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ESTABLISHING AN EFFICIENT OUTBOUND OVERSEAS LOGISTICS CHAIN OF SMALL CONSIGNMENTS: THE PERSPECTIVE OF EASTERN ADRIATIC REGION

Summary. The article deals with the problem of the appropriate transport mode choice in establishing efficient export overseas container groupage lines. The focus is on understanding the present transport network setup in the region of the Eastern Adriatic, which should enable cost- and time-efficient operation of LCL (Less than Container Load) services. The survey among LCL operators, NVOCC (Non-Vessel Operating Common Carriers) operators and forwarding companies provides a comprehensive overview of the possibility of introducing new LCL lines through the ports of the Eastern Adriatic coast. The study exposes the barriers LCL operators face in maintaining efficient overseas LCL export services, especially in the initial stage when starting with new lines. Initial low volume of small consignments should be transported by LTL (Less than Truck Load) in pre-carriage transport; thus, the research analyses actual modal split choices and eventual limitations from price and time perspectives. The study brings novelty in the understanding of the actual organisation of transport chains regionally and the bases for transport community decisions for future efficient establishment of new LCL lines.

1. INTRODUCTION

The development of multimodality is a key part of European transport policy. The goal is to shift cargo to the railways, where container transport certainly plays an important role. Containers are not intended just for the transport of consignments of one shipper that fills the entire container but also for smaller and lighter shipments of different shippers and consignees of goods. An LCL product (Less Than Container Load) uses 20', 40', 40' HC or even 45' containers, where shipments from various shippers are consolidated into a selected container. At the same time, the consignments are for different receivers; thus, a de-consolidation process is needed at the final destination. From an economic point of view, it is better to use the largest container, which allows economies of scale and lowers the cost of transport-logistics operations per individual consignment. It reduces the cost by volume and the weight of the shipment.

At the same time, LCL operators face many challenges that pose important limitations for the efficient operation of such intermodal chains. It is necessary to completely fill up the entire cargo area of the selected container, pay attention to the weight limit of the container, fill the container as close as possible to the cargo location, reduce the number of cargo handlings in the transport chain, etc. [1]. LCL operators need to define an LCL hub point, which represents a key hub terminal or warehouse for different import and export lines. Such a consolidation or deconsolidation point accepts the import or export flow of full containers and organizes an import or export distribution flow of each LCL shipment. Selecting the location of the warehouse is no longer a long-term decision as it used to be;

now the locations are adapted to the flows of goods, the volume of cargo and the total costs within the logistics chain [2].

Differences between the import and export flows of small container shipments result in disproportion, which complicates the optimal operation of LCL services in a particular regional environment. This often affects the various operational and tactical decisions of LCL operators, who need to look for optimal solutions for cargo owners and their LCL network operation [3]. Particularly important are modal split decisions that are based on an efficient combination of various transport processes, from both a cost and time perspective.

In the segment of LCL transport operations, the Eastern Adriatic region is predominantly import oriented. Import ports such as Koper, Rijeka, and Trieste, through which the markets of South-Eastern Europe and central Europe are supplied, are used. The export flow of LCL shipments is of lesser scope, which also makes use of other export ports that are hundreds or thousands of kilometres away from the origin of the LCL shipment. In such cases, it is necessary to establish effective road connections of full trucks (FTL – full truck load, where the entire truck is ordered only by one shipper) or land groupage lines (LTL – less than a truck load, where different shipments are loaded that are sent by different shippers to different consignees) with consolidation warehouses and loading ports (POL). The LTL and FTL lines are mostly oriented towards western European markets; therefore, LCL transport faces various restrictions that inhibit the faster growth of direct LCL lines across the Eastern Adriatic ports. Another important factor is the fragmentation of orders that travel through separate transport routes to the POL. This increases the cost burden of the individual shipment, which hinders the faster development of the product regionally.

The survey of LCL transport products in the Eastern Adriatic region is focused on the export or outbound services and is based on two hypotheses:

- H1: LCL operators face barriers in efficient overseas export service for LCL shipments in the initial stage of starting new lines.
- H2: modal split choices offer different possibilities in organizing outbound LCL services, from time and cost perspectives.

The research contributes to the understanding of the widgets that influence the speed and efficiency of the creation of new transport chains based on LCL transports and sets an improved basis for effective combination of different land transport modes with overseas transport. The key elements of proper decision making are cargo volumes and pricing policy. This study especially highlights a cost/price element in combining different transport services at the stage of setting up a new LCL line and at the stage of regular operation of the LCL line, with at least weekly departure for a particular port of discharge (POD).

2. BASIC CHARACTERISTICS OF LCL TRANSPORT EXPOSED BY RESEARCH STUDIES

The field of intermodal transport and modal split choices is the subject of extensive international research. LCL transport is an integral part of efficient intermodal transport. The efficiency of this transport process is based on the regular shipment of small consignments, the fulfilling of the cargo space and the transport of the whole container as close to the shippers and consignees of the goods as possible. Creazza et al. [4] point out that well-organized LCL transport plays an important role in the setting up of new logistics networks. Acciaro and Mckinon [5] stated that the need for LCL transport is greater in economies with higher demand and production. Namely, LCL transport supports the diversification of various products on the market. Thus, in advanced economies, freight forwarders and NVOCC (Non-Vessel Operating Common Carriers) operators are more likely to decide to establish their own LCL lines [6].

