SUSTAINABLE DEVELOPMENT OF NATURAL AND ECONOMIC SYSTEMS: THEORY, METHODOLOGY, AND PRACTICE

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The monograph considers theoretical and practical issues of sustainability modelling of natural and economic systems. Monograph will be useful to scholars, entrepreneurs, experts in the field of economics, management and administration, educators, graduate students, students and all those who wish to improve their command in English.

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3.3 PROBLEMS AND PROSPECTS OF LOGISTICS INNOVATION MANAGEMENT: THEORY AND PRACTICE

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Effective functioning of logistics systems in the face of intensified competition between producers in global and domestic markets leads to the intensification of production and implementation of innovations in logistics systems. However, theoretical and methodological aspects of logistics innovations formation are not fully disclosed by researchers, which necessitate depth research in this direction.

Analysis of enterprises logistics activities in Ukraine shows certain problems in the development of logistics approaches, presence of unused reserves in the implementation of logistics innovations.

Scientists give different definitions of the concept of «logistics system». According to the vision of scientists' logistics system is a relatively stable set of structural (functional) units of the company, as well as suppliers, consumers, and logistics intermediaries, interconnected by the main and (or) concomitant flow and management to implement a strategic logistics plan [1].

The logistics system is a set of actions of the participants in the logistics chain: manufacturers, transport, trade organizations, shops, etc. [2].

Logistics system is a system that integrates logistics elements (links, subsystems), related to organizational relations (internal and / or external) and have orderly connections to achieve strategic goals [3].

Types of logistics systems are given in table. 1.

The issue of innovation in logistics is in the field of researchers view that dealing with logistics issues. Thus, some of them point out that there is one of the few areas of the economy in each country that requires innovative development – transport and communications, another infrastructure that provides unimpeded

movement of goods, capital, information, people, services. Another reason for the actualization of innovative development in this area is the growth of megatrends, which characterize rapid growth of material, information, financial and human flows parameters. These same megatrends initiated accelerated diffusion of knowledge in logistics, a new branch of economics.

Table 1 – Types of logistics systems

Type	Essence
Logistics system of resource concentration	A system of concentration channels that provide management of resource flows in order to increase their quantitative parameters in accordance with the requirements of the external environment.
Logistics system of resource allocation	Distribution channel system that provides management of resource flows in order to reduce their quantitative parameters in accordance with the requirements of the external environment.
Logistic concentration and distribution system	A system of concentration / distribution channels that provides management of resource flows in order to change their quantitative parameters in accordance with the requirements of the external environment.

Source: compiled according to [4]

The subject of innovations in logistics is optimization of the trajectory of economic flows circulating in the chain (network), in order to reduce time of the logistics cycle, rationalize overall costs of trade, increase efficiency of the logistics chain.

According to the existing classification of innovations, logistics innovation belongs to the category of process (technological) innovations and is correlated with the use of an innovative approach to the implementation of system (information technology) and management functions of logistics within developed business schemes.

It is obvious that innovative approaches in the logistics of domestic enterprises are appropriate provided by implementation of such approaches as: development of knowledge accumulated by world science and their introduction into scientific circulation and teaching process; adaptation of borrowed knowledge to the economic realities of the state.

Given the methodological approaches, it is established that:

$$R_l > T_l > P_l, \quad (1)$$

R_l – pace of research on the development of new logistics technologies and technical means used in logistics processes;

T_l – pace of creation of new logistics technologies and technical means used in logistics processes;

P_l – rate of development production of new logistics technologies and technical means used in logistics processes.

Dependence (1) indicates the need to ensure a higher pace of research (research and development work) in this direction compared to the pace of innovation by industry; the latter should accordingly exceed pace of their practical implementation in the logistics activities of enterprises.

