	38.0%	1.432.094	1.891.514	32.1%
Austria - Italy	**31.088**	**136.509**	**>100%**	**327.574**	**1.568.315**	**>100%**
Czech Republic - Netherlands	80.865	116.105	43.6%	481.528	802.261	66.6%
Russia - Slovakia	58.984	102.000	73.1%	210.543	681.465	>100%


LINKS
EUSALP EU STRATEGY FOR THE ALPINE REGION
Intermodal/Container flows
UIRR-Statistiken zeigen das aktuelle Gleichgewicht / Ungleichgewicht in Bezug auf die Sendung
(Bezogen auf den Verkehr zwischen ganz Österreich und dem Ausland)
AT BE 2.247
BE AT 2.892
AT CH 8.475
CH AT 8.456
AT DE 52.351
DE AT 45.328
AT ES 6
AT FR 120
FR AT 10
AT HU 2.384
HU AT 6.200
AT IT 26.916
IT AT 34.546
AT NL 3.307
NL AT 6.704
AT RO 1
RO AT 2
AT RS 1.628
RS AT 1.690
AT SI 33.126
SI AT 21.489
AT SK 88
AT TR 31
(*)
(*)
Data Source: UIRR 2019
See also the visualisation on webGIS
(*) data for Country pair including RoLa
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3 June 2019 Innsbruck
Interreg Alpine Space
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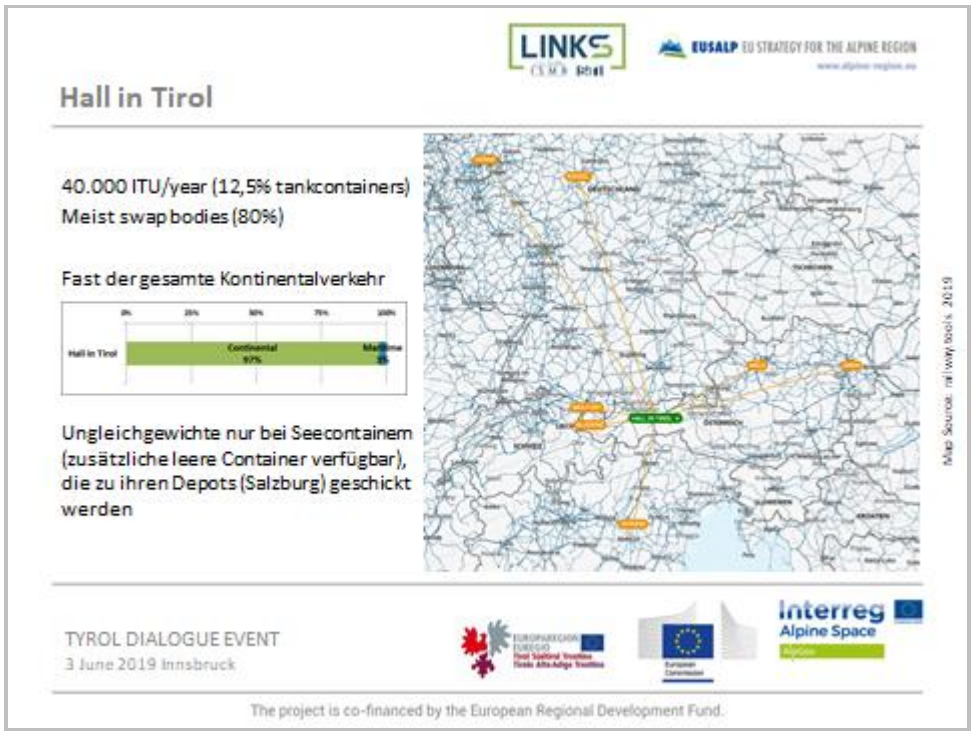
LINKS
EUSALP EU STRATEGY FOR THE ALPINE REGION
Hall in Tirol
40.000 ITU/year (12,5% tankcontainers)
Meist swap bodies (80%)
Fast der gesamte Kontinentalverkehr
Hall in Tirol
Continental
97%
Maritime
3%
Ungleichgewichte nur bei Seecontainern (zusätzliche leere Container verfügbar), die zu ihren Depots (Salzburg) geschickt werden
Map Source: railway tools 2019
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Ströme von leeren Containern

