

“UBERIZATION” in empty container repositioning – possibilities and challenges

Đurđica Stojanović¹, Marinko Maslarić² and Radica Žepinić³

Abstract – This paper explores the perspectives and challenges of the most innovative platforms for the purpose of empty container repositioning (ECR) reduction. Cooperation between all stakeholders is of crucial importance for efficient ECR. A last generation of e-marketplaces, related to “uberization”, may provide an additional impetus for collaboration between all parties.

Keywords – Empty container repositioning, Collaboration, Uber technology.

I. INTRODUCTION

Global trade imbalance causes a great amount of the containers capacity surplus globally. Such empty containers have to be repositioned to the place of next loading, which implies extra costs to container shipping companies and, consequently, to the end customers. According to some estimations, the empty container repositioning (ECR) costs the container shipping industry about \$20 billion per year [1]. Additionally, ECR affects other actors in supply chains, such as inland carriers, port and depot operators, leasing companies, shippers, freight forwarders etc. They need additional time and effort for planning and organizing their movement to the next place of loading.

The repositioning is an individual group of activities, which causes additional costs, whereas the main shipping company's interest is profit. Therefore, laden containers have advantage in occupying ship's capacity and empty ones are left in the place of their unloading whenever there is a chance for it. This has caused a great accumulation of empty containers on consumptive locations during the time, and still represents an increasing problem.

However, ECR has still not reached an adequate attention neither in the literature, nor in practice. This paper is aiming to reveal the possibilities and challenges of the ECR improvement, by applying some of the most advanced methods directed to enhancing cooperation between all stakeholders. More precisely, the focus is on an undergoing “uberization” of ECR. A few initiatives in the practice has been identified until this day.

¹Đurđica Stojanović is with the Faculty of Technical Sciences, Novi Sad, Serbia, durdja@uns.ac.rs

²Marinko Maslarić is with Faculty of Technical Sciences, Novi Sad, Serbia, marinko@uns.ac.rs

³Radica Žepinić, is with Faculty of Technical Sciences, Novi Sad, Serbia, radica.zep@gmail.com

The rest of the paper is organized as follows. In the second Section, it is highlighted an increasing need for ECR in the world shipping market, by analysing the shipping market characteristics and reasons for ECR. In the third Section, the main groups of measures for solving ECR problem are briefly presented. The fourth Section analyses the possibilities and challenges of “uberization” in ECR, whereas the final remarks and conclusion are in the last section.

II. INCREASING NEED FOR ECR ON THE WORLD SHIPPING MARKET

II.1. Characteristics of the world shipping market

Maritime container transport is the backbone of globalization, as well as of global economy. About 20 container shipping companies are dominating world maritime market. Three companies – Maersk, MSC and CMA CGM own approximately 40% of world's container ships fleet, whereas the market share of the first twenty companies is more than 80% [2]. According to [3], the total capacity of the world's container fleet has passed the 25 million TEU, whereas the estimated total container, or box fleet size is ca. 40 million TEU (or over 26 million of individual container units) [4]. An estimated number of TEUs that were handled in container ports worldwide in 2018 is around 800.000 million [5], with the Port of Shanghai, as the busiest port through which 42 million TEU containers passed [6]. The shipping companies are still the dominant container owners, which share in global container fleet has fluctuated between 59% and 51% in the period from 2010 to 2017, respectively [7]. Beside the shipping companies, container owners may be also the leasing companies, forwarders and others.

The shipping companies usually join their efforts within the alliances, due to the costs reduction, increasing ships capacity utilization and better overall business performances. Members of an alliance cooperate on the principles of integrated management [8]. The largest alliances in the world with main companies' market shares are shown in the Figure 1. The results of such cooperation is an increasing power of alliance members on the main line routes.

In 2018, the market share in fleet capacity of all alliances was above 95% on East-West trade lanes in container trade [9].

