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STRATEGIES AND OPERATION PRINCIPLES OF LOGISTIC INFORMATION SYSTEMS

Abstract: Over the last few years the so-called new logistic technologies are rapidly developed. Information systems hold the central position in these technologies. Development of logistics in the developed countries not least are stimulated with the need of fast reaction of producers to market condition, aspiration to adapt in the changing situations in short time. The central idea of logistics is planning, management and control of entrepreneurial activity, all material and information flows connected with this activity. Information systems in logistics assume fast appropriate response to the market demand, tracking delivery time, optimization of functions in chains of delivery and supply.

The research of modern backbone of information technologies in logistics is conducted in this article. Modern information technologies in logistics are analyzed. Modern technologies of information data processing in logistic streams and creation of logistic information technologies are also considered in the article. Some types of information technologies in logistics, structural principles and principles of operation of logistic information systems and also problems in the process of creation of logistic information technologies are described.

The article is addressed to a wide range of researchers and experts in the field of logistics and information technologies.

Keywords: logistic technologies, information and computer technologies, information flows, logistic information system, information processing, Electronic Data Interchange, information support, software, hardware, planned information systems, dispositive information systems, executive information systems

Introduction

Over the last few years new logistic technologies without which it is difficult to carry out activities of any enterprise are rapidly developed.

In modern logistics the use of information technologies is an integral part. Nowadays it is difficult to imagine work formation and organization of process of goods delivery without timely exchange of information and without quick response to the requirements of market. Today it is almost impossible to provide quality of goods and services which are demanded by the consumer, without using modern information systems and program complexes for planning,

analysis and support of commercial decision making in logistic system. And just due to the development of information systems and technologies logistics became the prevailing form of the organization of merchandise flow on the markets with high competition in economically developed countries.

In modern logistics information systems and information technologies are usually meant as a complex of program technical means and methods of production, processing, transfer and consumption of information in the systems which provide merchandise flow. The main direction in information technology development in logistics is integration of information flows and communication support transportation of goods. These directions are connected with integration processes in economy of the countries with high development and represent new scientifically practical direction telematics.

Any manufacturing enterprise is an open system which is connected with suppliers, consumers, dispatchers and transport organizations by material and information flows. Such connections define some failures in implementation of activity by each of participants in the general system of cooperation (partnership). Therefore, information support of logistic management is one of the most important and relevant directions. Owing to successful management of information flows it is possible to reduce warehousing and also due to exchange of information it is also possible to accelerate transportation.

At the bottom of management process of material flows lies the information processing circulating in logistic systems. A necessary condition of the coordinated work of all sectors of a logistic chain is the existence of information systems which similar to the central nervous system, are able to bring quickly and economically the necessary signal to the necessary point at the right time. One of the most important conditions of successful functioning of production in general is the existence of such information system which would allow to connect together all the activity (supply, production, transport, warehousing, distribution, etc.) and to operate it proceeding from the principles of a single whole.

Results and Discussion

The relevance of introduction and application of information technologies in logistics is connected with continuous growth of the volume of data, which are subjected to processing. In the habitual, classical ways, as far as is necessary, it is already impossible to take the required information from a data flow and it does not allow to apply it for company management. The most important factor in management is the speed of data processing and obtaining of the necessary information. Information circulation affects effective management of the company more seriously, and respectively its economic progress. In addition, even more often information began to be called "strategic raw material". In the developed western countries expenses on information surpass expenses on energy.

And at reasonable, correct approach these expenses yield the results. Labor productivity is significantly increased by modern information technologies, which are constructed on the basis of application of intellectual data processing and concepts of information warehouses.

In response to necessary information and availability of modern technologies of its processing in logistics systems, the firm will be able to gain quite good profit. Therefore, logistics divisions, which successfully function, put computerization in a priority and consider it as an important source of realization of logistics potential opportunities in financial aspects. If networks of Electronic Data Interchange with potential consumers are used, then the enterprise will be able to increase significantly its competitiveness and market share.