Onwuegbuchunam et al. [7] highlight the importance of economies of scale in the operation of LCL lines, with many freight forwarders and logistics companies outsourcing this service. Furthermore, Notteboom and Merckx [8] point out that the field of LCL development is interesting even for container shipping companies. Their goal is to control specific cargo and to follow key customers'

development by offering a comprehensive range of transport services. In the research of the shipping agency market in Slovenia, it was acknowledged that shipping agents also offer LCL services [9]. Caiazza, Volpe and Stanton [3] determine that LCL operators need to manage complex services based on market knowledge, cargo flows, cargo characteristics of smaller shipments, the operation of consolidation warehouses and possibilities of appropriate modal split decisions. Especially important is the proper planning in combining different loads with respect to volume and weight, the final delivery point and time frames of delivery, the possibility of stacking consignments with one another, etc. [1].

From the cost perspective, Bergqvist [10] highlights the importance of the location of LCL storage sites, whereas Zhang et al. [11] display the importance of land transport implementation. Bergqvist [10] emphasizes the need to set up consolidation points outside the city centre to ensure cost efficiency and lower costs of the entire transport chain. For transport costs, Zhang et al. [11] warn that container transport to hinterland destinations is affected by additional costs that arise due to container drop-off charges or empty return to POD. Consequently, the entire transport route requires dynamic planning and optimization. Kadlubek [12] highlights the importance of efficient land transport in the operation of LCL transport, as consolidation points in ports are increasingly overburdened due to rising container throughput and growing ships.

The development of digitization in logistics plays an important role in efficient coordination among different subjects in transport chains. Altuntas and Kurgun [13] analyse the most important areas where information systems can increase LCL transport performance. They offer virtual support as an information platform where more LCL providers offer service, space, price and transit time. Shippers, however, can choose the most suitable solution through one stop-shop points. Such a solution has multi-level positive effects, such as load balancing between LCL operators, a better bargaining position to shippers and an optimized LCL line. Undoubtedly, data sharing within the chain can support LCL line start-up process by cost analysis and optimisation as well as monitoring efficiency in ongoing services.

3. DEVELOPING LCL TRANSPORT NETWORKS

The development of LCL transport networks is a complex process that includes the activities of selection of consolidation warehouses, appropriate land connections for picking up small shipments in a particular region and container lines on demand-driven routes. It is very important to establish an appropriate cost model that defines tariff policy. LCL rates are most often formed at a uniformly modelled price throughout the entire transport route, expressed in terms of price per tonne or m³ of cargo (weight or measurement - w/m). The aim should be to use the loading space of actual land links that already have basic cargo to operate the lines and subsequently establish the land transport of full containers directly from the consolidation hub warehouse (CWH) to the POL.

3.1. Establishing LCL transport chains

The establishment of new LCL services in a wider gravitational area is an important challenge for NVOCC operators and freight forwarders. The LCL/LCL transport chain must take into account some of the key characteristics of the overseas transport of small consignments, such as the following:

- LCL transport is used for small overseas consignments.
- Shipments of more shippers and consignees in one container (LCL/LCL):
 - Consignments up-to 9-10 m³ or 9-10 tons of cargo (even more, up to 15 m³, dependent on all-in transport price),
- The need to directly handle shipments throughout the transport route.
- Transport of the entire container as longer as possible between the place of picking up and delivering the shipment to the recipient.
- To follow the concept of intermodality by using railways when transporting containers.

LCL operators take the risk that their lines and the entire network will not be optimally filled. In particular, they have problems in the start-up phase, as they face the risks of low cargo volume from origin consolidation points for each final destination, within desired frequency of departures. Moreover, the risks appear in eventual limited support of FCL, FTL and LTL services in pre-carriage transport up to CHW or to the POL and in on-carriage service from POD to a deconsolidation warehouse or in door-delivery services of last mile transport. Finally, there is a risk that the calculated and confirmed LCL charges, expressed in w/m (weight or volume measurement, where higher unit of 1 tone or 1 m³ is used for price calculation) do not cover the input costs of partial services or of the entire transport chain.

Besides this, LCL operators most often encounter the following strategic issues that shape LCL transport chains [14]:

- Where to position a consolidation or deconsolidation regional LCL hub warehouse?
- How to establish a reliable network to connect key economic basins in a wider gravitational area, depending on the cargo volume and structure?
- How many LCL lines to operate, their routes and their frequency?
- Defining best pre-carriage and on-carriage service from time, cost and frequency perspectives.

3.2. Selecting consolidation hub point

The consolidation warehouse plays an important role in the operation of LCL transport chains as it ensures the collection of smaller shipments and the formation of intermodal transport units. The location of the warehouse is important; it should be as close as possible to a greater number of shippers and volume of LCL shipments. The distance between shippers and the LCL consolidation warehouse is increasing with the fragmentation of the market, the low frequency of regular LCL shipments and the problems of proper land transport, from the connectivity and price points of view.

