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[Ahmedov* *et al.*, 6(4): April, 2017]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

FORMATION OF LOGISTICS CHAINS FOR THE CREATION OF A FUNCTIONAL MODEL OF CONTAINER TRANSPORTATION

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DOI: 10.5281/zenodo.496102

ABSTRACT

In the conditions of growth of the market of transport services in the sphere of container transportation an important stage in the development of rail container transportation is the formation of consolidated container companies. Consolidated container companies should have a network of information logistics centers and a network of container terminals for the consolidation of containers and the implementation of a linear inter-terminal service. The study of logistics chains based on the decomposition of processes for the formation of a container company led to a graphical representation of the problem. With the help of a formal model for constructing logistics chains to investigate the production activities of a container company, a functional model was created.

KEYWORDS: container company, container terminal, container flow, logistics chain, logistics center, Graph method.

INTRODUCTION

In recent years, the market for transport services in the sphere of container transport has been growing steadily, while contradictory relationships among the market participants often have a negative impact on the development of container transportations, in particular, it leads to rising their costs, reducing the competitiveness of railway container transportations on the domestic market and domestic goods on the world market.

In these conditions, an important stage in the development of rail container transportation is the formation of consolidated container companies (CCC). CCC should have a network of information logistics centers and a network of container terminals for the consolidation of containers and the implementation of a linear inter-terminal service. The main activity of the company is the organization of interterminal traffic of container trains according to the schedule and coordination of activity of other market participants.

In the different years Baginova V.V., Deribas A.T., Zubkov V.N., Kabanov E.A., Kovrov P.A., Kogan L.A., Kolesnikov V.I., Komarov A.V., Levin B.A., Mamaev E.A., Obermeister A.M., Persianov V.A., Povorozhenko V.V., Reser S.M., Smekhov A.A., Chislov O.N., Shafirkin B.I., Dingwei Wang, Wilson W. and others have made a great contribution to the theory of complex development of transport and container transportation.

FORMATION OF LOGISTICS CHAINS

Formation, management and optimization of logistics chains in the transport services market requires a combination of such provisions as customer-centricity, profitability and feasibility. On the one hand, it is necessary to offer logistics chains that reduce transportation costs for the client. To solve it, logisticians, sales agents need to maintain a databank in an up-to-date state and have an extensive network of information logistics centers. On the other hand, the company must manage container flows and car traffic volume, taking into account the minimization of its own costs for processing, accumulation and storage. Finally, the agreed requests require the provision of installed technical means and delivery in a timely manner.

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Impact Factor: 4.116
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In addition, the optimization of logistics chains has a strategic aspect: it is necessary to model the transportation and associated processes and identify bottlenecks that limit the development of the company. This can be as a shortage of receivers on the terminal complex, and the need for the development of crane tracks, the expansion of storage areas, the purchase of new rolling stock, etc. The task can be solved using simulation methods (block A-3). Having predicted the change in container flows through the terminal network, it is necessary to decide on the sequence of investment of investment resources to ensure the company's future growth.

Let us consider the enlarged scheme of transport flows in the container company (Fig. 1). It is important that for a container company any logistics chain is inseparable from the others, since the end of one leads to the release of vehicles and the beginning of another, etc.

For the formalization of logistics chains in container transport, we suggest to present the transportation process in the form of a cyclic two-graph. A two-graph G is a collection of technological states (finite set L) and technological events (finite set K). Let K_0 be the initial event, $K_з$ - the final event, then any chosen path from K_0 to $K_з$ uniquely determines the sequence of events-the protocol of the element $a \in M_{cont}$. Each technological state (storage on a container platform, transportation as part of a local train, transportation as part of a container train, transportation by vehicles, etc.) has a length in time and is limited to events K_i, K_j, where K_i is the initial event, K_j - the final event for this state.