Introduction of means of information technologies in logistics is focused on providing merchandise flow and interaction between divisions of the company and also between firms in procurement process and distribution of goods. And therefore, proceeding from it, as the

main direction of a research it is necessary to accept division of logistics systems according to the phases of a material flow with characteristic of the providing functions of logistics (transportation, stocks). It is important to note that information technologies in itself in practice of the organization of merchandise flow have no value. That is usual purchase, and installation of expensive specialized software will not be able to lead to the solution of problems of the company in the field of logistics. And in order that the logistics system of management yielded positive result, the detailed description of all physical processes and only then the introduction in the existing system of the computer program or development of the effective software is required. The effective software becomes only in cases when in the process of introduction and operation programmers and consultants collect all responses and wishes from users, perform the corresponding analysis, choose suitable decisions and finish the program already for the concrete company.

Use of the computer equipment and the modern software allows to improve considerably the speed and quality of management decisions. The current state of logistics and its development was in many respects created due to the rapid development and introduction to all spheres of business of information and computer technologies. Realization of the majority of logistic concepts (systems) such as SDP, JIT, DDT, and others would be impossible without the use of high-speed computers, local area networks, telecommunication systems and information software.

The various information flows circulating inside and between elements of logistic system, logistic system and the external environment form a peculiar logistic information system which can be defined as the interactive structure consisting of personnel, equipment and procedures (technologies) united by the connected information used by logistic management for planning, regulation, control and analysis of logistic system functioning.

If in an information system the automated information processing is carried out, then technical support includes the computer equipment and means of communication between computers.

Extensive penetration of logistics into the sphere of production management in essential degree is obliged to computerization of management of material flows. Computer became a daily instrument of labor for workers of the various specialties, people learned to treat it, it was believed. The software of computers allows to resolve in each workplace difficult questions on information processing. This ability of the microprocessor equipment gives the opportunity to approach from system positions the management of material flows, providing processing and mutual exchange of large volumes of information between various participants of logistic process.

At the realization of logistics functions the main directions of the work program are made at the enterprise:

- technical means for performance of a program task are defined;
- requirements to qualitative characteristics are drawn up and the necessary volume of financial and human resources is defined;
- basic methods of formation of program tasks are defined;
- organizational form of implementation of program tasks is chosen;
- network model of stages and works performance is drawn up;
- the system of evaluation criteria and motivations of actions is developed;
- control, account and assessment of work flow are organized.

The logical system on production is effective only when conditions for its integration into the current production and commercial processes are created. This problem is solved by creation of information basis corresponding to this kind of production and its volume and other characteristics of production structure of the enterprises. Also "relevant reviews"

of funds (existence of the actual and planned orders, the maintenance of production main and intermediate warehouses) and terms (deliveries, processings, waiting periods, idle times, deadline management) refer to it. For collecting these data the production system has “sensors and measuring tools” along the entire enterprise which control volumes and terms of the current processes.

Nowadays technologies of paperless information exchange are widely extended between partners. In transport instead of numerous documents accompanying freight (especially in the international transport) synchronously with freight information which contains all necessary characteristics of goods and company details about each sent unit is transferred by communication channels (Internet). At such system on all sites of a route it is possible to obtain comprehensive information on freight at any time and on the basis of it to make management decisions. The logistic system gives the opportunity to the consignor to get access to the files which reflect condition of transport services and transport loading.

The automatic documental exchange between producers of goods and large shops including exchange of delivery documents and transport offices at the direct sending of goods from the producer to the buyer is possible. By means of technology of paperless information exchange the buyer can directly place orders for purchase.

Electronic Data Interchange is the process which allows to connect by means of computers between the companies, to make a deal with the help World and local area networks which will directly organize interaction between computers of various companies. To realize these opportunities, the companies sign standard protocols of exchange and set up contracts with each other.