The process of selecting the most suitable location for the LCL CHW is very complex. Many factors need to be taken into account to enable the optimal operation of the entire LCL network service, such as follows:

- low transport cost of the pre-carriage transport;
- suitable connectivity with existing FTL and LTL networks and services regionally;
- competitive costs of handling and warehousing LCL shipments;
- the suitability of transport distances, according to the importance of served markets;
- transport and other costs (documentation, inspection, etc.) between CHW and POL; and
- lines, frequency and price of overseas container transport from POL to different POD globally.

Consequently, the choice and operation of consolidation points has a great impact on the optimal operation of LCL services from an operational and price point of view.

3.3. Pre-carriage transport service up to a hub node

Pre-carriage transport represents a dynamic LCL transport chain element and higher risk for consignment damage due to intensive vibration and cargo movements compared to ocean transport by containers [15]. From the organisational point of view, the implementation of the pre-carriage transport can be changed and adapted to the number of shippers, the size and weight of the LCL shipments, the origin locations of the LCL consignments, and the location of the LCL consolidation warehouses.

In the case of regular LCL consignments of just a few shippers for a particular consignee, it is rational to form the entire LCL container from the senders' points directly, in case they have enough cargo for the entire 20', 40' or 40' HC container. In such cases, LCL/FCL transport is organised predominantly by freight forwarders. Namely, LCL operators are particularly focused on LCL/LCL services.

The use of FTL transport is more appropriate when the LCL operator collects a large number of shipments from a specific geographic area but not for a common destination. FTL transport is used for transport to a consolidation warehouse in the hinterland of a POL or in a port. In cases of considerable fragmentation of shipments, changing order frequencies and different end-markets, it is necessary to

search for the possibility of combining with LTL lines. These lines use cost-efficient and high-density networks with high responsiveness and timeliness services [16]. With increasing market demand, LTL operators must add new trucks on established routes or even open new transport routes; thus, they are forced to constantly improve LTL truck load utilization [17]. Very often they establish connections to the hinterland CHW or even to CHWs located in ports that are used for LCL transportation (Fig. 1).

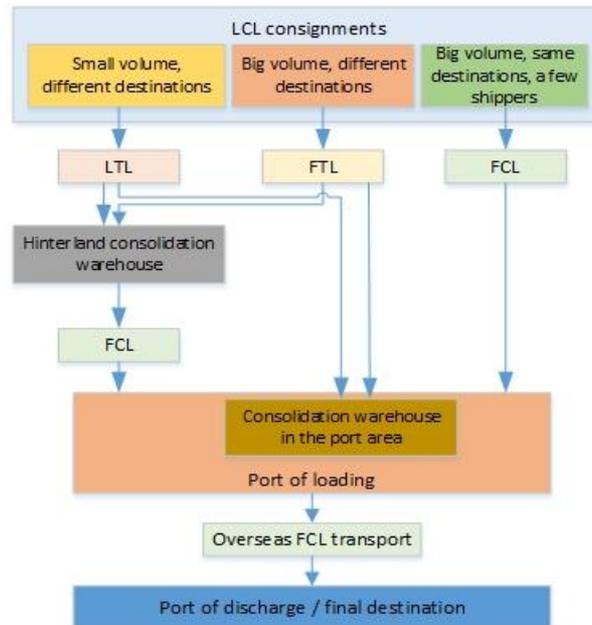


Fig. 1. Precarriage options in LCL transport chain. Source: Prepared by authors

LCL operators must set up an appropriate modal split model that is adapted for particular export-oriented regions. With the growth in market share, volume of shipments and the number of shippers, LCL operators pursue the establishment as many direct LCL lines as possible with the precarriage of FCL transport by rail or road to preselected POL. In doing so, the volume of shipments carried by LCL operators with other land transport modes is negatively affected, which requires additional adaptation in managing other land transport services.

3.4. Cost model and tariff policy

The complexity of the entire LCL transport chain is also reflected in the prism of the cost model and the creation of a uniform transport tariff. As mentioned, it is usually expressed in terms of price per tonne or m^3 of cargo and applies to the entire transport route. Bhatnagar [18] highlighted the complexity of planning and proper price calculation of LCL transport. The main reasons are connected to frequent change of operational and commercial variables in global transport and supply chains.

The cost model is often based on the summarized principle of all costs in the chain, which also includes the cost of the precarriage and eventual on-carriage, for delivering the shipment to the final consignee. The cost of maritime transport is defined for a whole 20', 40' or 40' HC container, and it is easier to convert such a price to a w/m tariff. Along the transport chain, some costs are incurred that are not related to the volume of shipments or their weight. These are costs for the production of operational and commercial documentation such as land transport documents, certificates, and post charges. The price is usually included in the basic w/m freight.

The most complex area of the cost model is the conversion of the LTL costs or domestic delivery transport costs, which are normally contracted by groupage lines or delivery companies to 100 kg of cargo or length meters. A different calculating "key" presents the risks to LCL operators when they have to convert prices in w/m tariffs. According to the presented precarriage model (Fig. 1), the cost

model of the LCL transport between the shipper and the consignee can be expressed through the following formula:

$$\text{Total LCL costs } C_T = C_{pt} + C_{co} + C_o + C_{st} + C_{dc} + C_{ot} + C_{dd} \quad , \quad (1)$$

where valid:

C_{pt} = cost of pre-carriage transport (different cost model based on selected transport mode - per 100 kg or laden meter, per FTL, per FCL trucking or railing);

C_{co} = cost of consolidation/handling (per pallet, per truck, per container, per ton...);

C_{od} = cost at origin of documentation in pick-up process and loading port (per document, per shipment);

C_{st} = cost of sea container transport (per FCL);

C_{dc} = cost of de-consolidation/handling (per FCL, per pallet, per ton...);

C_{ot} = cost of on-carriage and door-delivery (per 100 kg or laden meter, per FTL, per FCL trucking or railing); and

C_{dd} = cost of destination documentation (per shipment, per container, per document).

