Increase of efficiency of methodical maintenance of seaport work

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Summary. In article the work of transport service department of port is considered. The analysis of the documents necessary in the course of cargo operations is carried out. Dependence of level of methodical maintenance of technological process and economic efficiency of work in port is revealed. A variety of the factors influencing efficiency of reloading works, has found the reflexion in dependence of lay time of a vessel and time for performance of works at each stage of cargo process. For the purpose of definition of level of expected effect from application of information technologies the analysis of time of processing of the standard documents accompanying processes of transfer of cargoes in port is carried out. As a basis for the analysis the documents made and processed by transport service department of port in the course of registration of import and export cargoes are taken. The documents accompanying performance of treaty obligations of port before clients and the state structures are analyzed. The port overall performance depends on a turnover of goods and accordingly from quantity of the processed courts. In this case it is not important, loading on a vessel (export) or unloading (import) takes place. Dependence of quantity of processed courts on time is reward size. Also, dependence of time components of lay time of a vessel on use of means of information systems in reloading process of port is shown. The model of the analysis of the factors influencing process of economy of lay time of courts is offered. The scheme of interaction of transport service department with various structures both in port, and with external clients is described.

Use of systems of digital data processing in processes of preparation of documentary base is applicable for many technological processes and is universal algorithm on increase in efficiency of activity of the enterprise.

Key words: vessel, loading, port, the document, the forwarding agent.

INTRODUCTIONS

At the present stage it is necessary to consider as efficiency of development of a national economy, a heavy use of the created industrial potential, control system and economic mechanism perfection. The intensification of national economy developments is integrally connected with optimization of work of all types of transport and separate enterprises and links of transport system of the country. The overall performance of sea transport in many respects depends from coped works of its two basic links: the transport fleet which is carrying out transportation of cargoes, and seaports which carry out transfer of cargoes from one type of transport on another [1].

Perfection of the organization of processing of vehicles in ports first of all assumes perfection of a control system and the production organization [10]. It defines a special urgency theoretical and the applied researches directed on the decision the problems of increase of level of organization and efficiency of functioning of control systems by processing of vehicles in seaports. At the present stage of functioning of domestic seaports in the conditions of dynamically changing goods traffics special value gets the balance of works and used resources of port, an effective utilization of available resources of port for production realization.

The organization of process of processing and service of a separate vessel and set of courts is based on certain requirements, rules, the norms confirmed and installed at the international, national and operative levels. At level of a separate organizational unit it is possible to speak about methodical maintenance of work of port at operative level [11]. In this case from quality of methodical maintenance, from execution level on all sites of technological process the overall performance of all organizational unit will depend.

Mutual relations of ports, ship-owners, and also consignors and consignees is characterized by such concepts as processing of a vessel, service of a vessel, lay time and vessel lay days in port.

The greatest influence on total cost of spent operations renders lay time of a vessel [2] - all time of a arrival of the vessel in port from the moment of its arrival to port, i.e. the termination of mooring of a vessel to a pier or its statements on an anchor within port waters under instructions of port till the moment of its exit from port, i.e. the beginning disconnection a vessel from a pier or its removal from an anchor.

RESEARCH MATERIALS

Because technological processes of port are accompanied by certain documents circulation the operative coordination of the actions connected with loading-unloading of courts depends on speed of information interchange, preparation of necessary documents and, accordingly, time of processing of courts and performance of the cargo plan of port. According to requirements of the Ukrainian legislation [3, 6], function of the account of receipt and sending of cargoes, registration of the commodity-transport documentation and its dispatch to destination, official registration of papers and the organization of works according to customs, quarantine and sanitary requirements are assigned to transport service department of port. The list of documents, involved in preparation and processing, include such as:

- The contract on transportation by the railway;
- The contracts on transferring cargo and service of transport department;
- The delivery certificate;
- The certificate of the general form;
- The declaration on cargo;
- The order on loading;
- The cargo plan;
- The manifesto;
- The bill of lading;
- The tallyman receipt;
- The cargo customs declaration;
- The contract on quarantine of plants;
- The notices to foreign consignee;
- The hatch notes;
- The specification;
- The commodity documents and other documents.