For comfort we divide the digraph G into blocks: $P_1 \bigcup P_2 \bigcup P_3 \bigcup P_4 \bigcup P_5 = G$, where - P_1 describes the warehouse of the shipper; P_2 - terminal complex; P_3 - railway station of departure; P_4 - railway station of arrival;

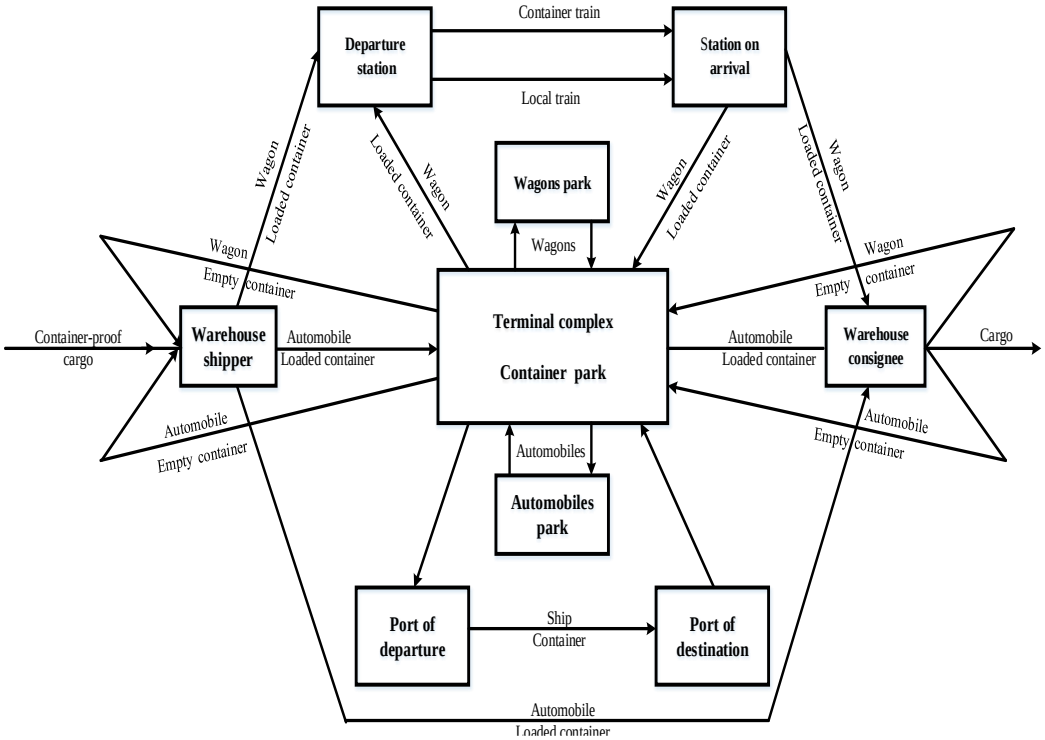

Figure 1. Transport streams of the container company

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P_5 - warehouse of the consignee. Table 1 and Fig. 2 describe the block P_1.

We consider the beginning of the logistics chain as: the arrival of the date of loading established by the contract for the provision of services, in the event of the possibility of accumulation of sending of various levels, this event coincides with the moment of completion.

Table 1. List of technological states and events of P_1

Condition		Event	
Code	Name	Code	Name
	Accumulation of container shipments	K0	Date of loading on request, completion of accumulation of dispatch
L1	Follow-up for loading, wagon	K1	Wagonsetting on the loading path
L2	Follow-up for loading, car	K2	Car setting for loading
L3	loading, wagon	K3	End of loading on the wagon
L4	car loading	K4	End of loading on the car
L5	Follow-up to the terminal complex	K5	Car unloading
L6	Follow-up to the consignee's warehouse	K6	Car unloading