- Der kombinierte Transport / Containertransport ist für den Transport beladener Container bestimmt
- Leercontainerbewegungen sind jedoch ein normaler Teil des Geschäfts, der Kosten mit sich bringt, die letztendlich von Versendern getragen werden
- 24% der Seecontainerbewegung im Jahr 2016 waren leer (UNCTAD)

- Es ist im Interesse der Verkehrsgesellschaft Leercontainertransport zu optimieren, aber vielleicht ist dies nicht lokal getan
- Aus öffentlicher Sicht sind Leercontainerbewegungen von Belang, wenn sie nicht lokal optimiert sind (z. B. zusätzlicher Verkehr, Lärm, Umweltverschmutzung, aber auch Chancen für Verlader).

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Die Containertransportketten

- **Maritime Containertransportkette**
- **Continental-Containertransportkette**

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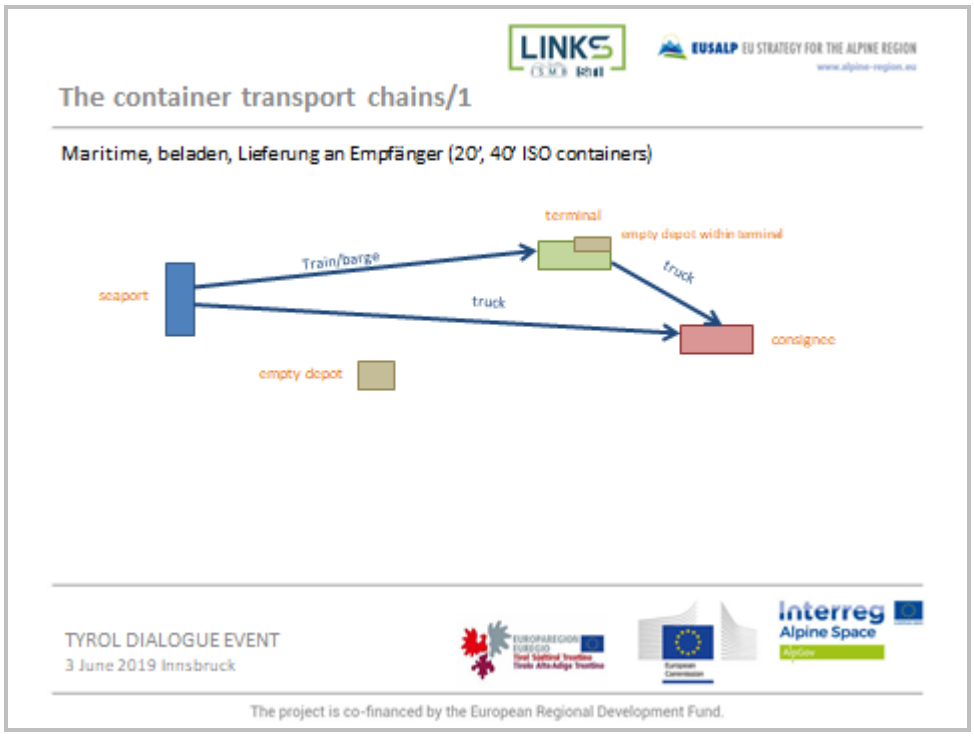
LINKS
EUSALP EU STRATEGY FOR THE ALPINE REGION
The container transport chains/1
Maritime, beladen, Lieferung an Empfänger (20', 40' ISO containers)
terminal
empty depot within terminal
Train/barge
truck
seaport
truck
consignee
empty depot
TYROL DIALOGUE EVENT
3 June 2019 Innsbruck
Interreg Alpine Space
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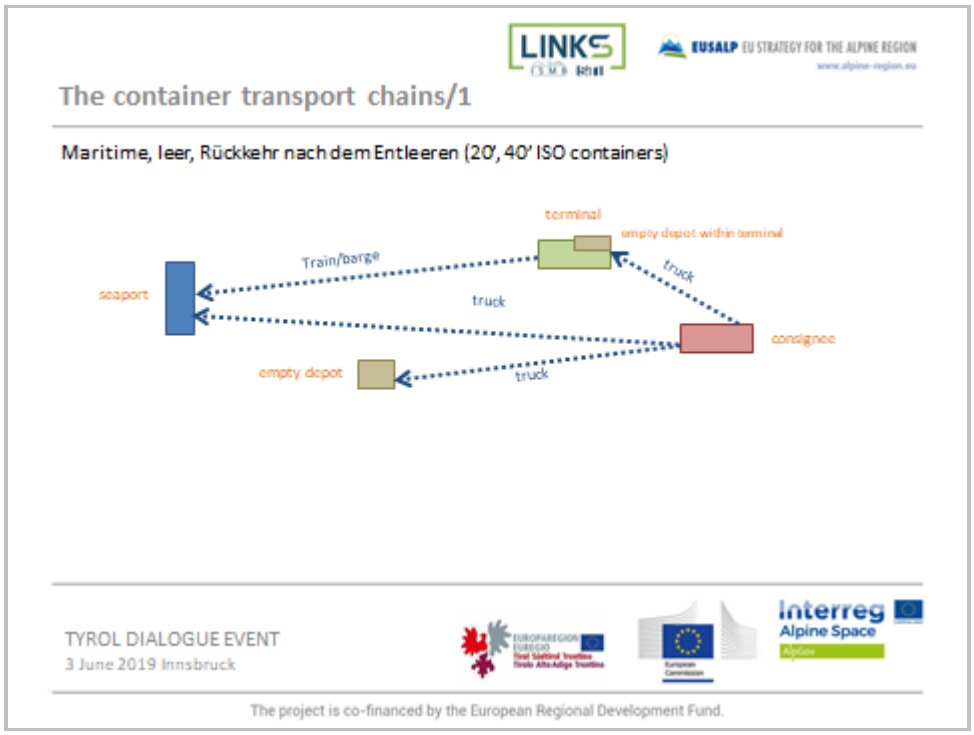
LINKS
EUSALP EU STRATEGY FOR THE ALPINE REGION
The container transport chains/1
Maritime, leer, Rückkehr nach dem Entleeren (20', 40' ISO containers)
terminal
empty depot within terminal
Train/barge
truck
seaport
truck
consignee
empty depot
truck