The highest level of risk in the creation of an LCL tariff is the occupancy of the loading area. Thus, when designing an LCL tariff, the 75-80% of the intended container filling is most commonly used, the maximum volume of which can be 33 m³ (20'), 67 m³ (40'), 76 m³ (40' HC) and 86 m³ (45' HC). Because of the proportion of costs that are not proportionate to the weight and volume of shipments, it is reasonable to use the largest containers, as the cost per w/m is the lowest. Thus, LCL operators strive to use 40' HC or 45' HC containers, but very often they have problems in obtaining 45' HC containers as container lines have a limited number of such containers.

The cost policy is also influenced by the frequency of departures and the envisaged transit time. LCL operators must respect the departure frequency and the announced transit time, which is a problem in cases where there are few orders. In such a circumstance, the occupancy of the loading space is usually lower, meanwhile the tariff is still charged according to the previously designed price policy.

4. RESEARCH METHODOLOGY

The LCL survey of the Eastern Adriatic market was carried out between logistics companies offering LCL transport services in export from the region to various overseas markets. Target companies were divided into three groups:

- independent LCL operators, which have their own export LCL lines and are mainly oriented towards the LCL transport organization;
- logistic companies that organize their own export LCL lines as part of the expanded portfolio of transport and logistics services; and
- logistics companies or freight forwarders who do not have their own export LCL lines, but also offer LCL transport in the portfolio of transport and logistics products.

Market analysis shows that there are global companies in the Eastern Adriatic market specialized in the field of LCL transport. Among them are Globelink, Shipco, Vanguard, ECU Worldwide, etc., which have their own branches or operate through agency representation. There are also niche regionally recognizable LCL operators on the market, such as Boxline and World transport overseas. The second group of companies, with global NVOCC companies that organize their own export LCL lines, are Kuehne+Nagel, DB Schenker, Cargopartner, etc. The third group is the largest and consists of all other transport and logistics companies that offer LCL services, where they use other LCL lines. The survey recorded 30 major logistics companies from all three groups and 33% of companies completely answered the survey.

For the survey, 22 questions were prepared, which were divided into 7 groups. The first set contains information about the company. The second set of three questions is about export services (whether they provide export services or the use other consolidation services and what is the percentage of such use). In the third set, 4 questions are asking about the location of consolidation warehouses (locations of hub LCL warehouse, locations of collecting warehouses in SE Europe,

loading ports of their LCL services, and the frequency of their LCL service via selected POL). The fourth set of four questions is intended to understand services through the ports of the Eastern Adriatic (whether they have services via Koper and/or Rijeka and the frequency of export LCL service), whereas the fifth section deals with 3 items of data regarding precarriage transport (kind of land transport to their warehouse, kind of land transport warehouse up-to POL and occupancy of cargo space in selected transport option). The sixth set of questions is aimed towards analysing export markets; thus, the survey contains questions about LCL destination markets (POD), kind of frequently used containers and the occupancy of used container. The last set of questions deals with the price aspect of LCL transport performance, where the companies are asked whether they offer to the clients a complete transport service calculated per w/m prices, how much of available volume of containers they use for rate calculation and what is the percentage of land transport cost in entire LCL transport service. Finally, the companies were asked to define (by using five-scale evaluation) eventual problems with LCL tariff calculation generated by land transport costs, warehousing costs, manipulation costs, documentation costs and/or sea prices.

5. RESULTS OF LCL NETWORK CHALLENGES

The survey results highlight important starting points for optimizing the performance of LCL transport networks. CHWs are placed at different points and connect different LTL lines, which reflects the complexity of the existing network and the consequent fragmentation of LTL shipments. For the future successful development of LCL services in the Eastern Adriatic region, a combination of land services, with an appropriate pricing policy, is important. The results of the survey are thus focused on the functioning of the LCL networks and the existing pricing policy.

5.1. LCL networks and services

The Eastern Adriatic market is predominantly import oriented. Thus, the ports of the Eastern Adriatic coast have a greater share of throughput with full containers on imports, especially for cargo in transit to central Europe or the markets of SE Europe. Export markets are in most cases North America, Asia, the Mediterranean, and to a lesser degree, Latin America.

The position of the Eastern Adriatic ports is especially advantageous for the export markets of the Mediterranean and Asia, whereas overseas services to the west (North and Latin America) are less competitive from a time and price point of view. Fragmentation of LCL shipments and dispatch irregularity make it much more difficult to use Koper or Rijeka as loading ports for LCL consignments to western overseas markets.