Significant element of any logistic technology is the subsystem which provides information passing and processing which is developed on closer examination in the complex information system consisting of various subsystems. As well as any other system, information system must consist from orderly interconnected elements and possess some set of integrative qualities. Decomposition of information systems on constituent elements can be carried out differently. The most frequently information systems are subdivided into two subsystems: functional and sustaining.

The functional subsystem consists of set of current tasks grouped according to mutuality of purpose. The sustaining subsystem, in turn, includes the following elements:

- technical support, i.e. set of technical means which provide processing and transfer of information flows;
- information support which includes various reference books, classifiers, codifiers, means of the formalized data description;
- software, i.e. set of methods of functional tasks solution.

Logistic information systems, as a rule, represent automated control systems for logistic processes. Therefore software in logistic information systems is a complex of programs and set of programming software providing the problems solution of management of material flows, word processing, obtaining reference data and functioning of technical means.

Link organization between elements in information systems of logistics can significantly differ from the organization of traditional information systems. It is caused by the fact that information systems have to provide comprehensive integration of all control elements of a material flow, their operational and reliable communication in logistics.

Computers are also applied in some links of logistic chain for difficult technical processes management and for their control. In the field of economic control, on the contrary, the regulator role (decision-making prerogative) is reserved by a human-being, and the computers provide him the necessary information. For management of operational logistic processes and for their control the dialogue with the electronic computer in online mode which allows to

minimize time of the regulator reaction is important. For economic control it is often sufficient periodic batch processing.

Due to miniaturization and cost-cutting of computers their decentralization becomes possible, i.e. an approach to workplaces. Decentralization of the electronic computer allows to reduce data transfer volume significantly. Dataset on logistic processes can be processed independently right in this division, for example, in a warehouse. The basic idea of creation of the decentralized databases is an opportunity to make decisions in place at information relatedness of all decentralized divisions.

The interconnection of computer aids in the territory of the enterprise or between several close located parts of the enterprise (for example, in one city) is implemented, as a rule, by the fixed line intended only for this purpose. Some part of the communication line route of mobile means and onboard computers is wireless. The electronic computer and subscriber stations are connected in so-called local networks.

The complexity of software creation is becoming the limiting factor for use of the electronic computer in recent years. Therefore one usually aspires to simplify and increase labor productivity of programmers on the one hand, on the other hand, to create application program packages of wide use suitable for different (especially personal) electronic computers and rather easily adapted to particular conditions of the user.

According to the specialists' research, 10-20% of all logistic expenses are fallen on logistic information systems. The hardware prices in the world are quickly going down; the rate of the electronic computer capacity [1] to their price is growing. It must be kept in mind that computing systems are not universal cure for badly controlled operations. Besides, with the uncontrolled use of new information technologies there is an easy overflow of excessive information and as a result data processing cost increases without noticeable effect for the enterprise. The insufficient effectiveness of information systems can have other reasons as well: for example, organizational barriers between divisions of the enterprise, data poor quality (by criteria "fidelity" and "relevance"), unreadiness of divisions of the enterprise to system introduction.

Types of information technologies in logistics.

Information technologies in logistics can be created for the purpose of management of material flows at the level of the separate enterprise, but also can promote organization of logistic processes in the territory of the region, country and even group of the countries.

At the level of the separate enterprise information systems, in turn, are subdivided into three groups [2]:

- planned;
- dispositive (or dispatching);
- executive (or operational).

Logistic information systems which enter into digit groups differ both in the functional, and enabling subsystems. Functional subsystems differ in structure of solvable tasks. The enabling subsystems can differ in all the elements, i.e. technical, dataware and software. Let's dwell upon specifics of some information systems.

Planned information systems. These systems are created at the administrative level of management and serve for adoption of long-term solutions of strategic character. Among solvable tasks there can be the following: creation and optimization of links of a logistic chain; management of the conditional-constant i.e. low-changing, data; production planning; general inventory control; standby control and other tasks.