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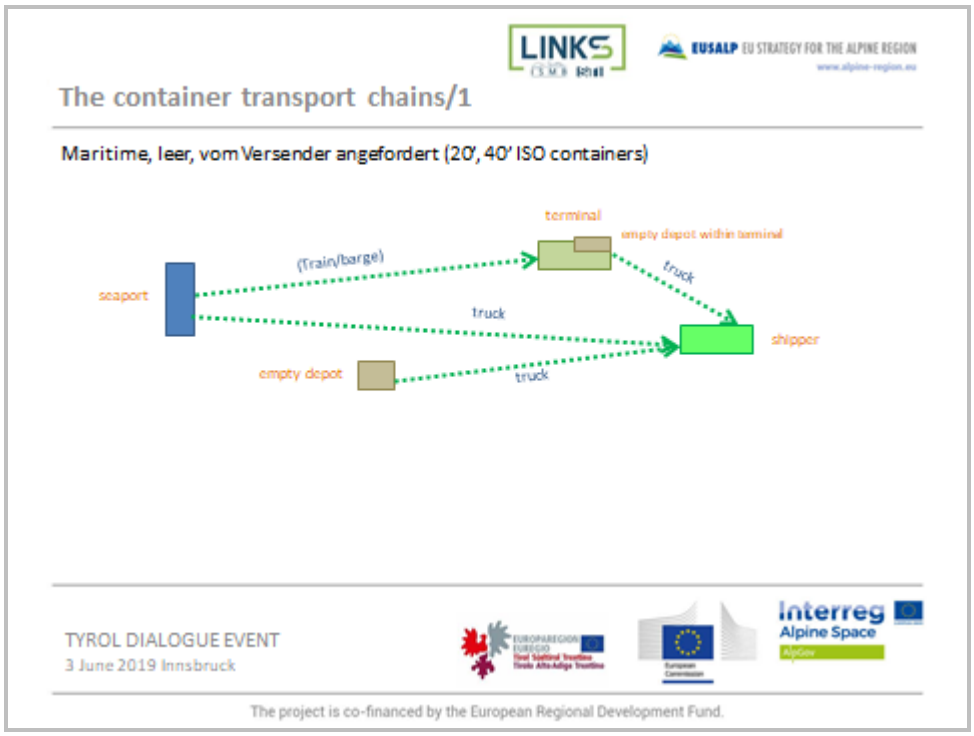
LINKS
EUSALP EU STRATEGY FOR THE ALPINE REGION
The container transport chains/1
Maritime, leer, vom Versender angefordert (20', 40' ISO containers)
terminal
empty depot within terminal
(Train/barge)
truck
seaport
truck
shipper
empty depot
truck
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3 June 2019 Innsbruck
Interreg
Alpine Space
AlpGov
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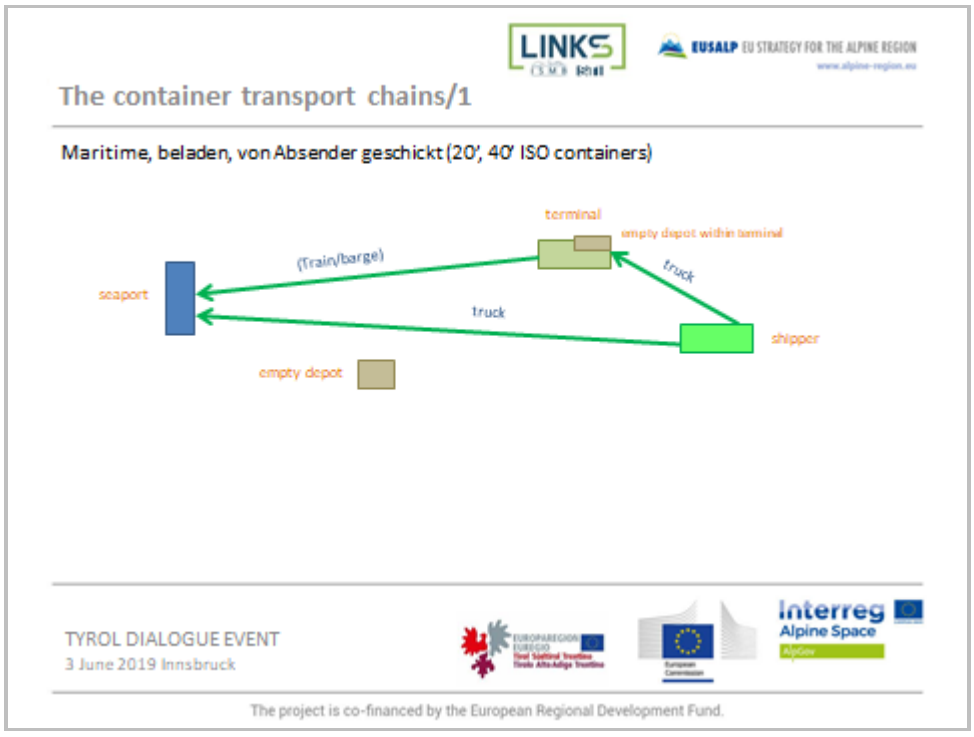
LINKS
EUSALP EU STRATEGY FOR THE ALPINE REGION
The container transport chains/1
Maritime, beladen, von Absender geschickt (20', 40' ISO containers)
terminal
empty depot within terminal
(Train/barge)
truck
seaport
truck
shipper
empty depot
