

## Перспективные направления развития информационно-коммуникационных систем и технологий в логистике

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**Реферат.** В настоящее время высокий торговый оборот является типичным для российской экономики, которая, в свою очередь, активирует достаточно интенсивность движения товаров. Логистика, как путь движения товаров в контексте различных способов доставки (авто-, воздушный, водный, железнодорожный транспорт), в том числе через таможенную границу, остро страдают от всех видов экономической трансформации. Таким образом, создание стабильных условий для перемещения товаров в соответствии с условиями взаимовыгодного сотрудничества является одним из приоритетов для материально-технического обеспечения. Тенденции экономического развития характеризуются ростом интеграционных процессов, доказавшие свою экономическую состоятельность. Такие преобразования означают необходимость улучшения механизмов контроля, в том числе материально-технического обеспечения. В статье рассматривается фактический выпуск бизнес-процессов информационной поддержки в условиях логистической интеграции. Основа информационной системы состоит из информационно-коммуникационных ресурсов, инструментов и технологий, использование которых направлено на решение конкретных задач для формирования информационной инфраструктуры, реинжиниринга бизнес-процессов, поддержки экономической безопасности бизнеса. В процессе изучения этого вопроса становятся очевидными неоспоримые преимущества информационно-коммуникационных технологий использования в логистических операциях, применение которых возможно в результате согласования интересов интегрированной системы. В статье приводятся доказательства того, что рынок оказывает определенное влияние на улучшение информационно-коммуникационных систем и технологий для комплекса, осуществляющего логистические операции, которые, в свою очередь, оптимизируют длительность движения товаров и связанных с этим процессом расходов, таким образом, улучшаются материально-технические условия с точки зрения роста бизнеса и повышается конкурентоспособность.

**Ключевые слова:** информационные и коммуникационные ресурсы и технологии, программного обеспечения, информационная интеграция в области логистики

## Prospective directions of information and communication systems and technologies development in logistics

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**Summary.** At present time the high trade turnover is typical of the Russian economy, which in turn, activates a sufficient intensity of goods movement. Logistics, as a goods movement path in the context of a variety of delivery methods: road, air, water, pipeline, railroad transport, including across the customs border, is acutely affected by all kinds of economic transformation. Therefore, the creation of stable conditions for movement of goods under the terms of mutually beneficial cooperation is a priority for logistics. Trends of economic development are characterized by growth of integration processes which have expressed themselves positively and proven their economic suitability. Such transformations denote the necessity of the control mechanisms improvement, including logistics. The actual issue of business processes information support in circumstances of logistical integration is considered in this article. The basis of the information system consists of information and communication resources, tools and technologies, the use of which is aimed at solving specific problems for the shaping of information infrastructure, business process reengineering, supporting economic security of business. In process of this issue studying are becoming obvious undeniable advantages of information and communication technologies use in logistics operations, the gaining of which is possible as a result of an integrated system's interests harmonization. The article provides evidence that the market has a certain influence on the improvement of information and communication systems and technologies for complex carrying out logistical operations, which, in turn, optimizes the duration of the movement of goods and related with this process costs, thereby determines the improvement of logistic conditions in terms of business growth and competitiveness development. The article provides evidence that the market has a certain influence on the improvement of information and communication systems and technologies for complex carrying out logistical operations, which, in turn, optimize the duration of the movement of goods and value of related with this process costs, thereby logistic conditions in terms of business growth and competitiveness development are made better.

**Keywords:** information and communication resources and technologies, software, information integration in logistics

### Theoretical basis of business's information support

Sustainable and mutually beneficial cooperation of organizations is the key to high competitiveness of business. The expediency of the integration processes in the modern reality is not in doubt. There is a wide variety of different approaches to the creation of an integration environment for conducting certain business operations, including logistics, and for the development of the organization as a whole. To our mind, in this aspect of the

problem, introduction and development of dataware for logistics processes management is quite urgent. It should be noted that the logistics has a huge potential and opportunities for business growth, and fast development of information technologies affects processing and decision-making speed, thus it is one of the most effective ways to reduce costs.

Figure 1 demonstrates the information and communication technologies (ICT) support

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scheme, which are recommended for implementation to support logistics processes. It should be borne in mind that it is necessary to harmonize the methods, tools, and technologies of company's information resources management.