The list is extensive enough. Thus, at the majority of documents are present repeating dates (names of courts, clients, names and quantity of cargoes, bank requisites and other) when repeat filling can be carried out with the errors and elimination will demand additional time. Accordingly, from speed of processing of the information, speed of performance of registration operations, speed of registration of transport documents, speed of processing of courts port will depend.

Application of methods of the automated processing and data transmission, and also association of information streams of management and industrial divisions raises reliability of data and accelerates decision-making, accordingly positively influences a continuity of the schedule of work of port [12, 23].

It is necessary to notice, that shipping documents for courts should prepare and be handed over by port of administration of a vessel before the beginning of cargo works [2]. After the termination of loading the port is made the executive cargo plan [4] corresponding to actual loading of a vessel, subscribes the captain of a vessel, by port and is sent in appointment port (ports). For the account of the lay time actually spent by a vessel in port, the vessel together with port conducts time-sheet. In time-sheet in a chronological order are fixed in hours and minutes (to accuracy 5 minutes) all industrial operations both all delays and breaks in processing of a vessel with description of the reasons and durations [15].

Economic efficiency of cargo handling of port depends on use of modern transmission and data processing, the correct account of the involved resources. Thus, it is provided not only maintenance of a continuity of reloading works, but also there is a possibility of increase in a goods traffic at the expense of decrease the time intervals between arrival of courts. The system of a turn of data properly organized and described in methodical documents at the enterprise and as result timely actions of management provide minimizing of unproductive idle times of technics and payments demurrage in case of a vessel delay.

RESEARCH ANALYSIS

In Vetrenko L.D.'s [1] works, Makeevoj J.N. [2], Aksjutina L.R. [4], Pluzhnikova K.I. [5], Snopkova V. I [8], Бауэрсокса Д [9], etc. it was repeatedly spoken about processes of transfer of cargoes in ports, and also about service on transport. Basically the attention to documentary maintenance of processes is paid. However the question of acceleration of document circulation at the expense of use of information systems in the financial and commodity account as link of interaction of a vertical divisions in port, is considered insufficiently.

RESEARCH OBJECT

Article purpose - search of ways of improvement of methodical maintenance of work of port by use of systems of information data processing, interrelation revealing between processes of preparation of the documents accompanying processes of transfer of cargoes, with use of information technologies, and increase of speed of processing of courts.

RESULTS OF RESEARCH

The port carries out loading, and the vessel accepts cargoes according to the maked by port and the confirmed captain of a vessel the cargo plan, on bill of lading of parties. In case of default of the specified requirements and a delay in this connection manufactures of cargo works the port pays penal sanctions to the ship-owner. Time of performance of cargo operations is the size dependent on quality of technological equipment of reloading process. In turn, from preparation of corresponding documents and reporting drawing up depends from level of use of information technologies.

A variety of the factors influencing efficiency of reloading works, has found the reflexion in dependence of lay time of a vessel from the time for performance of works at each stage of cargo process [2, 14]:

$$T_{st} = \sum(t_i) \tag{1}$$

where: t_i – time (seconds) performance of works at each stage of cargo process, such as:
- the cargo time used for loading-unloading of a vessel;
- time for performance of the auxiliary operations connected with processing of a vessel;
- time for performance of auxiliary operations on vessel service;
- time of breaks in loading-unloading of a vessel because of a bad weather;
- time of parking of a vessel in expectation of the beginning of the account of lay days;
- the time when vessel delays for the various reasons for which the port answers;
- the time when vessel delays for the various reasons for which the vessel answers.