Three specialised LCL operators offer export LCL services directly from POL Koper. The main destinations are Haifa and Ashdod/Israel, Alexandria/Egypt, Limassol/Cyprus, Nhava Sheva/India, Dubai/UAE, Hong Kong, Shanghai/China, Singapore and in case of enough volume also Busan/South Korea. Most shipments are for Asian destinations. All other destinations offered by LCL operators and NVOCC companies with their own lines, are served via other POL, such as Genova, Hamburg, Antwerp, Bremerhaven or even Rotterdam. The departures are scheduled on a weekly basis.

According to the survey, the CHWs for LCL consignments are located at the four most frequent locations: at Ljubljana, Koper, Sežana and Škofja Loka. From here, FCL carriage with trucks to POL Koper or FTL carriage to other European loading ports is organised. LCL operators also use regional collecting warehouses that are connected with the selected CHW. These are most often locations in Zagreb, Graz, Belgrade, Budapest and Vienna.

The survey exposes a quite complex network structure for export LCL services in the Eastern Adriatic (Fig. 2), where different transport modes are successively used. In the first leg, domestic or LTL transport modes are used to bring LCL consignments to national collection warehouses. When good connections and enough volume of LCL consignments are in hand, direct transport by FTL or

LTL to CHW is possible, but presently 70% respondents highlighted that due to market fragmentation they use their own or subcontractor's LTL service. In the second leg, FTL or LTL transport is used for connection between the collection point and CHW. In case enough consignments for a certain POD are collected, the FCL transport to POL Koper is arranged directly.

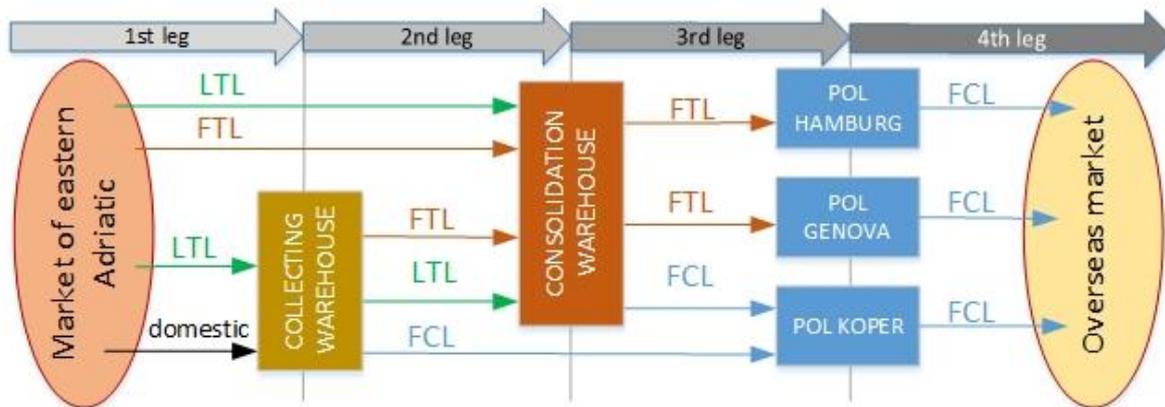


Fig. 2. Transport chains in organizing export LCL transport in Eastern Adriatic region. Source: Prepared by authors

In the third leg, LCL operators organize FCL transport to POL Koper as direct LCL service out of the Eastern Adriatic region or FTL transport to selected European loading ports for other overseas destinations. According to the survey, 50% of respondents organize FCL transport by truck to POL, 30% of respondents use FTL service and 20% LTL service, where consolidation into container is organised in the loading port. The last transport leg represents overseas FCL transport carried out by contracted container lines. The survey highlights that the way of organizing export LCL lines in the Eastern Adriatic is quite difficult to coordinate, due to land transport orientation primarily on inter-European cargo flows, dynamic optimization issues and price sensitivity.

5.2. Cost perspective

The survey confirms that on average, LCL operators reach 75 to 90% occupancy of the loading area of the selected container for overseas transport. The most commonly used are 40' HC containers, due to the higher volume and lower total cost per w/m unit (45' HC containers are not used as just a few carriers offer this equipment locally). When calculating the w/m price, 50% of respondents stated that the calculation starting point for occupancy is between 70 and 80%, and 30% of respondents stated that they use occupancy between 80 to 90% of available volume, which means that LCL operators cover the low-volume risk with a higher selling price per w/m. All surveyed LCL operators use such pricing policies.

The occupancy of FTL and LTL lines in the precarriage transport of the second or third transport leg is at the same level of container occupancy. Namely, 60% respondents stated that on average the truck occupancy is between 80 and 90%, meanwhile 20% stated that the occupancy is even over 90% of available capacity. Thus, there are possibilities of coming closer to optimizing the loading space; however, LCL operators face problems with the irregularity of export shipments, the size of orders and the size of each consignment.

When creating a single export price, 50% respondents observe the most problems in the cost of precarriage transport. Transport prices may vary, and they differ according to the transport mode organisation and market situation (domestic express transport, LTL, FTL). Likewise, calculation methods for LTL transport are important because the price is based on weight classes and size of shipments.