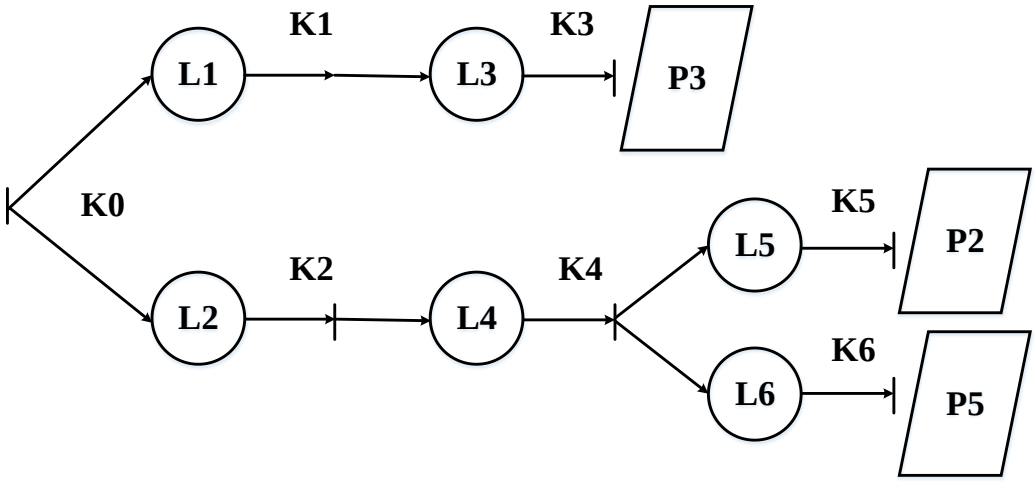

Figure 2. Shipper's warehouse block

Table 2 and Fig. 2 describe the block.

Table 2. List of technological states and events P_2

Condition		Event	
Code	Name	Code	Name
1	2	3	4
		K1	Car setting for unloading
		K1	Wagonsetting for unloading
		K1	Ship setting for unloading
L1	Overload on the "direct option" on the wagon	K2	End of loading on the wagon
L2	Unloading the container to the container site	K3	Termination of unloading to the container site
L3	Unloading to container yard	K3	Termination of unloading to the container site

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L4	Overload by "direct option" to the car	K4	- end of loading on the car
L5	Overload on the "direct option" to the ship	K5	End of loading to the ship
L6	Overload on the "direct option" on the wagon	K2	End of loading on the wagon
L7	Unloading the container to the container site	K3	Termination of unloading to the container site
L8	Container storage and accumulation at the container site	K6	End of storage and accumulation
L9	Loading container to the carriage from the site	K2	End of loading on the wagon
L10	Loading container to the car from the site	K4	End of loading on the car
L11	Loading of the container onto the ship from the site	K5	End of loading

Accumulation of sending of the appropriate level. The states L_1 , L_2 , of container loading with the cargo on board a wagon or a car can be replaced by installing an already loaded own container on board if there is an exchange park of containers in the enterprise. The events K_3 , K_4 , K_5 that are output for this block are input to the blocks, P_2 , P_3 , P_5 .