Inequality (1) can be represented in the form of formula (2) processed by us:

$$R_l = K_{1log}\, T_l = K_2\, P_l, \quad (2)$$

$$K_{1log} = \frac{T_l}{R_l}; \quad (3)$$

$$K_{2log} = \frac{P_l}{T_l}. \quad (4)$$

In this case, in our opinion, the following condition should be met:

$$K_1 > K_2 > 1. \quad (5)$$

Various classifications of innovations are given in the scientific literature. The following types of innovations are distinguished in the economic encyclopaedia [5]:

1) product – creation of new goods or services that focus on emerging demand;

2) technological – improvement of production methods for existing goods (services);

3) market – development of new methods of activity in the market;

4) organizational – improving organizational structures of enterprise management.

By areas of application, innovations are classified as follows: technical and technological, economic, organizational, managerial, legal and social. In particular, economic include innovations in planning, motivation and evaluation of activity result, organizational – study of new forms and methods of organization, regulation and production, management – those that manifest themselves in changing the content of functions, technologies and organization of management, methods of operation of the management staff.

However, in our opinion, from the point of modern management areas of activity outlined above concern to management (as management of the enterprises in market conditions). The management process consists of four interrelated functions: planning, organization, motivation and control. Therefore, these approaches allow us to identify this type of logistics innovations as management, which, in our opinion, include innovations in the planning of logistics activities, its organization, motivation of logistics staff and control of logistics processes.

The effective functioning of logistics systems in the face of intensified competition between manufacturers in global and domestic markets leads to the intensification of production and implementation of innovations in logistics systems.

Logistics innovations are innovations in the logistics system. Taking into account these approaches, in our opinion, logistics innovations can be classified as follows (Fig. 1).

However, a number of domestic and foreign researchers are narrowing the list of forecasting methods. There are following methods of forecasting demand: method of qualitative estimates generalization, method of forecasting on the basis of time series; method of normative forecasting, method of factor forecasting, method of model forecasting.

There are two groups of forecasting methods:

1) heuristic methods, including individual (models such as interviews, generation of ideas), collective (simple ranking method, weighting method,

sequential comparison method, pairwise comparison method), combined (Delphi method and its modifications), expert assessments;