According to the survey, 56% of respondents state that the structure of total LCL export costs on CFR parity (Incoterms parity where the sender pays cost of loading and freight) consists on average of

50% to 75% of shipping prices. On the contrary, 33% of respondents have lower shipping costs representing 25 to 50% of total LCL costs. Thus, the costs of pre-carriage, consignment handling and temporary storage have a significant impact on the competitiveness and cost-effectiveness of overseas LCL lines. The total cost of pre-carriage transport by different road transport service on the CFR parity from different collection points in SE Europe to POL Koper is shown in Figure 3. The comparison of prices of calculated rate per m³ of loading space and per km of distance shows significant price deviation of LTL transport. The prices for FCL and FTL transport are fairly balanced, meanwhile the LTL prices are very different per origin place.

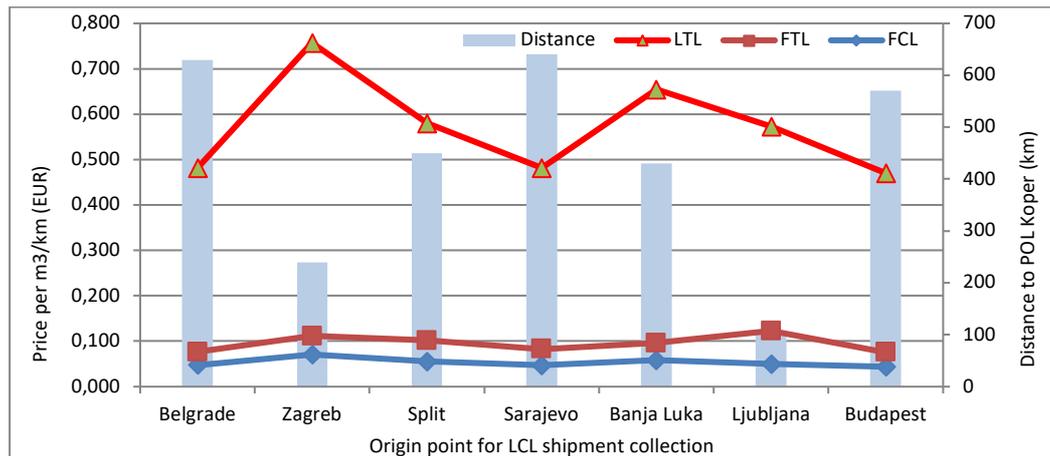


Fig. 3. Precarriage costs from origin point to POL Koper by different road transport services

From the cost point of view, LCL operators can use FCL or FTL transport as a pre-carriage transport more or less equally. The price comparison shows a small difference between the pre-carriage organized by FTL and FCL transport. The FTL service is competitive; even small consignments must be additionally handled from a truck to a container. The cost of such handling is on average between EUR 300 and EUR 400 per 40' HC container, but FTL transport provides a higher loading volume and achieves a lower transport cost. Such a means of pre-carriage is useful for a larger volume of LCL shipments, where not all shipments are for the same POD or final destination. On the contrary, FCL transport does not require additional handling of shipments, but the container has a smaller loading volume, and trucking costs are between 10 and 20% higher than by FTL transport on the same transport route. Lower transport costs can be achieved by rail; however, cost rate per transport unit and kilometre must be significantly smaller compared to road transportation, because the traveling distance of an intermodal chain is always longer and additional handlings are requested [19]. According to the market survey, rail services in Eastern Adriatic region are very often unreliable, with longer transit times.

Undoubtedly, the LCL service is the most expensive pre-carriage option, and the survey exposed that 70% of respondents use LTL service as pre-carriage transport of small consignments; although the study exposes that with low occupancy of FTL line or FCL transport, the price would be significantly more competitive as paid for existing LTL service (Fig. 4). Consequently, it can be affirmed that actual services are not cost optimised, and the exposure to damages during multi-handling processes is at a higher level.

Due to higher pre-carriage costs in the region, LCL operators and NVOCCs frequently use export services via Genoa, owing to the higher range of export services and because they easily fulfil entire truck with consignments for different overseas destinations. They rarely use northern European ports (just 22% respondents) such as Hamburg, Antwerp and Rotterdam. On this basis, the pre-carriage transport from CHW to POL Genova, which is usually organized by FTL transport, is analysed. The data in Figure 5 show that although longer transport is requested and additional handling of small consignments, the total transport costs of export LCL line over Genoa are approximately just 10%

higher than via Koper. The prices are calculated as a CFR transport price of one shipment consisting of 1 pallet, weighing 800 kg and a volume of 0.8 m³. As can be seen from Figure 5, the least economical pre-carriage is transport using LTL service, which is two to three times more expensive compared to FTL or FCL service.