Time spent for each operation, depends on technological equipment of process, and also from depth and completeness of use of information means. Accordingly, in

case of use of information technologies in documents circulation, it is possible to expect decrease the time of making the technological documentation and preparation of primary documents and bills.

For the purpose of definition of level of expected effect from application of information technologies the analysis of time of processing of the standard documents accompanying processes of transfer of cargoes in port is carried out [13, 16, 17]. As a basis for the analysis the documents made and processed by transport service department of port in the course of registration of import and export cargoes, and also the documents accompanying performance of treaty obligations of port for clients and the state structures are taken.
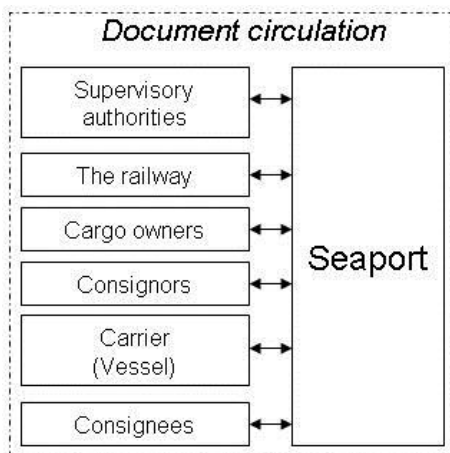
The Transport service department of seaport is operatively-industrial division of port and was created for the organization and realization of transport service work in port.

Division work is spent to interrelations with operational, economic, financial services of port, commercial department, cargo handling areas, legal service [22].

The Transport service department in the work is guided:
- The rules of Seaport,
- The charter of port,
- The code of trading navigation,
- The law On the enterprises of Ukraine,
- Rules of transportations of export-import and transit cargoes,
- Other standard documents regulating work of transport,
- Decisions and Orders of the Ministry of transport of Ukraine and Department of sea and river transport of Ukraine,
- Contracts with clientele, transport service firms, the agency companies,
- Orders of the chief of port.

In the course of documents circulation the transport service department of port constantly co-operates with various structures both in port, and with external clients (Fig. 1).

Fig. 1. The scheme of documentary interaction of transport service department of port

Frequently, in the course of movement from the manufacturer to the consumer, cargo and accompanying documents pass numerous processing. Cargo can change the form of transportation and carriers, and data in documents can be supplemented and specified. In this connection, the correctness of data and the authentic accounts have vital importance for decrease in expenses of time for processing and creation of new documents.

During research it is defined, that each document consists of the standard text for certain cases (the form of contracts, forms of accounts, the reporting etc.) and the information specified depending on a kind of the document. Thus, the changeable information is often used repeatedly and repeat in various documents. Thus, for manufacturing of the demanded document the operator (forwarding agent) should use a standard kind (form) of the document, time of which preparation of the form aspires to zero because of its universality, and also to bring in it demanded data manually, having spent the quantity of time depending on a kind of the document. In case of processing of the documents made not by the operator, time for carrying over of the data containing in the document in an electronic format or in registration system also is required [21].

Modeling of process of entering of non-standard data has shown, that time of processing or creation of the standard document occupies on the average from 145 till 3270 seconds depending on a situation. In the course of the analysis the frequency of processing documents was not considered because the given factor depends on quantity of courts processed by port, cargoes, clients under contracts. Results of the analysis are presented in Table 1.

Table 1. Time of processing of repeating data at creation or processing of standard documents

№	The document name	Type of use of the document	Time, sec.
1.	The contract of transportation RW transit through Port	Creation	575
2.	The contract of transportation RW	Processing	575
3.	The contract on transfer of cargo and transporting service	Creation	440
4.	The transfer certificate	Creation	1630
5.	The certificate of the general form	Processing	185
6.	The declaration on cargo	Processing	720
7.	The order on loading	Processing	3270
8.	The cargo plan	Creation	155
9.	The manifesto	Processing	805
10.	Bill of lading	Processing	280
11.	The tallyman receipt	Creation	1225
12.	The cargo customs declaration	Processing	1790
13.	The contract on quarantine of plants	Processing	145
14.	Documents on an origin of the goods and other documents	Processing	1050
All, sec.		Creation	4025
		Processing	8820
All, %		Creation	31,3
		Processing	68,7

It is necessary to consider, that the list of the analyzed documents is not full and reflects only time dependence [20, 24]. Thus the data coming together with processed documents and which will be used subsequently for drawing up of new documents, in the given special case occupy almost 70 %.