The basis of the company's information system is business software that covers information

and communication resources, tools, and technologies of materials and related processes management. There is plenty of information resources used in business. The list of information and communication resources designed to support logistics processes is formed in table 1 on the basis of systems approach.

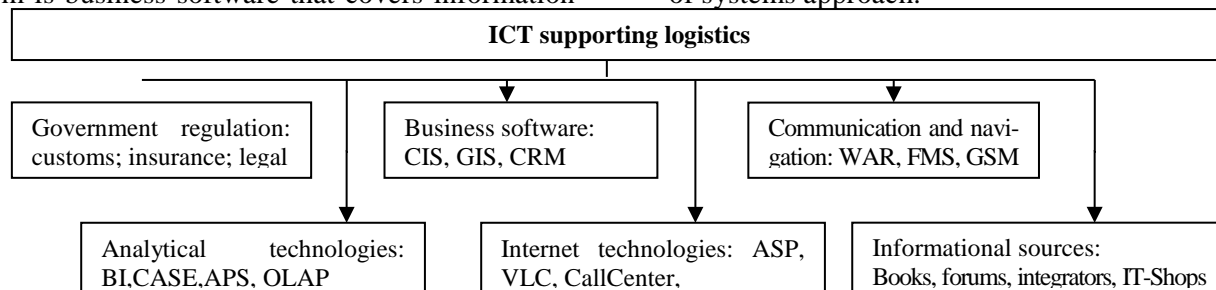


Figure 1. Modern ICT supporting logistics operations execution

Table 1.

Terminological review of information and communication resources

Resource name	Abbreviation expansion
MES	Manufacturing execution system
MRP	Material requirements planning
MRP II	Manufacturing resource planning
ERP	Enterprise resource planning
CSRP	Customer synchronized resources planning
SCM	Supply chain management
GIS	Geographic information system
CRM	Customer relations management
SRM	Supplier relations management
BRM	Business Performance Management
WMS	Warehouse management system
EDI	Electronic data interchange
FMS	Fleet management system
GSM	Global System for Mobile connections
WAP	Wireless Application Protocol
ASP	Application service providing (technology outsourcing various programs with user access via the Internet)
RFID	Radio frequency identification
VLC	Virtual logistics center
APS	Advanced planning & scheduling
GPS	Global positioning system
OLAP	Online analytical processing
BI	Business Intelligence
e-SCOR	Supply Chain Operation Reference model
CASE	Computer Aided System Engineering

Selection of a specific software is aimed at solving specific problems for the formation of information infrastructure, the choice of hardware and software, business process reengineering based on information systems, information outsourcing, ensuring the information security of business. When creating information space for support of logistics operations in the supply chain it is important to coordinate decisions on the selection of a particular set of information and communication

resources, otherwise, lack of harmonization does not allow participants of product distribution to recognize the information. It should be noted that the market of information and communication technologies is very diverse, which in turn determines the high demands of the abilities and skills of IT-managers, both in design and development of information solutions, as well as when they are used in business practice.

### Directions in the development of logistics software.

The development of ICT and their practical application level in logistics is directly related to changes in the market economy. A qualitative picture of the dynamics of the logistics services market on the basis of information support is shown in Figure 2.

According to Figure 2, information support of logistics processes meets the requirements of the market environment and trends of its development. In turn, enhancement of information support promotes the complex automation of material flows management in time and space.

Information component in this format of development is becoming increasingly global, especially with the development of electronic forms of doing business based on Internet technologies. Due to market globalization logistics systems are subject to significant changes. Currently, in virtue of the integration processes development, a new commercial paradigm forms. It is integration paradigm based on material flow management concepts synchronized on the basis of MRP, MRPII, ERP, CSRP, CALS concepts presented in Table 2.

Market's requirements			Reliability
			Uniqueness of services
			Expansion of choice and assortment
			Quality of services
Company's priorities	Price		
	1960's.		Today
	Economic efficiency		
	MRP	New techniques and technologies	
	MRPII	Organizational and technological flexibility	
	ERP	Innovations	
	CSRP	Integration	

Figure 2. Market trends of logistics services development

Table 2.