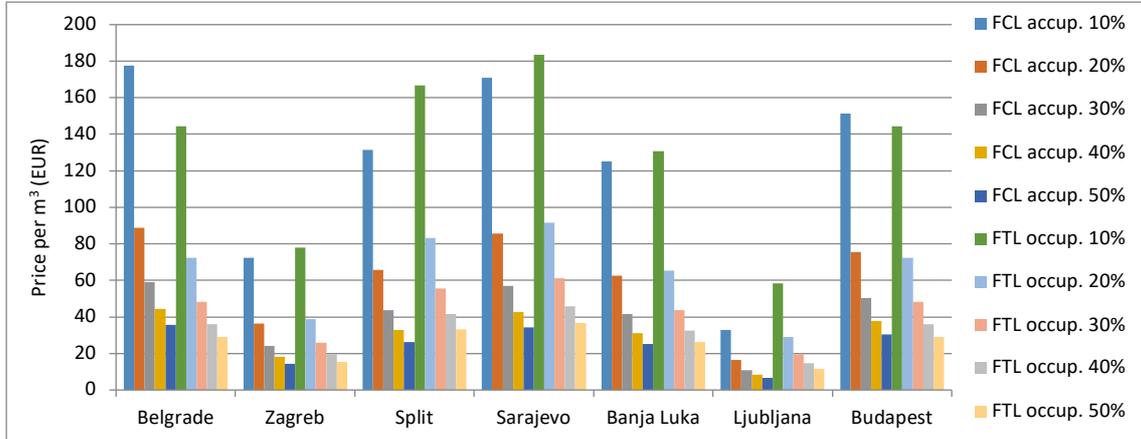


Fig. 4. FCL and FTL cost estimation with loading capacity occupancy between 10 and 50%

The whole transport time to POL Genova is extended by 2 to 3 days, representing approximately 10% longer transit time via Koper, but through POL Genova more direct connections to various global destinations are offered. On the other hand, it is valid also for this export service, that the LTL service has a strong impact on the total operating LCL line costs on CFR parity.

The price and time comparison of LCL services via northern Adriatic port or western Italian port of Genova exposes that even there is a 600 km distance between POL the total price of collecting small overseas consignments in SE Europe differs only by 10%. Undoubtedly, the pre-carriage services and manipulation costs up to POL Koper are not optimised, which is due to the poor connectivity of various road transport services and incompatibility of prices when calculated per kg or m³/shipment in LTL transport and per weight or volume in LCL transport. The issue of pre-carriage costs is exposed by the survey, as 50% of respondents claim problems with these costs.

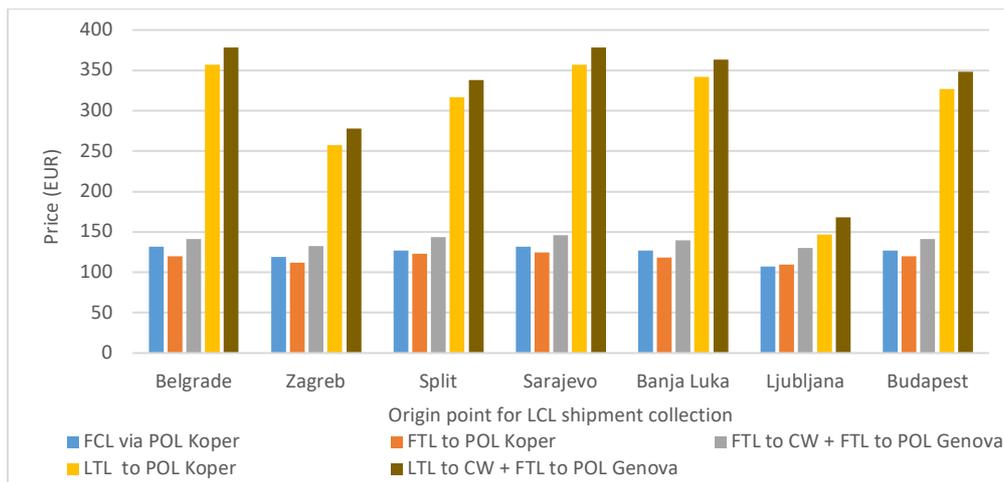
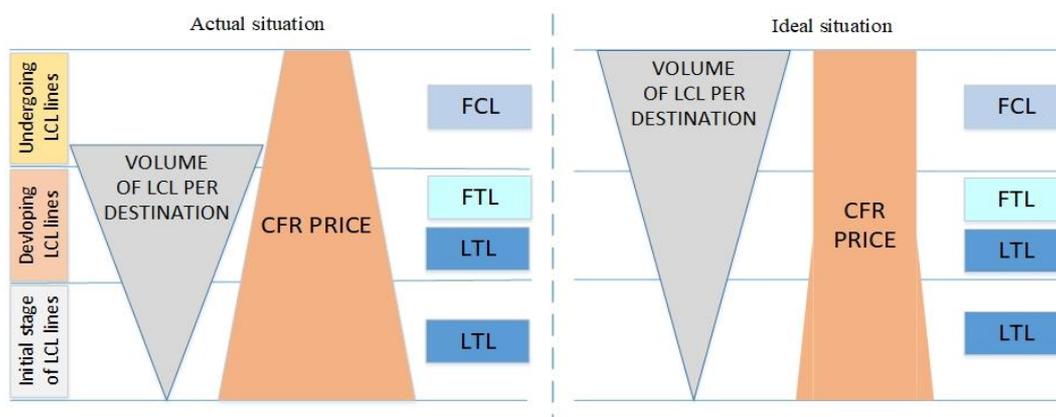


Fig. 5. LCL export CFR price comparison via POL Koper and POL Genova to POD Hong Kong or Singapore

6. DISCUSSION

The results of the study confirm the H1 hypothesis that LCL operators face barriers in efficient overseas export service for LCL shipments in the initial stage of starting new lines. In the initial phase, LCL operators do not have a large volume of shipments for a single POD, so they cannot organize

FCL services at origin points or from collecting warehouses. It is also difficult to collect 70 to 90 m³ of shipments per week, in order to organize regular FTL lines from the origin point. Thus, they must rely on LTL transport, which presently does not offer adequate price support as it is 2.5 to 3 times more expensive compared with other two options. LTL transport has an adequately developed transport network, with regular daily services, which allows time-weighted transportation of services; however, the cost of transport is too high. Consequently, currently operating LCL services in their maturity stage have a great advantage over LCL services in the initial working stage, which must survive with less volume, booking irregularity and higher operational costs. Engebretsen and Dauzère-Pèrès [20] expose that LTL services should be based on decreasing price for increased shipment quantities, that is not in practice on the market presently, as very often just a regular tariff per 100 kg of LTL shipment is used. By this, LCL operators might obtain lower pre-carriage prices and faster introduce FTL or FCL services in pre-carriage transport.