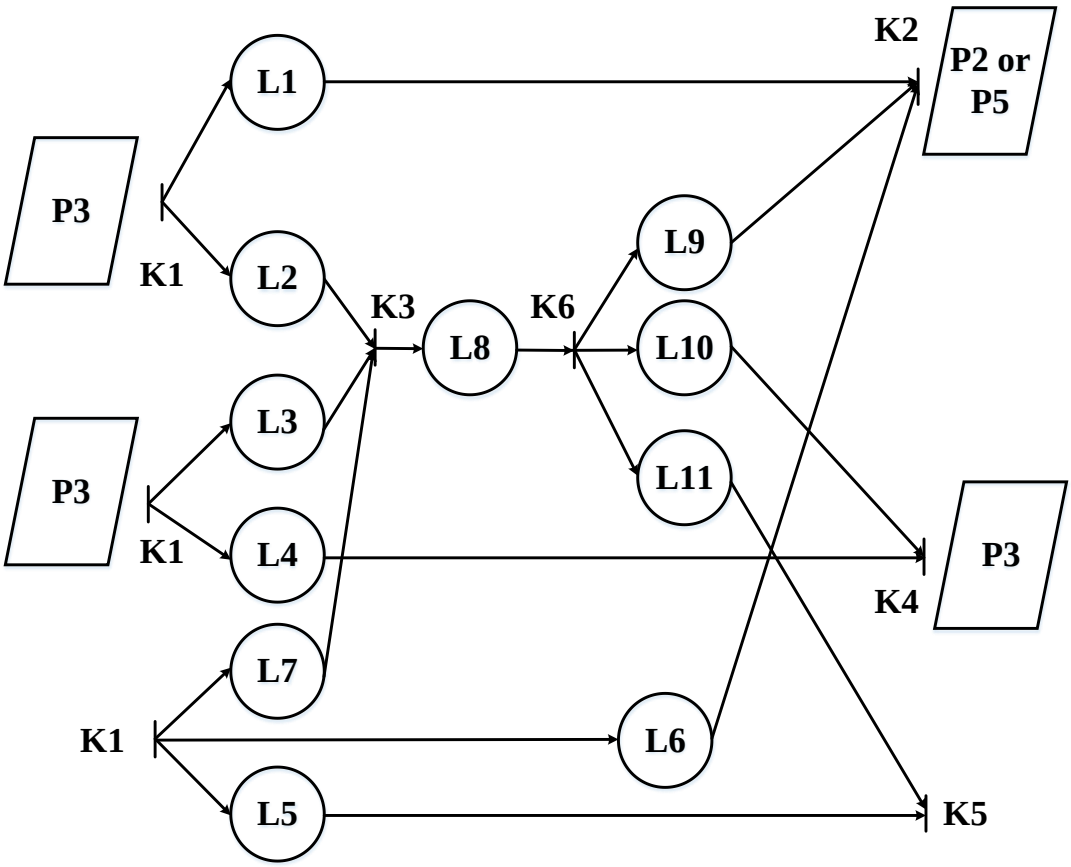

Figure 3. Block terminal complex

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In this block, it is carried out storage of containers, transshipment of loaded and empty containers from one vehicle to another one by the "direct option" or through the terminal, etc. In addition to changing the mode of transport: railway - automobile, railway - water, automobile - water, there can be a variant railway - railway for example, on the basic container terminal.
Table 3 and Fig. 4 describe the block.

Table 3. List of technological states and events P_3

Condition		Event	
Name	Code	Name	Code
		K1	End of loading on the wagon
L1	Car cleaning from the crane track	K2	Arrival to the departure park
L2	Formation of composition	K3	Train fencing
L3	Technical and commercial inspection	K4	End of inspection
L4	Waiting for the locomotive, transferring documents, testing the brakes and unloading the train	K5	The train is ready for departure
L5	Waiting for the train schedule	K6	Dispatch of a container as part of a freight train

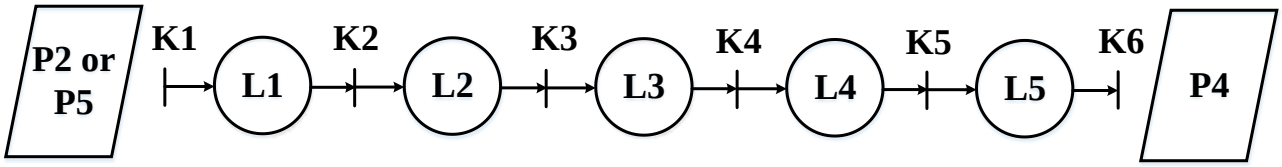

Figure 4. Block of railway station for departure

Block of railway station on departure describes the states and events from the moment of loading the container onto the wagon on the crane track until it is sent to the train traffic schedule as part of the freight train. Table 4 and Fig. 5 describe the block P_4.