The alliances integrates transport of cargoes for the members of that alliance, which creates the opportunity for the use of mega cargo ships and, consequently, the economies of scale. Also, the frequency and reliability of transportation are increasing, which can serve a much larger number of users simultaneously. Such cooperation impact on cost and idle time

reduction, which has contributed to an increase in the market share of all carriers.

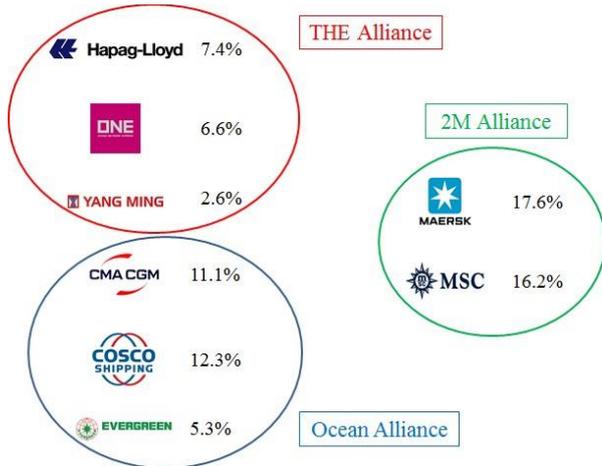


Fig. 1. The largest alliances of container companies in the world with TEU capacity share [9, 10]

II.II. Reasons for ECR

Based on an estimate from 2015, there are approximately 5 to 6 million of containers in transit worldwide at any given moment [11]. However, container flows are not evenly distributed, but there is an *imbalance* in the world market. Namely, Asian countries have been the large producers for decades, whereas the Western Europe and North America are large consumers. Therefore, a large number of laden containers were imported from Asia to Europe and America, and due to the constant import and lack of exports, empty containers have been accumulated over the time. According to [12], in 2009 the Far East-Mediterranean route recorded the imbalance of 53% in TEU, whereas for the Transatlantic route the imbalance was 40% and for the Transpacific route the imbalance was 63%. This trade and demand imbalance is the main cause of ECR [ibid.].

Some authors indicate that at least half of the containers moving westward to Europe were sent back empty in the first decade of 21st century [13]. The share of empty containers in hinterland transport ranges from 40-50% of all containers transported [ibid.]. It was estimated that the costs of ECR could be up to \$30.1 billion including both the seaborne and the cost of landside transportation, and account for 19 percent of global industry income in 2009 [ibid.]. The problem of empty containers idling also arises because of [2,8]:

- the available vessel capacity varies in each vessel call;
- the demand in the deficit locations which require empty container replenishment varies along the time;
- the supply of empty container from the surplus locations also varies;
- cost of transporting, maintenance, repair and inspection of containers;
- the dynamics of container leasing industry.

The significant contribution to the containers imbalance and accumulation was the ban on the import of waste into China. In 2016, China imported 45 million tonnes of waste. At that moment, Beijing abolished the import of 24 solid wastes and enhanced the container surplus in other regions [14].

Among other causes for ECR are dynamic operations, uncertainties, size and type of equipment, lack of visibility and collaboration within the transport chain, and shipping companies' practices [13].

Excessive accumulation of empty containers in one place leads to the depots where boxes wait for their end of life moment (areas occupied by empty abandoned containers). In addition to the costs of tied up capital and the growing operating costs of empty containers storing, the big problem with unused containers is that they are made of metal prone to corrosion and thus become unusable over time. This represents a kind of landfill and environmental catastrophe. Given that this problem is common to all shipping companies, the chance to solve this problem lies in the cooperation between them.

III. MEASURES FOR DECREASING GLOBAL ECR PROBLEM

The average container spends more than 50% of its lifespan as being idle, or empty repositioned. The estimations show that shipping companies spend from 16-20 billion of US\$ repositioning empties [1, 15]. Therefore, the advanced solutions for ECR are more than necessary. Among others, [13] identify four groups of ECR solutions:

- organizational solutions;
- technological solutions;
- vertical collaboration (intra-channel solutions), and
- horizontal collaboration (inter-channel solutions).