Source: Prepared by authors

Fig. 6. Actual and ideal situation of LCL transport chains

The study also confirms the H2 hypothesis that modal split choices offer different possibilities in organizing outbound LCL services, from time and cost perspectives. LCL operators can choose different combinations of pre-carriage transport and different POL; however, analysed prices on the CFR parity to the Asian ports vary considerably depending on the different service combinations. One-way price for FTL transport from a consolidation warehouse in Slovenia to Milan or Genoa allows the competitive operation of such an LCL export service, although it is 600 km from the nearest POL Koper.

The study exposes that the main problem of modal split choices in the Eastern Adriatic region is the price competitiveness of LTL services that hinder the establishment of new LCL lines and the arrival of additional LCL operators into the region. The current situation is shown in Figure 6. LCL and NVOCC operators are still in the phases of establishing regular and strong export services. The survey highlights that owing to non-regular and lack of high-volume cargo they are forced to use LTL and LTL+FTL transport, which is an expensive solution. The ideal scenario would be a price adjustment of LTL services, in order to support LCL development regionally. Namely, LTL lines very often have free space owing to high-frequency services (mostly on daily basis), and this space could be offered to LCL operators at commercially more favourable conditions. Of course, LTL service should remain as the most expensive option, because provides quick response to the market. This would constitute a good basis for the emergence of new export LCL lines and greater choice of export companies in the region. The prices of FCL and FTL services are fairly evenly balanced (Fig. 3). Moreover, the accessibility of trucks of both modes of transport is at a very high level, which represents the comparability of both modes of transport that already provides good basis for keeping the LCL services in the maturity stage.

With different approaches from the entire industry (LTL providers, warehousing operators etc.), LCL and NVOCC operators would find it easier to set up their own LCL lines and redirect some current LCL flows generated in central Europe to the southern European transport route via the Adriatic Sea. The entire industry would feel the multi-layer benefits of such an activity, which are usually felt through the erosion of monopolistic tendencies, better choices of the LCL lines through various aspects of transport service quality (transport time, responsiveness, information, etc.) and greater price competitiveness.

7. CONCLUSION

The Eastern Adriatic region has the potential to develop LCL transport by using already established land transport networks and better overseas container connections for key export markets. On one side, the land transport connections between different markets and CHW enable the nearer optimization of the pre-carriage transport, and on the other, the ocean connections secure regularity of the dispatch of containers and the shorter transit time between POL and POD. The listed network specifics represent a good basis for the further development of the LCL product, which must also be cost effective. The survey exposes that FCL and FTL transport as a pre-carriage solution is convenient, but these services are used once the LCL operator controls enough and regular volume of small overseas consignments. Although the LTL prices are not convenient when comparing them to the FTL or FCL ones, one is forced to use LTL services due low number of consignments per collection area or market.

In addition, the survey points out that the greatest challenges of modal split decisions are in the use of LTL networks, as transport prices are shaped by the high demand and transport needs from the Eastern Adriatic market towards western European markets. Compared with FTL or FCL transports to the selected POL, the prices of LTL services are far too high. Thus, LCL operators, NVOCC operators and regional freight forwarders face difficulties in starting up new LCL lines. Consequently, the study confirms both research hypotheses, that LCL operators face barriers in efficient overseas export service for LCL shipments in the initial stage of starting new lines and that modal split choices offer different possibilities in organizing outbound LCL services, from time and cost perspectives. The difference between export LCL service via POL Koper or via POL Genova is minimal, as the price and transit time difference is within 10%, although the transport route is 600-km longer. Thus, LCL operators regularly use Italian port for export LCL services as they can combine different shipments for different destinations in one FTL.

The price disparity and the divergence between different pre-carriage transports are particularly apparent with LTL transport. Among the possible measures are the decisions that the land groupage carriers adjust the prices of transport for overseas shipments in their LTL services, with specially designed or customized tariffs. Such a commercial decision is difficult to accept in circumstances where export LTL lines towards western Europe are well occupied, but very often cross-selling of products to the same client brings such a commercial decision. On the contrary, the economic development of the entire region and increase in export orientation towards overseas markets will speed up the establishment of new LCL lines that will be able to switch from existing LTL services in pre-carriage transport to FTL or even FCL services under their direct organisation, as is already the practice for some services from Belgrade via POL Koper, where the LCL operator controls the entire transport process. Consequently, LTL operators would lose a part of regular cargo that is presently transported by their lines. Undoubtedly, there are a lot of challenges for LCL transport optimisation in the Eastern Adriatic region that will be subject of further researches.

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