Table 4. List of technological states and events P_4

Condition		Event	
Code	Name	Code	Name
		K1	Arrival at the station
L1	Fastening the train, waiting for the locomotive to disengage	K2	Fencing the train
L2	Technical and commercial inspection	K3	End of inspection
L3	Disassembly of a train	K4	Termination of dissolution
L4	Car delivery on the unloading track	K5	Wagon setting for unloading

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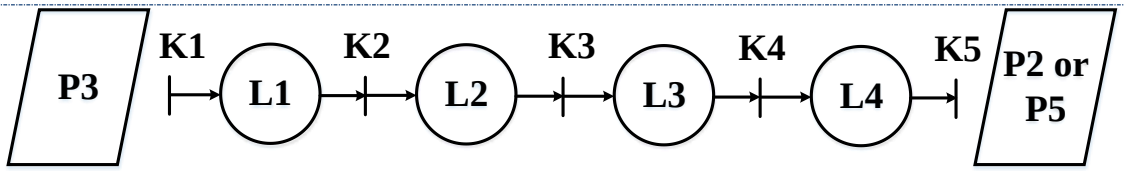

Figure5. Block of railway station on arrival

The wagon, with the container arriving at the station, can be sent to the crane runway for transshipment - the block of terminal complex, on the unloading path for the delivery of cargo - the warehouse block of the consignee or in the case of passing the station by a set of containers to the wagon in transit - to the block of railway station on departure. Table 5 and Fig.6 describe the block.

Table 5. List of technological states and events P_5

Condition		Event	
Code	Name	Code	Name
		K1	Wagon setting for unloading
		K1	Car unloading
L1	Unloading a wagon	K3	End of unloading
L2	Unloading a car	K3	End of unloading

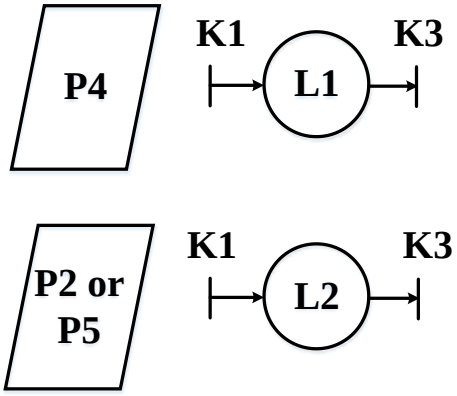

Figure 6. Block of consignee's warehouse

The concept of the beginning and the end of the logistics chain for the container company is conditional, because the integrated logistics chain is formed from a variety of private logistics chains. For example, for an object of a car, after the container is unloaded onto the site, the logistics chain ends and a new one begins. The proposed scheme for formalizing logistics chains can be supplemented depending on the complexity of the logistics chain. For example, when consolidating a container shipping team in a warehouse of a container company, the Consolidation Warehouse Block is added, if the warehouse belongs to the forwarder, then for the container company the forwarder acts in the role of the consignor.

FORMATION OF FUNCTIONAL MODEL OF CONTAINER TRANSPORTATION

To study the management of production activities of the container company, we presented a functional model, for the visualization of which to use the methodology IDEF0, developed by Douglas T. Ross. This methodology is a clearly formalized approach to the creation of functional models - the structural diagrams of the system under study. The separation of information and material flows of incoming and outgoing is due to different ways of managing them. By means of vehicles here it is meant wagons, cars, ships, containers. Figure 7 shows the main processes in the container company.