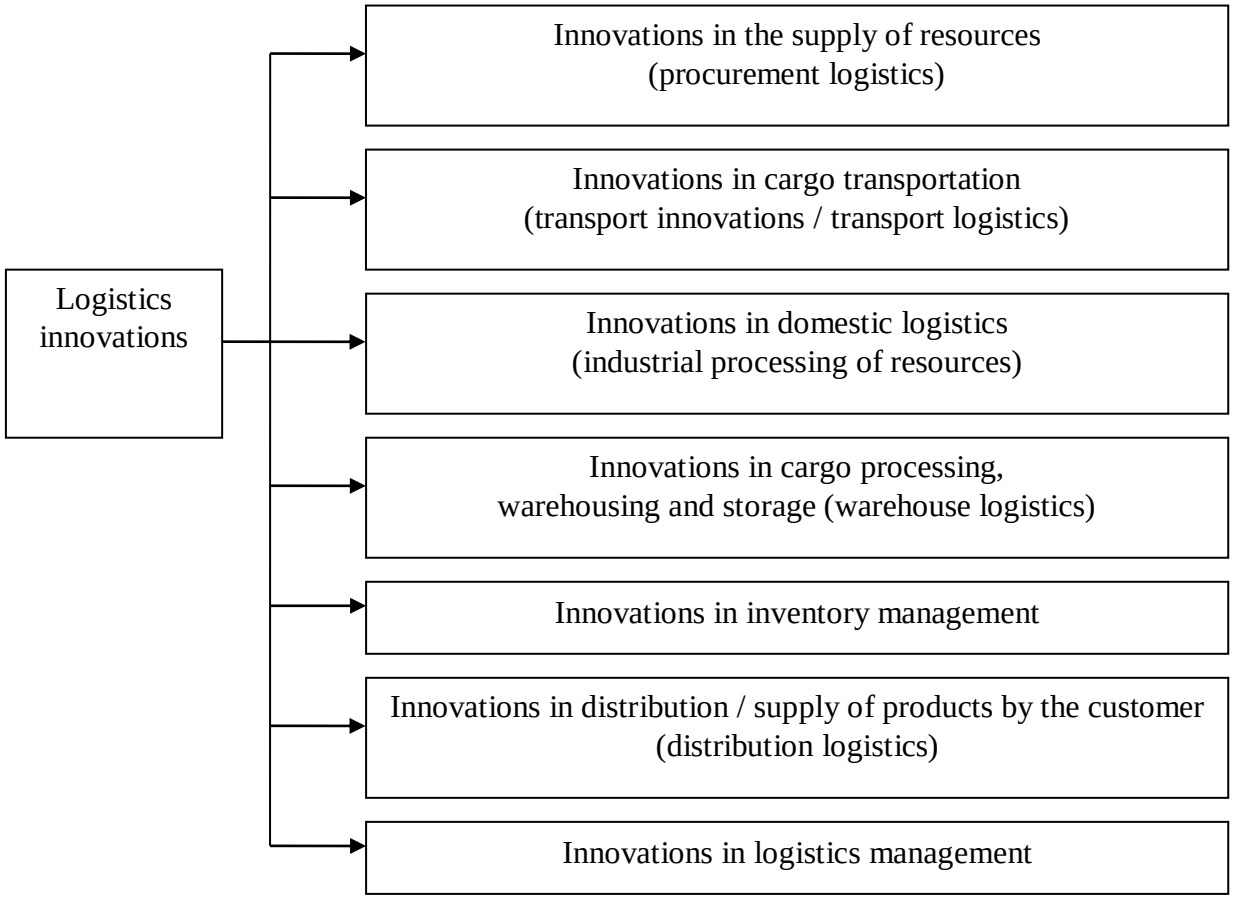

Fig. 1. Classification of logistics innovations

2) mathematical methods, including simplex (simple) methods of extrapolation by time series (least squares method, exponential smoothing, etc.), statistical methods (correlation and regression analysis, factor analysis, etc.), combined methods, which are a synthesis different forecast options.

Jeremy Shapiro [6] notes that the main forecasting models are:

time series models used in short-term forecasting (with a planning horizon of one week to three months) or in medium-term forecasting (with a planning horizon of three months to one year);

causal models used for long-term forecasting from one year and more; new product models that are used to analyze supply chain strategy of a new product;

evaluation models used to predict demand for new products and based on expert estimates.

Today, there are at least 40 software packages for forecasting with a wide range of features and different costs.

Logistics communications are an important link in logistics systems. Because logistics is one of the strategic ways to increase competitiveness of domestic business organizations and efficiency of the economy as a whole. Therefore, it is necessary to analyze experience of foreign enterprises in the field of logistics and take it into account in solving a number of problems that arise during the conduct of organizational and economic activities of domestic enterprises.

Information technologies are widely used in warehousing and storage. In particular, Porsche (Germany) [7] uses software for warehouse management systems (WMS), which allows distribution center to obtain more accurate information about spare parts stored in warehouses, reduce number of paper media and time to keep records. The company has also installed a Radio Frequency Identification (RFDC) system that provides real-time inventory control. The combination of WMS and RFDC systems has speeded up the processing of information about incoming parts. As a result, the capacity of warehouses increased by 17%.

The practice of using the WMS system shows that payback period does not exceed 1.5-2 years. At application of this system: time for acceptance, a complete set and shipment of the order in 1,5-2 times is reduced; accuracy of orders execution increases to 99%; number of staff is reduced by 2-2.5 times; losses related to shelf life or storage conditions are significantly reduced; range of goods increases due to increase of work accuracy; possibility of warehouse management for 4,000-10,000 pallet places by one or two operators is achieved; downtime costs are significantly reduced; reduced time for training warehouse personnel.

Recently, attention has been drawn to the logistics of reverse flows, which deals with the processing of returned goods, as well as waste disposal. Thus, the NKL cooperative (Norway) [7], which produces food, uses 1.5 million reusable fruit and vegetable containers to reduce costs and speed up orders and delivers 14,000 tons (70% of all Norwegian fruit and vegetables). At the same time, cooperative has achieved an increase in the level of loading of its railway transport from 50% to 60%, as a result of which it has reduced the cost of transportation, energy costs, and environmental pollution.