Dispositive information systems. These systems are created at the level of warehouse management or shop control and serve for ensuring smoothly running work of logical systems. Here the following problems can be solved: detailed inventory control (places of storage);

management of warehousing (or interfactory) transport; selection of freights by orders and their consolidation; accounting of the shipment for deliveries and other tasks.

Executive information systems. These systems are created at the level of administrative or operational management. Information processing in these systems is carried out at the time determined by the speed of its entry in the electronic computer. It is a so-called operating mode in real time which allows to obtain necessary information on the movement of freights in the current moment of time and to give the corresponding administrative and controlling actions on the object of management in due time. The various problems connected with the control of material flows, operational management of production service, management of rooms, etc. can be solved by these systems.

Creation of multilevel automated control systems of material flows is connected with considerable expenses, generally in the field of software development which, on the one hand, has to provide multifunctionality of a system, and on the other hand – high degree of its integration. In this regard in the process of automated control systems creation in the sphere of logistics the possibility of use of rather inexpensive standard software with its adaptation [3] to local conditions has to be investigated.

Nowadays quite perfect software packages are created. However they are applicable not in all types of information systems. It depends on the level of standardization of the tasks solved in the process of material flows management.

Structural principles and principles of operation of logistic information systems.

According to the principles of system approach any system at first has to be investigated in relationship with the external environment, and only then in its structure. This principle, the principle of consecutive progress on the stages of system creation, has to be observed also in the process of creation of logistic information systems.

Three levels are distinguished from positions of system approach in the processes of logistics. The first level – a workplace in which logistic operation with a material flow is carried out, i.e. a cargo unit, a detail or any other element of a material flow is moved, unloaded, packed, etc. The second level – the site, shop, warehouse where the processes of freights transportation take place, workplaces are allocated.

The third level – the system of transportation and movement in general which covers a chain of events for beginning of which it is possible to take the moment of raw materials shipment by the supplier. This chain comes to an end when finished products go in final consumption.

In planned information systems the problems which connect logistic system with a cumulative material flow are solved. At the same time end-to-end planning in a chain “sale-production-supply” is carried out that allows to create effective system of the production organization constructed on the requirements of market with the issue of necessary requirements in the system of material support of the enterprise. By this means planned systems seeming to “involve in” [4] logistic system to the external environment, in a cumulative material flow.

Dispositive and executive systems work out in detail the drawn-up plans and implement on certain production sites, in warehouses and also in concrete workplaces.

According to the concept of logistics the information systems relating to various groups are integrated into the unified information system. Vertical and horizontal integration are distinguished.

Connection between planned, dispositive and executive systems by means of vertical information flows is considered to be *vertical integration*.

Connection between certain complexes of tasks in dispositive and executive systems by means of horizontal information flows is considered to be *horizontal integration*.

In general advantages of the integrated information systems consist in the following:

- the speed of information exchange increases;
- the quantity of mistakes in account decreases;
- the volume of unproductive, “paperwork” decreases;
- separate information blocks are combined.

In the process of creation of logistic information systems on the basis of the electronic computer it is necessary to observe certain principles.

The principle of hardware and software modules use. The hardware module is understood as the unified functional unit of the radio-electronic equipment executed in the form of independent product. The software module can be considered unified, independent to some extent, program element which performs a certain function in the general software. Observance of the principle of software and hardware modules use will allow:

- to provide compatibility of computers and the software at the different levels of management;
- to reduce their cost;
- to accelerate construction.

The principle of possibility of gradual system creation. Logistic information systems constructed on the basis of the electronic computer as well as other automated control systems, are constantly developed systems. It means that in the process of their design it is necessary to provide the possibility of constant increase in number of automation objects, the possibility of structure expansion of the functions realized by information system and quantities of solvable tasks. At the same time it must be kept in mind that defining of stages of system creation, i.e. the choice of priorities, has a great influence on the subsequent development of a logistic information system and on efficiency of its functioning.

The principle of accurate fixation of butting positions. “In butting positions the material and information flow passes through the limits of eligibility and responsibility of certain divisions of the enterprise or through the limits of independent organizations. Ensuring smooth overcoming of butting positions is one of the important problems of logistics”.