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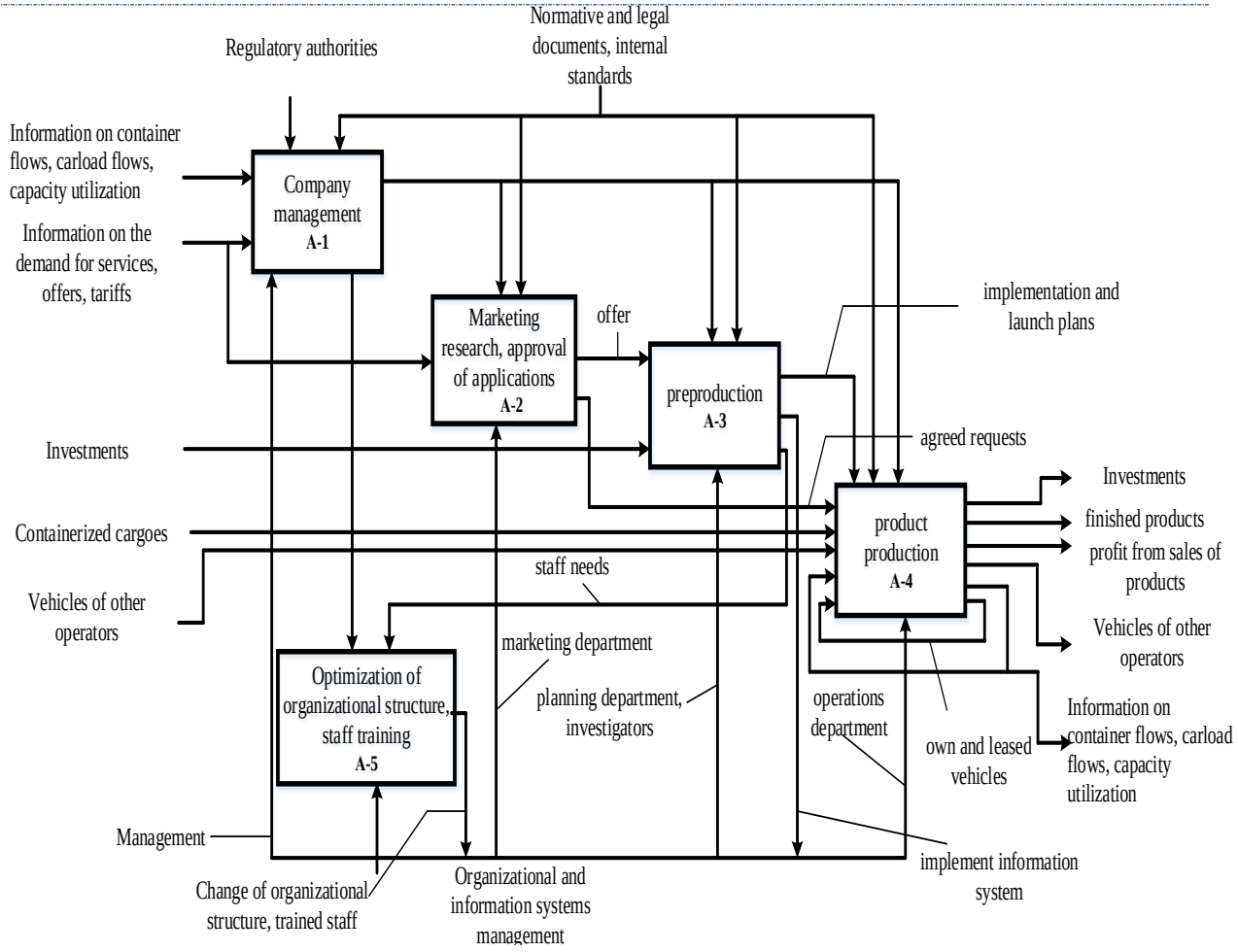

Figure 7. The main processes associated with production activities

In Figure 8, it is considered block A-4: block A41 is the most important block, it specifies the parameters of the transport network, plans and manages the flows of the container company; In the A42 block, it is conducted the transportation of own containers, special platforms, as well as those attracted from outside, including by trailing container trains and flexible tariffs for rail transport; Block A-43 - carries out transportation by road and by water transport; Block A-44 provides multimodality and seamless transport, transshipment of containers from one type of transport to another, as well as storage of containers at terminals. Agreed bids by marketers, container loads and vehicles of other operators are the input streams for the A-4 block.