Considering logistics innovations, we cannot avoid the latest (at that time in developed countries, and today – for many Ukrainian companies) logistics technologies. In particular, foreign firms make extensive use of the MRP (Resource Requirement Planning) system [8], a computerized product-oriented approach designed to minimize inventory and adhere to a delivery schedule. American Production and Inventory Control Society defines resource planning as «a system formed around resource planning, as well as one that includes additional planning functions: production planning, basic production scheduling, and capacity planning».

The advanced version (MRP II) [8] has a wider application than MRP, as it can be used not only for planning material resources, but also for planning labour and financial resources, production equipment. The next step in development (after MRP and MRP II) is the ERP system (enterprise resource planning), which is defined as «a business management system that, with the support of multimodular application software, integrates all departments of individual functional areas of the enterprise». Application of the ERP system allows to provide: faster rotation of stocks and reduction by 10-40% of expenses for stocks; quality customer service, increasing the level of order fulfilment to 80-90%; higher accuracy of inventory accounting (up to 90%) with the reduction of physical checks of inventories; less system debugging time (by 25-80%); higher quality of operations; timely receipt of income and increase cash flows.

When considering implementation of a resource planning system (ERP), Mark West and Lee Sparks [9] draw attention to the following dangers: underestimation of the importance of change management; choice of software product to define the business process; promises to provide an ERP package «specifically designed for your business»; insufficient funding for training; choice of «big bang» technique (covering the whole company); limited term of supplier selection; attempt to preserve existing systems; fragmented development at the level of a separate unit; apathy (or attitude «this is not my job») on the part of top managers; use of the new ERP system while maintaining the previous forms of management reporting; belief in the prospect of «open systems» of ERP-interfaces; assumption that enterprise resource planning is a project of limited validity.

DRP (distribution requirements planning) system [8] is inventory control and management techniques in which MRP principles are applied to inventory distribution, a method of inventory replenishment in a multi-tier business environment.

A further development of ERP / MRP II approaches was the CSRP system (resource planning, synchronized with the consumer), which is also called an integrated system for maintaining functional life cycle of the product, proposed by Symix.

«Just in Time» System (JIT) developed in Japan [8] is seen as a philosophy of inventory control, which aims to maintain a sufficient amount of materials in the right place and at the right time to produce the right amount of product.

One of the first attempts to put the JIT concept into practice was the KANBAN system developed by Toyota Motors, which is a «traction logistics system». This system was introduced by the corporation at Takhama plant (Nagoya, Japan). The essence of the KANBAN system is that all production units of the plant are supplied with material resources only in the amount and for such time as is necessary to fulfil order of the consumer unit.

Created in Israel [8], optimized production technology (OPT) as well as JIT is aimed at minimizing inventories of materials and work in progress, reducing

production component of the order execution time, especially with flow and serial production methods.

At the end of the twentieth century, logistics technology Lean production («slender/flat production») beginning to be used, the essence of which is a creative combination of high quality, small production batches, low inventory, highly qualified personnel, flexible equipment.

At this time, various variants of the DOL system (demand-oriented logistics), including ECR, QR and VMI, have become widespread among logistics technologies in distribution. The ECR (Effective Consumer Reaction) system is some extent equivalent of a JIT system adapted to meet consumer needs. The ECR system is connected to the QR (Quick Response) system, which is based on the use by computer and retail companies of computerized technologies for automatic identification of goods for everyday business operations related to the movement of goods.

If the ESR and QR systems are used in trade in groceries and other consumer goods, the CRP (Continuous Replenishment Planning) system is used in the service. Thus, Kendall Healthcare Products [10] successfully uses this system to supply hospitals.

VMI (vendor-managed inventory) [8] is a type of JIT in which decision of replenish inventory is made centrally by manufacturers or distributors at the top of the chain.