The principle of flexibility of a system in terms of specific requirements of concrete application.

The principle of the acceptability of a system for the user of dialogue “human-machine”.

Strategic planning of an information system includes the following steps:

- defining of divisions of the enterprise which will be included in the integrated information system (also prospectively);
- rough project of functional areas of information system and ratios between them;
- defining of objects, important for work of the enterprise (customers, suppliers of materials, details, etc.) and their display in an information system (it is the most difficult task of strategic planning which is closely connected with the previous step);
- defining of opportunities of functional areas use of a system in various divisions of the enterprise and assessment of the expected effect;
- establishment of the rules for architecture and technical implementation of the subsystems and connecting links created by own efforts;
- establishment of the general, independent of functions rules and formats for data transfer between functional areas of information system;
- establishment of parameters for computers (hardware, operating system, data management system, hierarchical levels of electronic computer, technical methods of transfer);
- development of the realization-design (priorities, terms, etc.).

The strategic general plan is created within several months. Its annual updating with account of new experience of certain projects implementation, changes in the market environment and further development of the information technology is necessary.

For creation of the strategic general plan formation of not numerous group of experts in informatics and the workers of user divisions is recommended. A decisive prerequisite of successful work of such group is the support of enterprise management; it formulates the purposes and controls work flow.

Combination of strategic general planning of information system with situational action allows to make decisions on certain projects flexibly and with account of requirements of certain divisions, but without emergence of isolated uncoordinated private decisions.

Construction and functioning of logistic system is based on the following most essential conceptual provisions:

- realization of the principle of system approach which is shown first of all in integration and accurate interaction of all elements of logistic system. This principle finds the reflection in the development and implementation of uniform technological process of the production transport system, in transition from constructing certain types of equipment to creation of complex production-warehouse and production-transport systems. System approach opens new opportunities for reduction of duration and optimization of a production cycle, increase in productivity in all parts of logistic system, their harmonious development, especially in the process of storage, warehousing, transportation and reloading processes;

- individualization of requirements to the production and weight-handling equipment and industrial products, i.e. refusal of universality in favor of fuller correspondence of the equipment to specific conditions;

- humanization of technological processes with account of creation of modern working conditions, an exclusion of adverse effect on the external environment;

- accounting of set of expenses throughout all logistic chain with orientation to the market;

- development of favours of service at the modern level, ensuring flexibility, reliability, high quality.

Logistic system usually functions in the conditions of obvious uncertainty, stochasticity of the external environment – for market condition, work of transport stochastic processes are characteristic. Therefore in the conditions of their activity indispensable property of logistic system is the ability to adaptation. High reliability and stability ensuring – one of the fundamental principles of its functioning. The conflicts at the joints of different types of transport can be liquidated due to the development of interindustry automated systems to provide stability of the transport system.

For stability of system functioning reliable planning production of Sales and Distribution has the high priority, and preference is given to strategic planning in relation to operational. For the purpose of high reliability achievement of such planning behavioral inquiry of the external environment and, first of all, the market, identification of possible situations and obtaining strategic answers to the questions which arose in this regard is necessary.

Problems in the process of creation of logistic information technologies.

Over the last few years the so-called new logistic technologies based on informatics are rapidly developed. Information systems hold the central position in these technologies. Development of logistics in the developed countries not least are stimulated with the need of fast reaction of producers to market condition, aspiration to adapt in the changing situations in short time.

The central idea of logistics is planning, management and control of entrepreneurial activity, all material and information flows connected with this activity. Information systems

in logistics assume fast appropriate response to the market demand, tracking delivery time, optimization of functions in chains of delivery and supply and so on.

But also there are difficulties and problems of creation of information systems at the enterprise. One of the first problems is lack of data collection at the enterprises. Generally information carries not exact, not operational and not successive character. Often the companies collapse because of the untimely, or unreliable obtained information.