Also, data in table 1 visually show considerable time expenses for document circulation in the organization of reloading process of port.

In spite of the fact that the majority of documents by transport service department only are processed (68.7 % of total of data), more detailed analysis of document is showing, that among created documents the most part (74.8 % of data in created documents) occupy the sea documents intended for a carrier, port of an unloading and consignee (Fig. 2).
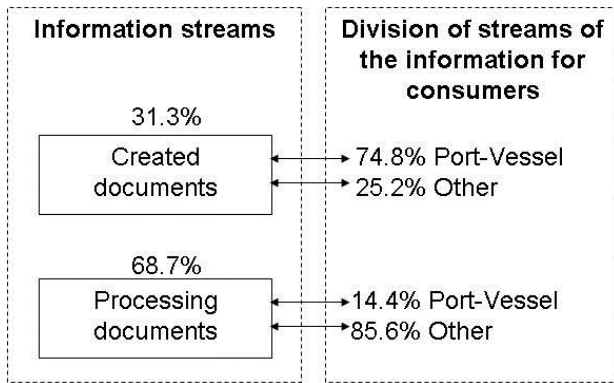
Fig. 2. The scheme of proportional division of information streams

It is necessary to pay attention, that 85.6 % of processed documents are used by other consumers. It means, that work will depend on a data input correctness and other divisions of port (port management, financial divisions, commercial divisions, warehouse divisions), and external consumers of information data flows.

Use of information technologies at drawing up and data processing of documents can be expressed economic benefit of decrease in expenditures of labour, and also increase in throughput of port in the form of growth of a turnover of goods [18, 26]. Here influence on time parameter of function of calculation of lay time of a vessel (Eq. 1) is carried out as time spent for preparation of the documentation on cargoes, directly influences duration of a staying of a vessel in port.

The port overall performance depends on a turnover of goods and accordingly from quantity of the processed courts. In this case it is not important, loading on a vessel (export) or unloading (import) takes place. Dependence of quantity of processed courts on time is inverse value (Eq. 2):

$$K_s = \sum_j \frac{T_{per} - T_{0j}}{T_{stj}} , \qquad (2)$$

where: K_s – quantity of the courts processed during time on piers j, piece, j – piers of port, piece; T_{per} – the general accounting period of time, sec.; T_{stj} – average lay time of a vessel at a mooring j, sec.; T_{0j} – time of a beginning of a mooring j in not loaded condition (the vessel is not processed), sec.

Having regulating influence for the period of vessel parking, it is possible to change an indicator of efficiency (turnover of goods) of port [19, 25]. In this case, [7] it is possible to present lay time of a vessel in the form of the function depending not only from time of performance of each stage of loading/unloading of a vessel, but also from time spent for process of documents circulation (Eq. 3):

$$T_{st} = \sum_i (t_{oper} - t_{econ}), \qquad (3)$$

where: T_{st} – lay time of a vessel, sec.; i – quantity of operations making the general time of processing of a vessel, piece; t_{oper} – time of performance of operation of processing of a vessel, sec.; t_{econ} – time saved in process of documents circulation at the expense of use of means of information data processing, sec.

By the maximum economy of time at a documents circulation stage it is possible to achieve the general decrease in lay time of courts and accordingly increase in a turnover of goods of port. The economy is reached by one-time data input with the subsequent extraction according to demanded algorithms of use in concrete documents.