All these solutions are interrelated and may be interdependent in development a unique package of solution. Some of them are reasonable at least on the alliance level. Most of the literature on ECR problem investigates internal organizational solutions in a single shipping company. That's because shipping companies are the focal companies in the container transport chain and are mainly responsible for ECR. Some of the organizational solutions are megaships, container leasing, and forecasting.

The larger the ships, the more cargo and empty containers can be accommodated. The capacity of containers vessels increased by 1200% from 1968 to 2015 [16]. Leasing out containers charges additional costs to companies - rental costs. However, after the expiry of the leasing contract, the containers must be handed over to the next client who rented them. In fact, the containers are repositioned in the form of the contractual obligations. This prevents container from being retained in one place or from being unused [17].

By increasing the costs of new containers production, so that they exceed the costs of repositioning the empty ones, companies whose main interest is profit should be much more interested in repositioning [8]. The problem can also be solved by planning the number of containers that will appear at specific locations, and determining the locations to which a certain number of containers need to be moved. It's based on information received from regional offices on request for empty containers. Then, based on this data, forecasts could be made to better utilize the capacity of the ship [8].

With the advance in linear and integer programming and the development of computing power the joint optimization of

loaded and empty container allocation, which bring economic benefit, became feasible for a reasonable size of problems [13]. A natural extension to the organizational solutions are intra channel solutions which emphasize on the coordination across different players in the vertical channel. "Street turns" or "Empty reuse" refers to reusing import containers for export loads at the consignee's site or nearby where direct exchange of empty containers between consignee and consignor can be realized. The potential benefits include [ibid.]:

- less truck mileage;
- the haulier can generate more revenue in less time;
- the ocean carrier (shipping company) can save paperwork and improve the container utilization;
- the export customer gets the empty container faster;
- the environmental impact can be reduced.

"Depot-direct off-hire" is a process of off hiring and repositioning an empty container to the leasing company at an inland depot directly before returning to the maritime terminal. This concept would cut down truck mileage [13]. "Off-dock empty return depot" is another solution, which assumes a proper choice of the depot location for the storage of empty containers [18]. Inter-channel solution implies horizontal integration of transport chains (e.g. alliances).

Container pool means sharing containers with other partners by participating into a pool. This solution implies that different companies accumulate their containers in one place at the agreed time and then collect and relocate these containers by one ship to necessary places. In case of alliances, there must be an adequate information system to accompany all request. Pools can be in or near the port [2].

All alliances could be combined into one alliance that would deal with ECR. That alliance would have a unique IT structure, a common database and an information system common to alliance members [2]. This way of organizing ECR gives a better insight into the number and position of empty containers, increases the efficiency of their utilization, provides better control over them, and gives the opportunity to attract more jobs.

Technology development mostly contributes to the development of previous solutions. However, it can bring some new solutions that contribute to the ECR cost reduction. Tracking system are needed to track the movement of containers. RFID technology is used for tracking containers inside the terminals. GPS system can be attached to trucks to identify containers location. Foldable containers are technological innovation where up to 5 stacked containers can be placed in a single container, which may significantly contribute to transport and warehouse space utilization [19].

IV. POSSIBILITIES AND CHALLENGES OF "UBERIZATION" IN ECR

The alliance-level ECR solutions involve a combination of the aforementioned measures, with the almost mandatory intelligent applications. Some organizations have started to develop neutral advanced online platforms that increase ECR efficiency based on the Uber-type technology. Generally, the

"uberization" of business services, which is changing the whole market, assumes the possibility of accessing of the desired service, at the desired costs, at any time and place. In container shipping industry, a common feature of all such platforms is that they offer the opportunity to ship containers immediately to the next loading point after emptying, without returning to the port, if the demand and offer are matched [14]. They provide real-time solutions, involve a great number of stakeholders, with significant fleets of shipping companies, inland transport capacities and containers, and so meet the condition of crowdsourcing. They also include the easy-to-use applications for desktops, tablets and mobile phones. Such characteristics may be described as the Uber-type technology, due to similarities with the well-known application used for taxi service. The positive side of "uberization" could be in transport and storage costs reduction, as well as the milder negative environmental impacts [14]. Also, introducing of such a kind of neutral platform also may decrease the technology investment costs for the main actors. In the rest of this Section, the three companies which offer such solutions on the market will be briefly presented, to exemplify what we consider under "uberization" of ECR.