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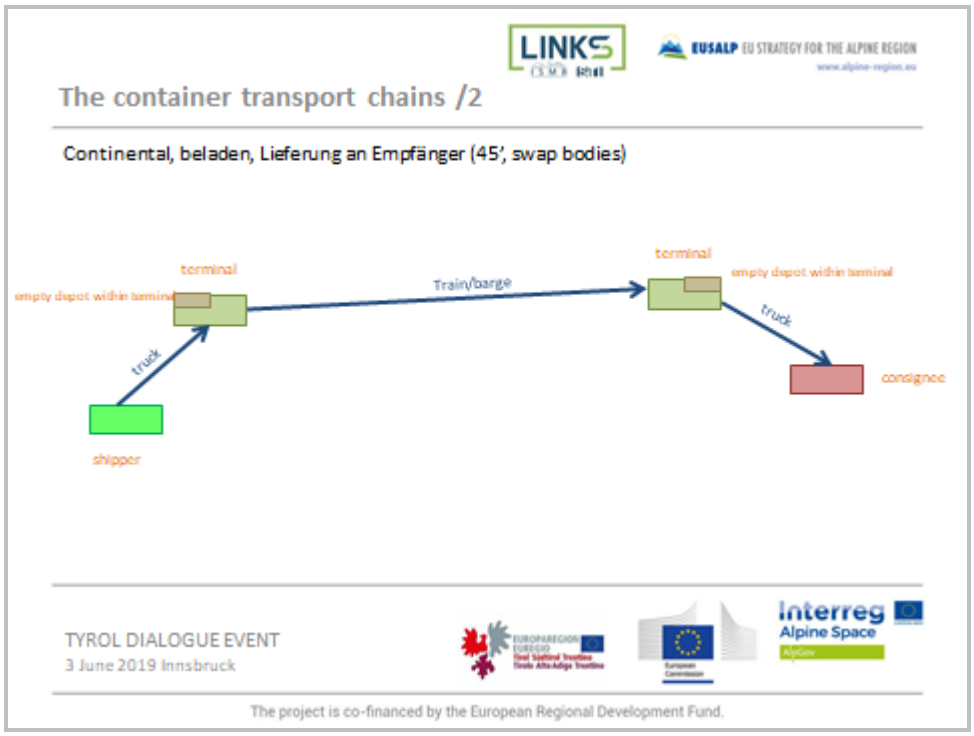
LINKS
EUSALP EU STRATEGY FOR THE ALPINE REGION
The container transport chains /2
Continental, beladen, Lieferung an Empfänger (45', swap bodies)
terminal
empty depot within terminal
Train/barge
terminal
empty depot within terminal
truck
truck
consignee
shipper
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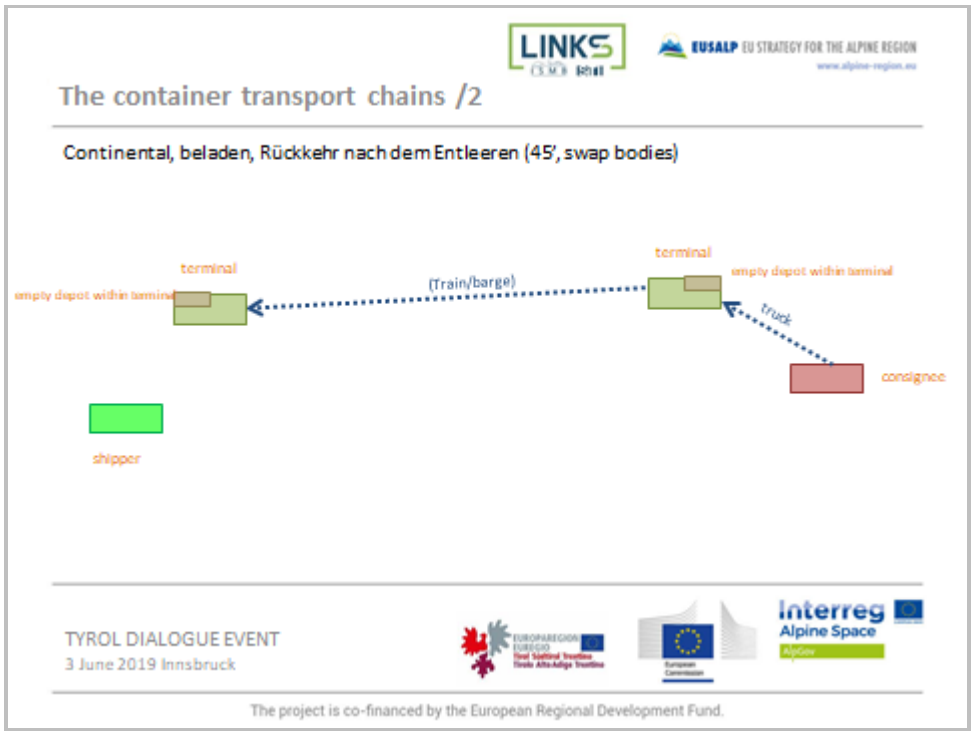
LINKS
EUSALP EU STRATEGY FOR THE ALPINE REGION
The container transport chains /2
Continental, beladen, Rückkehr nach dem Entleeren (45', swap bodies)
terminal
empty depot within terminal
(Train/barge)
terminal
empty depot within terminal
truck
consignee
shipper
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The container transport chains /2