To optimize the passage of all container traffic involved in the activity of the container company through the network of terminal-warehouse complexes, the target functional can be used which includes the costs of organizing permanent container messages between nodes of the network, loss of cost and time associated with the accumulation and processing of cargo traffic, as well as the resulted costs for the development of capacities and resources of the nodes.

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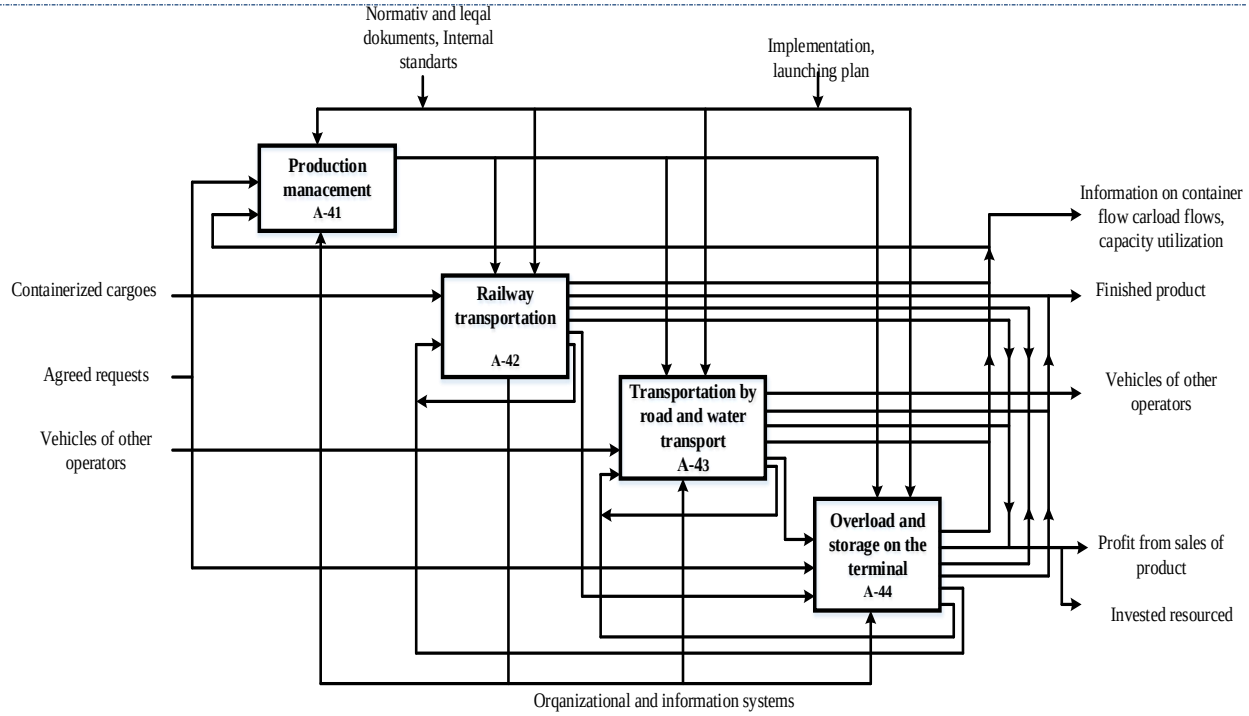

Figure 8. Production of the products

CONCLUSION

Thus, based on the above factors, we can draw the following conclusions:

An important step in the development of rail container transportation is the formation of a consolidating container company. The study of logistics chains based on the decomposition of processes for the formation of a container company led to a graphical representation of the problem. With the help of a formal model for constructing logistics chains to investigate the production activity of a container company, a functional model has been created, the sequential decomposition of which has made it possible to identify the interrelationship of the blocks for solving the problem of producing a quality transport-logistic product.

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