LOGISTICS INTERACTION WITHIN THE SYSTEM OF RAIL STATION AND SEA PORT

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ABSTRACT

The transport system of Russia processes powerful foreign trade commodity flows. The combination of developed network of railways and highways, ports, border crossing points creates a basis for formation of one of the largest transport and logistics complexes. Reliability of all its components, positive synergy of links, sufficient throughput and carrying capacity influences the effectiveness of business of many domestic and foreign enterprises that have become participants in the common logistics process. The authors of the article focus discussion on the system significance of logistics solutions for interaction of various modes of transport at the stages of carriage of goods in international traffic using the example of Ust-Luga transport hub.

Keywords: management, logistics, interaction, logistics center, port, dry port, station–sea port system, multimodal transportation, transport hub.

Background. *Optimization of the management system of transport and logistics business should be carried out on the basis of successful logistics solutions, the application of which requires a systematic approach. Failures in the management of a cargo flow towards the ports lead to economic and production losses for all participants in the transportation process: for consignors and consignees, as well as for carriers and owners of rolling stock.*

Objective. *The objective of the authors is to consider logistic interactions in the system «rail station–sea port».*

Methods. *The authors use general scientific methods, comparative analysis, evaluation approach, management analysis tools.*

Results.

Port of concerted actions

Undoubtedly, the technical equipment of ports and rail stations at the ports plays a decisive role in ensuring the growth of cargo turnover, but the quality of organization of cargo transportation through the port and the level of interaction of all participants in the transport process, which often poorly coordinate their interests with subcontractors, is of no less importance.

For example, shippers are interested in the fastest shipment of goods from their enterprises and their transportation to destination, regardless of the problems of the railway and sea terminals. The task of railways, that execute initial loading, is to increase the volume of loading and removal of goods from enterprises. Sea terminals are interested in maximum loading of processing capacities and for this purpose they accept all volumes planned for transportation, irrespective of the situation within the railway segment. Freight forwarders and owners of cars want to achieve an increase in the volume of traffic regardless of the transport capacity of the transport infrastructure. Concern for transit and unloading (port) roads is the organization of unimpeded passage of freight traffic with the least cost and optimal benefit for all participants in the process [1, 2].

Ust-Luga hub was created with an emphasis mainly on servicing export cargo flows. The sea terminal here has a unique geographical location between the centers of world trade. The appearance of a new port allows reducing transport costs and directing export cargo flows along the most efficient route. Ust-Luga uses state-of-the-art equipment that provides not only a high level of industrial and environmental safety, the ability to handle ever-growing cargo flow, but also to develop, make better its own territories, design new terminals, and build additional warehouses and parks.

The role of an intermediary between the structures of JSC Russian Railways and port terminals is played by JSC PUL trans, which performs the functions of a single shunting operator (SSO) [3].

The main function of SSO is provision of services for supply and removal of cars by its own locomotives from Luzhskaya port station to the terminals of the port, including directly to their loading and unloading front points and back. The dispatching management in the port is centralized: the entire planning, organization and operational management of the shunting work with the rolling stock arriving at the terminals and sent from them is carried out round the clock by shunting dispatchers.

SSO has a very wide range of functions:

• provision of shunting locomotives and organization of a full range of services on common and non-public routes:

• organization and planning of shunting operations;

• 24-hour dispatching;

• maintenance of non-public tracks.

Also, the tasks of the company PUL trans include the provision of transport and forwarding services on the principle of «one-stop shop»:

• intraport forwarding: a complex of loading and unloading operations (through a warehouse/on a direct option), cargo storage, customs services, registration of railway waybills, TTN, TN;

• development of optimal schemes for delivery of goods, including oversized equipment;

• selection of types of rolling stock, provision of cars and trucks;

• payment of railway tariffs in the territory of Russia and CIS countries;

• development and coordination of drawings and cargo securing schemes;

• formation of sender routes;

• organization of cargo insurance and survey services.