Continental, leer, vom Versender angefordert (45', swap bodies)

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Wie kommen leere Container wieder in den Warentransport?

Nach dem Entleeren können die Container:

- vom Versender direkt für den Versand von Waren wiederverwendet werden (selten)
- Die Container können direkt zum nächsten Versender befördert werden (Triangulation) (Kontinental- und Seecontainer, aber wie sieht es mit der Inspektion und der Genehmigung der Wiederverwendbarkeit aus?)
- zu einem Terminal mit speziellem Bereich / Freiraum für leere Container (Kontinental- und Seecontainer) gebracht werden. Oftmals weisen Terminals Reedereien / MTOs, die leere Container zurückgeben / abholen, freien Platz oder eine Reihe von Parkplätzen zu.
- zu einem Depot für Leergut gehen (Seecontainer)
- in einen Hafen zurückkehren (Seecontainer)

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Was wäre die ideale Situation?

- Ausgewogenheit der Container nach Typ innerhalb einer Region / eines Fertigungsclusters
- Keine oder reduzierte LKW- oder Zugfahrten für den Transport leerer Container in / aus einer Region / einem Fertigungscluster
- Sofortige Verfügbarkeit des richtigen Containers

Die ideale Situation für wen und warum? ....

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Wer kann handeln und warum?

Stake-holder	Maritime shipping lines	Container leasing comp.	MTO	Intermodal operator	Road transp operator	Terminal	Empty depot	Shippers	PA
Aims for	Max usage of ships esp on routes with high rates	Max usage rate of containers (empty or full)	Cost, reliability, time of solution	Fully laden trains		Max traffic (crane moves) with min stay of containers	Use of depot and added value services (repairs)	Ready availability of transport solutions	Favourable economic situation Reduced env.impact (traffic, noise, accidents, landscape)
Strength of role regarding container flows	●●●●	●	●●●●	●●		●		●	●●
How can they act	Repositioning decisions, location of depots, collab. ITS	?	Commercial activity	Commercial activity, collaboration, ITS	?	Tariffs for container stay	?	Collaboration/grouping	Subsidies, regulation

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Lösungen für Container Ungleichgewichte

Nach der technischen Literatur sind die folgenden möglichen Lösungen für Containersungleichgewichte

Lösung / Aktion
Containertransport in der entgegengesetzten Richtung, der vor fehlenden Containern warnt, erhöhen
Verkürzung der Zeit und der Schritte zwischen den Containernutzungen (street-turning/triangulation)
Graue Kästen / gemeinsame Pools
Virtual container yards
Homogenisierung von gebrauchten Containern / Fahrtenkombinationen
Subventionen (für Dienstleistungen zur Lieferung von Containern / zum Umladen)
Umladen
Faltbare containers
Compoundierbare containers

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The project is co-financed by the European Regional Development Fund.

Vielen Dank für Ihre Teilnahme und Ihre Beiträge. Die endgültigen Ergebnisse dieser Arbeit werden auf der EUSALP-Website veröffentlicht

ILARIA TOSONI, ANDREA ROSA
LINKS FOUNDATION

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