The main types of information systems applied in a comprehensive logistics automation

IS type	Purpose
MRP	Material requirements planning. These systems are used in planning of parts demand for production of certain products quantity. Thus MRPs allow enterprise to determine optimal stocks for manufacturing goods according to forecasted sales. Nowadays MRP concept is outdated and usually isn't used singly, but it forms part of current information systems [11]
MRPII	Manufacturing resource planning. MRP II systems have the capabilities of MRPs and provide additional functions of planning and controlling of cost calculation, procurement, sales and production data acquisition. Main idea of MRP II systems is to take into account all relevant resources for company's success in planning. However, these systems include only manufacturing resources.
ERP	Enterprise resource planning. ERP systems include MRP II functionality and provide general functions of accounting, controlling, financial planning and HR.
CSRP	Customer synchronized resource planning. This type of systems has abilities of ERP and CRM. Concept of CSRP is inclusion of customer in the production process. It allows customer to order manufacturing of product and control it's implementation and deadline.
CALS	Continuous acquisitions and life cycle support. CALS is an approach to designing and production of highly technological products. CALS technologies provide information support at all stages of lifecycle of the merchandise. This approach is based on creation of unified information space implemented according requirements of international standards system.

These concepts reflect the importance of managing both of the internal resources of the company and external, such as consumer behavior, the means of distribution of goods and service maintenance, which are fundamentally important aspects under the conditions of modern integration processes.

A typical response to the needs of companies in the information integration can be seen in the evolution of information systems, and this process is accompanied by not only expanding their functionality, but also increasing compatibility with other systems, such as CRM, SCM, BPM (Figure 3).

Information integration in logistics and management at the global level is currently being implemented in the framework of international programs. One of these programs, which Russia has ratified, is TEDIM – Telematics in Foreign

Trade Logistics and Delivery Management. The development of program is going in the direction of the integrated logistics and SCM network formation with the appropriate information support based on the concept of a unified information technology environment "Northern Dimension".

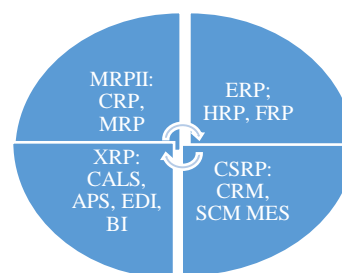


Figure 3. The evolution of corporate information system in the direction of information resources integration

Among the promising, emerging logistics trends in domestic practice there are several ones that require the use of ICT and should be noticed first and foremost:

- Automation of supply planning and re-planning with minimal losses;
- Client-oriented supply management using CRM and SRM integrated automation technologies based on personified accounting of demand, ranging customers and suppliers;
- Automation of supplies on the basis of electronic planning (e-commerce).
- Transportation outsourcing in coordination of logistics operations, including interactive kind, that operate through virtual centers;
- Design of supply chain on the basis of automation principles (e-SCOR).

Information integration should be carried out comprehensively and in the combination of different organizational and technological forms. In the modern economic practice there are the most demanded ones:

- network integration associated with the construction of the physical topology of computer

networks and data networks driven by network operating systems;

- integration of business processes (business integration), focused on the office integration through e-mail and document management systems;
- intraindustrial integration, related to the automation of planning and management of manufacturing processes on the basis of MRP, ERP, MES systems;
- cross-enterprise integration based on Internet network, expandable up to the level of integration with customers;
- integration of business applications and resources sharing enterprise-level data, providing a comprehensive, interlinked solution of organization's tasks, tactical production management, long-term planning and business process reengineering.

The main instruments of information integration are unified protocols, documentation languages and data communication systems, Open-Source and Internet/Intranet technologies, remote access to data and mobile management systems, shown in Table 3.

Table 3.

Terminology of information resources integration system

Definition	Matter (functions)
Internet	Open global information system based on WEB technology; it is used for creation of a local network of a company, inter-corporate associations (integration of Intranet) and regional networks (Extranet integration)
Integration	Technology and tools of integration of IS developed by various implementators (IBM WebSphere, AquaLogisBEASystems)
SOA	Service Oriented Architecture is a process technology of applications integration to the unified company's information system
XML/XSL	Extensible Markup Language and Extensible Style Language are languages that simplify the interaction between different information systems on the document flow and data exchange. It serves as an environment for application integration
SCADA	Supervisory Control And Acquisition can be described as an automated process control system (APCS). These systems are quiet suitable for control over technological and business processes of industrial enterprise.