The additional service includes, among other things, audit of technological solutions (selection of a point of accession of a non-public railway track, layout of loading and unloading fronts, selection of shunting technology, calculation of the technological

period of turnover of cars on a non-public railway track); optimization of a railway complex in ports and on industrial sites; operator activity in the automobile-railway complex (loading/unloading of cars to railway ferries); services of the locomotive technical maintenance station; all types of operations with railway cargo at Luzhskaya station.

Who coordinates with whom and why

Thanks to these functions, the efforts of the participants in the transport process (railway specialists, port workers, terminal owners) are consolidated, which significantly increases the efficiency of Luzhskaya station. All the processes at it are organized in such a way that the work is carried out in a single rhythm with the port. The «station–port» tactic is of particular importance, since the main principle for the port station is to bring not as much cargo as possible to it, but precisely such quantity that the terminals can process.

Let's consider in more detail the interaction process and the goals of each of the participants of the transportation process: cargo owners (CO), central directorate of traffic management of JSC Russian Railways (CD), rolling stock owners (RSO), center of corporate (firm) transport service of JSC Russian Railways (CFTO), terminals of the port (stevedores) (TSP), ship owners (SO), SSO PUL trans and directly the sea port (P).

1. CO: to transport cargo quickly, efficiently and in extremely fast terms at the lowest price. Of particular interest are door-to-door and last mile services.

2. CD: provision of infrastructure and transportation of goods, quality organization and management of the transportation process, compliance with the schedule of train traffic; increase the efficiency of the use of infrastructure.

3. RSO: attraction of clients, timely provision of cars.

4. CFTO: carrying out commercial activities in the field of cargo transportation, forming the revenue side of Russian Railways budget, maintaining contractual work, providing information and additional services to customers, improving transport services.

5. TSP: loading, unloading, transshipment and intermediate storage of goods, in some cases, sale of goods, servicing ships, as well as providing a wide range of services to both shipowners and cargo owners.

6. SO: provision of sea transport for export and import transportation, an interest in increasing the vessel's capacity.

7. SSO: integration of individual components of the process of delivery and transshipment of goods in the port in a single logistics chain; implementation of all shunting and associated operations at the port terminals and Luzhskaya port station routes to ensure uninterrupted processing of a cargo flow at the junction «railway–port–sea»; providing cargo owners with a complex of freight forwarding services. In some cases, it can act as a consignor.

8. P: Exports and imports of goods (maintaining communication with the world market), ensuring the safety of shipping through the development of transport infrastructure, the implementation of operational communication with ships and related modes of transport.

The summary table of interaction of participants in the transportation process is presented in Table 1.

Three zones of interaction

Undoubtedly, one of the main components for optimizing the interaction of rail and sea transport is the coordinated delivery of cargo trains on a schedule to cargo transshipment complexes. It provides for interconnection of technologies of interacting modes of transport in the port junctions at the stages of developing a plan for formation and schedule of train traffic, planning and operational management of operational work [4].

Interaction begins with the choice of the rhythm of shipment of cargo by appointment to the port and appearance of vessels in the forecast area. To do this it is necessary to:

1. To identify zones of interaction, to formulate tasks, to define criteria and to choose methods for optimizing interaction technology.

2. To develop the principles of construction of a manageable technology from two sides of interaction. At the same time, one should proceed from the premise that a more manageable technology should be on the side where greater controllability is objectively possible. In this case, it is more real in the railway subsystem, since the processed flow is multi-jet (for loading of one vessel, a cargo of hundreds of cars is required).

According to the structural and functional features, three zones of interaction from the sea and railway transport are distinguished (Pic. 1). Zones of long-range, medium-range and short-range interaction have their own peculiarities, although all of them should function as subsystems of one system.

Direct contact interaction occurs in the near areas, where there is complete information about the required loading rhythm and direct possibility to control transport, cargo and technological operations. From the sea side – this is an opportunity to flexibly change the loading mode of different compartments of the vessel. From the railway – management of supply of cargo for loading from warehouses or from cars.

The task of interaction between short-range interaction zones is to build a rational technological process for operation of a railway station. Irrational technology leads to unnecessary inter-operational downtime and reduces the maneuverability and capacity of port stations, most of which are the «bottleneck» of the railway subsystem. That is, the criterion of interaction in the near zone can be formulated as a minimum of the total costs associated with delays in the performance of cargo and technological operations.