In our opinion, it is expedient to include such managerial innovations used in logistics as outsourcing, benchmarking, suppliers' associations, and shippers' cooperatives. Outsourcing is the strategic use of external resources to solve problems that have traditionally been provided by the company's internal resources [8]. This is a management strategy according to which performance of non-key functions of the company is entrusted to an external (third party) company, which is a specialized professional service provider.

In particular, Lucent Technologies, which owned most of its manufacturing plants, outsourced its operations after being defeated in the market. This

innovation, as well as a strategic partnership with suppliers, has provided a nearly 20 percent reduction in production costs.

In the field of logistics outsourcing, can also be used for traffic management, use of information technology. In developed countries, outsourcing of warehousing services is increasingly used. In some cases, firms even hand over management of their European centers to logistics operators (for example, Rank Xerox) [11]. In recent years, there has also been outsourcing of production services that increase cost of the final product. In such cases, contractor is responsible for the packaging, labeling and configuration of the product in its warehouse, and sometimes even on vehicles.

According to [12], the largest European market for logistics services is in Germany (28% of the European), followed by France (20%) and the United Kingdom (17%). Thus, in the UK, almost 40% of logistics operations are used under contracts.

In Ukraine, outsourcing of logistics services is not developing so actively, which is explained by the following reasons: non-compliance with commitments regarding the level of service; lack of strategic vision of management staff; difficulty in reducing costs; price increase after cooperation; reducing ability to influence and control functions that delegated to the service provider; lack of knowledge-based consulting opportunities, etc.

According to the definition given in the International Dictionary of Marketing Terms [13], benchmarking is a standard of efficiency, quality or advantage, in relation to which all simple activities are evaluated, measured and positioned. In this case, in particular, logistics activities are considered relatively the best in the field of competitors and relatively the best companies in other industries.

Supplier Associations [8] is «a group of the most important subcontractors for the company, whose relations are mutually beneficial, operating on a regular basis for coordination and cooperation, as well as mutual assistance to benefit from cooperation based on Japanese principles such as Kaizen, JIT (just-in-time), U-

cell-production. This definition was later expanded: a group of companies operating on a regular basis, created for the open and productive exchange of knowledge and experience. Large Japanese manufacturers, such as Toyota, with the help of a supplier association, promoted development of contractors, coordinated their work to disseminate best practices, provide technical assistance, and use training as needed.

Shippers' cooperatives perform functions of freight forwarding companies, remaining non-profit operations. In this case, all the savings are distributed among members of the cooperative. Thus, the Washington and Oregon Shippers Cooperative Association [10] has 1,200 members, 43 permanent staff and an annual turnover of about $ 25 million. The association has seven terminals in major cities across the country.

Thus, analysis indicates the need to ensure a higher pace of research (scientific and development work) to create new logistics technologies and logistics technical means compared to the pace of innovation by industry; latter must accordingly exceed pace of their practical implementation in the production and commercial activities of enterprises.

Generalization of the advanced foreign experience in the field of logistics allows to allocate the following directions of logistic innovations development:

1) improvement of logistics services to consumers through the use of modern methods of forecasting food demand;

2) effective management of raw materials and products stocks, for which can be used: Internet protocol for replenishment of CFAR stocks; EDI electronic data exchange system; combination of EDI system and bar coding; planned CTP order notification system; radio frequency identification systems; MRPII, CSRR, JIT, KANBAN, OPT and ERP, DRP, VMI planning systems;

3) improvement of cargo processing (movement of raw materials, stocks, work in progress or finished products) through the use of automated transport and warehousing systems AS/RS («automated warehouse»); WMS (warehouse management systems);

4) use of packaging systems: taking into account communicative role of packaging; use of containers, which allows to reduce volume of packaging, etc.;

5) minimization of transport costs by optimizing located distribution centers and warehouses;

6) use of the supply chain management concept, in particular, transport logistics;

7) creation of enterprises with producers of material and technical resources that use FMEA reliability system;

8) use of logistics of return flows, dealing with waste disposal, other reusable containers;

9) use such methods of logistics management as: outsourcing of logistics services, benchmarking in logistics, supplier associations, corporate shipment.

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