It goes without saying such problems in our country lead just to chaos in economy. Also poor development of communication networks on structure and technological level for information systems serving electronic computers and lack of information exchange between suppliers-producers and buyers – consumers become the next problem of creation of robust logistic information systems.

What can be made about it? One can create the industry and intraproductive centers which will control information and material flows at the enterprise at the same time. Also one can create logistic information system in the sphere of making up load for transportation with application of electronic transportation documents in internal and direct international traffics. And also to establish logistic cooperation of suppliers and buyers of transport and production, to create flexible methods of management with orientation to cost saving of resources and energy.

The following problem of creation of logistic information system is the lack of technical support at the enterprises. This is the lack of the electronic computer which would collect, keep and transform information and also facilitate management process. Because absolutely by means of the increasing speed and effectiveness of reaction to the operating data the maintenance of the computing system in economic and production structures is more profitable.

The problem in the sphere of foreign economic activity of the enterprise in the process of overcoming customs barriers is also essential and especially for the states which are in close proximity from each other and which almost every day have communications.

To facilitate the relation in this area it is necessary to introduce a uniform international communication information system. It will be intended for information transfer about material flows and control of their movement.

This information system will unite the communication systems of many countries and in this regard it will reduce surface intransit time at border stations and the expenses connected with it. This system should constantly be open for users concerning data exchange and also to use this system it is necessary to create common language as uniform.

The system will have available independent communication network, and this network will not depend on other state information systems. Also it has to provide the round-the-clock information exchange between users and develop in the process of increase in information flow and number of subscribers.

In providing of information support of all enterprises it will be possible to replace some paper documents by electronic analogs, [5] that allows to synchronize the movement of material and information flows and also expenses in the process of preparation of paper documents will be reduced.

In certain cases there are excessive legal complications. But in order to carry out all of these things it is necessary to follow innovative technologies, such as: communications links constructed with the use of lasers, light guides, space communications and so on and as all of this is very, very expensive, it also becomes a significant problem for many enterprises.

The main concept of logistic system construction is based on the principle of accurate interaction and coherence of functional elements. In this case it is possible to refer to them objects of production and product consumption, volumes of its deliveries to them (by transit

and through warehouses), existence and the need for storage capabilities for its storage, volumes of the required capital investments, etc.

In the course of this approach within logistic system functions of production, supply and sale are integrated, i.e. the system by the principle of construction is represented macrologistic. Such system resolves the following key issues in the global plan: production, development of the general concept of merchandise flow, choice of rational material flows, volume of stock determination, volume of the required storage capabilities for their storage, need of their expansion or new construction, necessary volume of capital investments, both for increase of production, and for expansion of warehouse spaces.

Conclusions

Undoubtedly, use of information logistics allowed to establish efficient communications between the participants of management process though it had caused some problems, for example, a lack of data receiving and processing, a problem of operation research in management of material and information flows, a problem of supply management, etc. For management of information flows and organization of electronic data transfer between the enterprises first of all it is necessary to reach compatibility of the hardware and the software.

Extensive penetration of logistics into the sphere of economy in essential degree is obliged to computerization of management of material flows. The ability of microprocessor technology to resolve difficult issues on information processing allows to provide processing and mutual exchange of large volumes of information between various participants of logistic process.

The information infrastructure created both within separate production units and in all firm in general on the basis of the modern, quick operating electronic computers, corresponding software, turns information from an auxiliary factor into independent productive power capable to increase labor productivity and to minimize costs of production considerably and in short terms.

Thus, it is possible to draw the following conclusions: use of information logistic systems allowed to establish efficient communications between participants of management process though it had caused some problems, for example, lack of data collection at the enterprise, technical support at the enterprises, etc.

Now these problems are found at a stage of solution as the role of information support of logistic management increases every day, assuming global scale thus accelerates process of information technologies formation in logistics.

As for automated systems particularly, of course we cannot do without them if we want to accelerate and facilitate communications between partners along logistic chains as each movement of materials is connected with information transfer.

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