Thus economy time depends on set of the factors [27] analyzed during research, such as: document type; the parties participating in filling of the document; an orientation of cargoes (export/import); repeatability of data in drawing up of one document; use of data in other documents; a document orientation (it is created or only is processed) and other factors.

The approach of construction of the determined model of the factor analysis has been applied to a communication between influencing factors in the form of the algebraic sum of influencing indicators [28] (Eq. 4):

$$Y = \sum_{i=1}^{m} z_1 \cdot (n_{1j} \cdot t_j + n_{2j} \cdot t_j) + \\ + \sum_{i=1}^{k} z_2 \cdot (n_{1j} \cdot t_j + n_{2j} \cdot t_j) \qquad (4)$$

where: Y – required time of economy, sec.; m, k – quantity of processed courts in directions export/import, piece; z_1 – quantity of cargo parties on export, piece; z_2 – quantity of cargo parties on import, piece; n_{1j} – quantity of created documents j-th kind, piece; n_{2j}- quantity of processed documents j-th kind, piece; t_j- data processing time j-th document, sec.

Distinctive feature of the developed multifactor model consists that she allows to analyze all complex of indicators influencing time of processing of documents and as a result gives the information on character of interdependence of organizational and economic operations, providing thus integrity of representation about all organizational-time system of process of an overload.

CONCLUSIONS

1. During research the dependence of time components of lay time of a vessel from application of means of information systems in reloading process of port is defined.
2. The model of the analysis of the factors influencing process of economy of lay time of courts and as consequence on economic efficiency of work of port is offered. Use of systems of digital data processing in processes of preparation of documentary base is applicable for many technological processes and is universal algorithm on increase in efficiency of activity of the enterprise.
3. The additional effect from use of electronic data in settlement programs (formation disbursement accounts, calculations of placing and fastening of cargoes, logistical warehouse modules, dispatching programs) can be received.
4. Introduction of modern information systems in process of data processing and creation of corresponding methodical maintenance will allow to raise a turnover of goods and general efficiency of activity of seaport.

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ПОВЫШЕНИЕ ЭФФЕКТИВНОСТИ МЕТОДИЧЕСКОГО ОБЕСПЕЧЕНИЯ РАБОТЫ МОРСКОГО ПОРТА

А. Пархотько

Аннотация. В статье рассмотрена работа транспортной экспедиторской службы порта. Проведен анализ документов, необходимых в процессе грузовых операций. Выявлена зависимость уровня методического обеспечения технологического процесса и экономической эффективности работы порта. Разнообразие факторов, влияющих на эффективность перегрузочных работ, нашло свое отражение в зависимости стояночного времени судна от времени на выполнение работ на каждом этапе грузового процесса. С целью определения уровня ожидаемого эффекта от применения информационных технологий проведен анализ времени обработки стандартных документов, сопровождающих процессы перевалки грузов в порту. За основу для анализа взяты документы, составляемые и обрабатываемые транспортно-экспедиторской службой порта в процессе оформления импортных и экспортных грузов. Проанализированы документы, сопровождающие выполнение договорных обязательств порта перед контрагентами и государственными структурами. Эффективность работы порта зависит от грузооборота и соответственно от количества обработанных судов. В данном случае не важно, имеет место погрузка на судно (экспорт) либо разгрузка (импорт). Зависимость количества обрабатываемых судов от времени является обратной величиной. Также, показана зависимость временных составляющих стояночного времени судна от использования средств информационных систем в перегрузочном процессе порта. Предложена модель анализа факторов, влияющих на процесс экономии стояночного времени судов. Описана схема взаимодействия транспортной экспедиторской службы с различными структурами как внутри порта, так и с внешними абонентами.

Использование систем цифровой обработки данных в процессах подготовки документальной базы применимо для многих технологических процессов и является универсальным алгоритмом по увеличению эффективности деятельности предприятия.

Ключевые слова: судно, погрузка, порт, документ, экспедитор.