The first examined company is the *Boston Consulting Group*, which has developed *xChange* - an online empty container platform where merchandise owners reserve empty containers for their goods for one-way transportation. In this way, contracting time can be shortened by a few weeks. The advantage of this platform is that the client is not connected to a particular network, but is given the opportunity to cooperate with more than 200 companies, including carriers, container leasing companies, shipping companies and others. The platform *xChange* operates around 2500 locations and plans to expand its network [14]. Consumers browse free containers listings at specific locations and form contract term themselves, such as the price of using the container or damage protection plans. The platform remembers users' searches and contracts, after which they approach them proactively [14].

The second case is the port of Rotterdam that has developed *Navigate* - an online platform that displays empty containers for free use, but it is based on their location. These users are shown places where empty containers are located, avoiding their transportation to the port or depot before being shipped [14]. This is not a completely neutral solution, because the port is also a part of transport chains.

The third case is *Avantida*, recently merged by *INTTRA*, as the world's ocean shipping electronic marketplace. It is a virtual company which offers a cloud based platform, with more than 7.000 trucking companies in more than 20 countries around the globe. The users are enabled to calculate the savings based on saved mileage for all triangulations in Europe, Asia and North America. A dynamic pricing-model offered by participating ocean carriers allows transporters to also execute short-distance street turns [20]. The company's reuse and repositioning applications enhance the collaboration in the land-based activities between shipping companies, haulage carriers, ports, logistics centres, freight forwarders and other intermediaries, exporters and importers, etc.

Based on the briefly presented analysis of selected online platforms, which are considered as "uberized" marketplaces, a

short SWOT analysis of the “uberization” in ECR has been made. It is quite general as it captures the perspectives of all stakeholders.

	Beneficial	Harmful
Internal	<p>Strengths</p> <ol style="list-style-type: none"> 1. Neutral e-marketplaces have already shown a success in logistics industry 2. Easy implementation on different devices and easy to use new apps 3. Real-time display of data 4. Usage does not depend on working hours or time zone 5. Costs and idle time reduction for all stakeholders 6. Increased productivity and interoperability 7. Reduced negative environmental impact of disposed containers and land operations (containers transport, storage and handling) 8. Increased flexibility 	<p>Weaknesses</p> <ol style="list-style-type: none"> 1. The fastest solution in connecting supply and demand is not always the overall optimal solution 2. Data privacy concerns 3. Possible conflicts of interest at the same chain level within and between the stakeholders and alliances 4. The risk of neutrality loss 5. Land operators are not equal players in estimating the benefits of new technologies and voting in adoption
	<p>Opportunities</p> <ol style="list-style-type: none"> 1. Oligopolistic market, where the common decision of few shipping companies is enough for success 2. Online platform represents a good basis for fast spreading connectivity between all stakeholders, alliances and routes 3. Global development of digitalization and other ECR solutions cause synergy effects 	<p>Threats</p> <ol style="list-style-type: none"> 1. It may enhance the oligopolistic container market characteristics (ownership shares, number of manufactured containers, etc.) 2. Lack of the legal regulations, privacy threats 3. Technology limitations 4. Great interdependence with the implementation of other ECR solutions may be also an obstacle
External		

Fig. 2. SWOT analysis of ECR “uberization”

V. FINAL REMARKS AND CONCLUSION

E-markets have existed in freight transport for decades. Unlike taxi transportation or city logistics, “uberization” in long-distance freight transport would rather represent the evolutionary, than revolutionary and disruptive technology wave. This should not decrease the positive effects, but rather impact on specific challenges and threats in its implementation, compared with e.g. taxi uber.