The zones of medium-range interaction include from the sea side the vessels in the water area of the port, and from the railway side – trains at the stations in the waiting area (several nearby stations that are used as a certain storage). The object of interaction is a controlled supply of vessels and trains with criteria of a minimum total cost associated with deviations from a predetermined train rate of arrival at the dock stations and vessels to berths.

The long-range interaction includes from the sea side the vessels in the forecast area (10–20 days), from the railway – cargo flows from loading points. Here, precise control is impossible, since the periods of movement of vessels and cars are large, and therefore the combination of random factors affects the final result too much.

«Single window» logistics

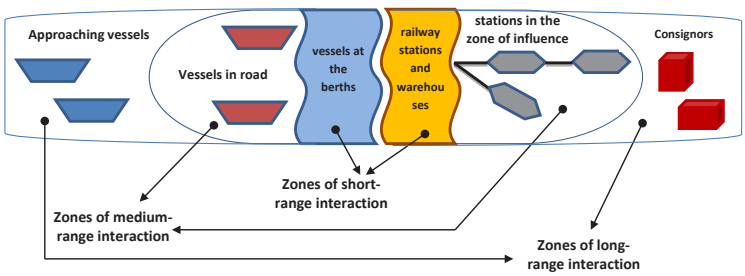
The logistics of cargo forwarding to ports are now built on the principles of «pushing» logistics[1], the main

[1] The «pushing» logistics system is movement of material resources in which they are supplied from a previous operation to a subsequent one in accordance with a predefined delivery schedule.

Table 1

Interaction of participants in the transportation process in the seaport of Ust-Luga

	CO	CD	RSO	CFTO	TSP	P	SSO
CO	–	Use of infrastructure	Rental of RS, use of RS	Application for carriage of goods, Contract of carriage; mutual settlement; information services	Service contract; cargo operations, information and logistics services; distribution and processing of goods	Export/import transportation; customs clearance of cargoes	Cargo operations with cars, shunting work
CD	Provision of infrastructure, organization and management of the transportation process, transport safety; «scheduled trains»	–	RS movement, monitoring of technical and technological capabilities of the infrastructure; accounting for the registration and layover of RS on the infrastructure	Harmonization of the application for carriage of goods, performance of transportation	Delivery of cars to the port station, transfer of information for formation of a daily plan for supply of trains to the port stations	Redemption/ origin of export/ import cargo flow; expansion of infrastructure on approaches to the port.	Uncoupling of the locomotive of JSC Russian Railways
RSO	Provision of RS, ensuring its suitable technical condition for transportation	Reconciliation of the registration and layover of RS taking into account technical and technological capabilities of the infrastructure, agency agreement	–	Provision of data on planned transportation, request for transportation of empty RS, agency agreement	Sending RS for transportation of cargoes, excess of empty RS at terminals	Sending RS for export of cargoes of cargo owner	Transfer of RS for supply/removal at port terminals, for ferry, for shunting work
CFTO	Applications for carriage of goods, contracts for services, mutual settlement, improving the quality of service; information services, declaring, cargo insurance	Formation of an order for cargo transportation services taking into account technical and technological capabilities of the infrastructure	Planning of transportation volumes, documents for carriage of goods in laden and empty cars, contracts for layover of empty RS, agency agreement	–	Transfer of information to the road logistics center RLC) for formation of a daily train supply plan for the purpose of organizing the rhythmic work of port terminals (indirectly)	Transportation planning and RLC participation for organ ization of smooth operation	Interaction in the established order in the case where SSO acts as a consignor
TSP	Loading, unloading, reloading, storage of goods; information and logistics services; processing and distribution of goods	Work with the arrived RS, reception of a cargo flow with an admission of an overload	Loading and unloading of RS; difficulty of work in connection with the excess of empty RS	Work with the arrived declared cargoes; reception of a cargo flow with an admission of an overload	–	Processing of vessels	Performance of shunting works, supply/removal of RS
P	Maintenance of safety and search of cargoes; consideration of claims and lawsuits; customs clearance of goods at customs	Redemption/ origin of export/ import cargo flow	Receipt of cars for transportation of goods	Transfer of information about planned cargo flows	Supply of arrived cargo for processing	–	Ensuring the smooth processing of cargo flow at the junction of «railway–port–sea»
EMO	Complex of freight forwarding services	Coupling of a locomotive of JSC PUL trans, shunting work	Supply/removal of RS on the track of terminals, shunting work	Interaction in the established order in the case when SSO acts as a consignor	Coordination of RS movements, shunting work, informing about the planned approach time of trains; maintenance of tracks	Ensuring uninterrupted processing of cargo flow at the junction of «railway–port–sea», round-the-clock dispatching	–
CB	Supply of vessels for transportation, interaction with the world market; issuance of a bill of lading	Supply of import, acceptance of export cargoes for organization of transportation (indirectly)	Supply of cargo for loading/unloading	–	Supply of a vessel for servicing	A service contract; providing information on the approach of the vessel and the amount of cargo; transportation of the vessel with cargo to the port	–