Integration of information resources is related to the tactical tasks of information support of management in modern logistics, and therefore it's implementation should be formed comprehensively by joined tools and technologies at all levels of the supply chain as follows:

- workplace should be automated to work with a local information system, e-mail, office applications and Internet access;
- department, service or unit should be equipped with a network information system of narrow functional orientation to work in groups, conduct electronic meetings management automation;
- at the level of the organization (corporation) a comprehensive management automation with a guide to the relevant sectoral, national and international projects and programs should be carried out.

One of main principles of describing the future development of logistics is the safety of product distribution and data transmission. In this connection there should be noted feasibility of important management tools to ensure security in the supply chain:

- Automatic tracking of the shipment (GPS);

- Generation of warnings about the dangers of electronic communication;

- Electronic seals;
- Audio and video identification when paying invoices by using special credit cards;
- Electronic flow of document, providing out-running information support;
- The virtual inspection of the goods packaging.

Table 4 provides a list of tools and technologies for monitoring the supply chain that are recommended for use in business practice.

Since logistical services market capacity is continuously growing, it causes the expansion of the logistics abilities of subjects (senders, recipients, freight forwarders, brokers, carriers, etc.) in the management of material and associated flows.

A promising direction in terms of this trend of market changes is the formation of logistical structures managed by operators of logistics and transport and logistics centers. An example of the logistics subjects' interaction for transport of cargo is the multi-modal transportation of goods (Figure 4).

Means and technologies for monitoring the supply chain

Monitoring tool	Available functions
Satellite system	Ensuring global communication, navigation (GPS); global dispatching management of transport operations.
Mobile communications	Providing local level of the mobile voice communication; roaming in the global communication systems.
Internet	Video monitoring; notifications in real time.
Individual display	Special stickers for single use to control the object's state.
Board units	On-board computer; digital tachograph for control of work and rest of the crew; authorization of routing information record from the sensors.
Radio-electronic and optical equipment and technologies of identification	Passive and active RFID tags and devices designed for reading and processing information in warehousing management systems and the movement of goods.

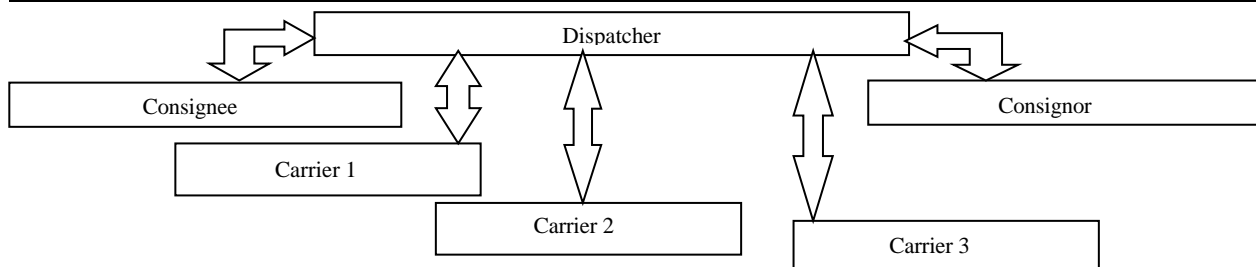


Figure 4. Information interaction of the subjects of delivery through the control center on the basis of requests for information

### Conclusion

The integration of information flows and communication chains ensuring the supply of goods on the basis of open client-server technologies and unified data delivery technology are going to become the key areas in the development of logistics services. Thus, information integration is needed to build a unified information space of the chain, which helps to secure the necessary speed, completeness and accuracy of obtaining the information useful for the provision of services at a particular time.

It should be noted that currently virtual technology in logistics are actively developing, because competition in this sector is quite high.

By virtue of the special conditions defined by the limited time and the specificity of business processes, companies actively use more modern ICT, tools of information resources integration for mobility of management and broad consumer access to services.

These means and tools of information resources integration will simplify the coordination of material flows and increase efficiency by identifying specific areas of establishing linkages between enterprises [10]. Taken together, this will give an opportunity to improve significantly the competitiveness of all enterprises of logistics integrated structure [10].

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## CONTRIBUTION

**Ekaterina V. Pustynnikova** wrote the manuscript, is responsible for the plagiarism, and corrects the manuscript prior to submission to the editorial board

**Vadim V. Baklushinsky** collected material for the review of existing information and communication resources

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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