Online cloud platforms are the youngest form of electronic marketplaces, which have existed for decades in freight transport, especially in road freight transport. The main innovations lie in incorporating latest information technology solutions, such as cloud business models, big data, blockchain, artificial intelligence, machine learning, mobile apps, etc., to transform logistics chains and processes. The main possibilities also include combining with other existing ECR solutions. “Uberization” facilitates the horizontal and vertical connection of participants on specific routes and in different hinterland regions, as well as between major routes. Higher data visibility can certainly have the effect of reducing the number of idle empty containers and optimize them in ECR. Currently, we can find a couple of virtual platforms which have such characteristics. It could be expected that some new ones, important on the regional level will arise, whereas the existing ones will accelerate their development. The integration of such platforms on the global level in the future period could

maximise the opportunities, but also the threats. The main challenges and threats lie in the conflict of interest of the participants, increasing the power of main shipping companies in already oligopolistic market, legal issues and the dependence on the development and implementation of other ECR solutions.

ACKNOWLEDGEMENT

This research was partly financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (projects no. TR36030 and 451-03-9/2021- 14/200156: “Innovative scientific and artistic research from theFTS domain”).

REFERENCES

- [1] <https://gcaptain.com/empty-container-repositioning-costs-shipping-industry-up-to-20-billion-per-year/>
- [2] H. Tong, H. Yan, “Equipment planning strategy for liners: empty container repositioning across alliances”, *Maritime Business Review*, vol. 3, no. 1, pp. 89-106, 2018.
- [3] <https://www.alphaliner.com/>
- [4] <https://www.world-leasing-yearbook.com/feature/intermodal-container-leasing/>
- [5] UNCTAD, “Review of maritime transport 2019”, United Nations, Geneva, 2019.
- [6] <https://www.billiebox.co.uk/facts-about-shipping-containers>
- [7] <https://www.world-leasing-yearbook.com/feature/intermodal-container-leasing/>
- [8] R. Diaz, W. Talley, M. Tulpule, „Forecasting empty container volumes“, *The Asian Journal of Shipping and Logistics*, vol. 27, no. 2. 217-236, 2011.
- [9] ITF “Container Shipping in Europe: Data for the Evaluation of the EU Consortia Block Exemption”, Working Document, International Transport Forum, Paris, 2019.
- [10] <https://alphaliner.axsmarine.com/PublicTop100/>
- [11] <https://www.yachtingworld.com/comment/shipping-containers-lost-at-sea-61867>
- [12] J. Karmelić, Č. Dundović, I. Kolanović, “Empty Container Logistics”, *Promet – Traffic & Transportation*, vol. 24, no. 3, 223-230, 2012.
- [13] Song, D.P. and Dong, J.X., “Empty Container Repositioning, In Lee, C.-Y. and Q. Meng (ed.)”, *Handbook of Ocean Container Transport Logistics– Making Global Supply Chain Effective*, Springer, New York, pp163-208, 2015.
- [14] <https://www.supplychaindive.com/news/empty-container-imbalance-transparency-startup/540949/>
- [15] P. Trott, D. Hartmann, P. van der Duin, V. Scholten, R. Ortt, “Managing Technology Entrepreneurship and Innovation”, Routledge, London and New York, 2016.
- [16] <http://www.worldshipping.org/about-the-industry/linerships/container-ship-design>
- [17] <https://www.otc-global.com/en/international-transportation/container/leasing-containers-shipping-containers/>
- [18] https://transportgeography.org/?page_id=9509
- [19] <https://www.finchandbeak.com/1039/foldable-containers-revolutionary-logistics.htm>
- [20] <https://www.avantida.com/en/news/avantida-by-e2open-releases-distance-based-street-turn-model-globally/>