Pic. 1. The structure of interaction zones.

characteristics of which in the «station–port» system are: «blind» loading (when the loading stations do not always know the situation that is built up at the unloading stations), the lack of interaction between transit roads and destination road, lack of progress control and uneven arrival of cargo, a large number of abandoned trains and underload of unloading terminals.

Therefore, when developing logistics solutions in a transport hub, it is necessary to realize the principle of «pulling» logistics[2], which, in the case of rail transportation, means managing the operations of loading or sending from the initial or intermediate station solely by the actual availability of the section capacity or the processing capacity of the destination station (or consignee) and the planning of loading of goods taking into account the actual time of cargo movement.

The growth of export supplies and the problems associated with their regulation pose the task of creating a single vertical logistics management system for export freight flows to seaports.

The logistics centers, the main purpose of which is to draw up a plan for supplying trains to the port stations by the nomenclature of cargoes, ensuring the unloading capacity of at least the processing capacities of sea terminals, deal with this most effectively [5].

The best organizational solution for such a center is adherence to the principle of a «single window», which allows to realize the interaction of transport companies and terminals, provide a full cycle of interaction with customers in the formation and execution of orders for carriage of goods, as well as carry out contractual work with forwarding organizations, rolling stock owners and other transport market participants.

One of the striking examples of implementation of the «single window» principle was DAKOSY system in Hamburg[3], which provides the exchange of electronic data (EDI). From the very beginning of the design, the port considered it from the «position of needs», taking into account the point of view of the user. Today, a huge flow of information from around the world passes through the system, it is processed by more than 150 forwarding companies with the help of universal EDI-interfaces, they also manage logistics chains, involving more than 500 transport companies of the port and other participants in the transport process. For the port of Hamburg, a fast and flexible information flow in the interests of all parties is one of the most important and strong competitive advantages and can serve as a model for imitation.

The Dutch «single window» system PortBase, which services the largest port of Rotterdam, which passes 25 % of the EU's total cargo flow, provides 98 % of the information electronically in advance, even before the cargo arrives.

«Single window» of Finland PortNet closely interacts with representatives of ship owners, sea agents and serves 21 Finnish ports, while having an archive of information about all calls for the past 20 years and for six months ahead [7].

As for the information exchange in the port of Ust-Luga, here the source of preliminary information about the cargo are the sea agents. Data on vessels (arrival and departure) by means of the «single window» mechanism are received by the logistics center, the seaport administration and state control bodies. This allows to track in real time the actual location of goods, handle cargo flows in a timely manner and provide customers with a full range of transport and logistics services [6].

Conclusion. *In the long term, the implementation of the «single window» principle will make it possible to offer the most efficient tariff schemes based on the analysis of the commodity markets, the operator services market and using information and mathematical models, to offer optimal transportation terms from the client's point of view and to quickly complete the missing links of the logistics chain.*

[2] The «pulling» logistics system is movement of material resources, in which they are supplied to the next technological operation from the previous one as necessary, and therefore there is no rigid schedule for movement of material flows.

[3] https://www.hafen-hamburg.de/en.

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