THE MODERN TRENDS OF INFRASTRUCTURE DEVELOPMENT

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Abstract. *Purpose* – is to summarise and present the development of theoretical foundations of the process of integration of the national industrial infrastructure system based on logistic transformations. *Methodology of research*. Theoretical and methodological basis of the study are research works of domestic and foreign scholars on the integration of social and economic systems. The article used the dialectical method of cognition, as well as the following methods: a systematic and structural analysis, logical generalization – the study of the formation of scientific positions and forming the methodological foundations of the development of production infrastructure. *Results*. Implemented theoretical and methodological substantiation of the implementation of transformational changes infrastructural capacity in the context of sustainable development of the regional economic system. The transformation of the infrastructure capacity in the region is defined as a process of deep changes in the quantitative and qualitative characteristics of the Multisectoral infrastructure complex on the principles of sustainable development in the direction of achieving the optimum, tailored to the needs of the regional parameters of its operation, taking into account global trends and inherited experience. The authors constructed a conceptual framework based on the transformation of infrastructure transformation sector. Transport related activities have many impacts on the environment. The most important effects are contribution to climate change, to local air pollution, to noise levels, to biodiversity loss and natural resources depletion. *Practical value*. These findings have practical value in the development of regional strategies and programs of development in the context of the European integration vector.

Key words: integration, infrastructure capacity, environment, ecological safety, transport.

JEL Classification: F15, L91, R11, R40

1. Introduction

Selected by Ukraine European integration vector necessitates consideration of modern global trends, one of this trends is a solving problems in ecological and socio-economic development for the socio-economic growth while preserving planetary resources for future generations. Under sustainable understand the development that meets the needs of the present generation, but without compromising the possibility of future generations to meet theirs. The implementation of this paradigm provides the following purposes: high-quality environment and a healthy economy for all peoples of the world and meet the needs of people and the preservation of sustainable development for a long period.

2. The bases of infrastructure development

The development of methodology of development of production infrastructure takes into consideration the following premises. Firstly, regional infrastructure acts both as a specific public institution and a type of economic activity. It has the material, production, socio-economic and environmental focus and is based on the integration of regional, national and transnational network structures. Infrastructural potential is represented by the available opportunities and untapped reserves in the area of infrastructure maintenance of socio-economic needs of the region. Secondly, the vector of logistics transformations of infrastructure potential due to the peculiarities of the socio-economic relations and the process of reproduction, which are formed within a specific regional area. Thirdly, the process of modernization of production infrastructure is designed to optimize the relationship of material, financial and information links in the formation of the regional logistic flows.

3. Environmental factors of integration

Integration of national logistic system in the European and global logistic network should take place, taking into account not only the economic, technical, spatial, market and social conditions.

Today worldwide topical issue is the realization of the principles of sustainable development paradigm. The

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concept of «sustainable development» means to ensure continuity of balanced development as a process based on the harmonization of quantitative and qualitative changes triad economy – society – nature.

An important aspect in this case is the mechanism of interaction of the three components. In particular, the relationship of social and environmental components leads to the need of preserving equal opportunities for today and future generations to use natural resources. The interaction of social and economic components requires achieving fairness in the distribution of wealth between people and providing targeted assistance to the poor segments of society. The harmonization of ecological and economical components causes to valuation and minimization of man-made impacts on the environment.

So one of the important factors is an environmental factor that affects to the success of entering into the European Economic Area, according to the principles of sustainable development

The largest share of the logistic activities in Ukraine has the transport industry. At the same time, transport has a significant environmental impact, is a source of thirds of harmful substances in Ukraine. The greatest concern it is about road transport in the cities where its share in the emissions of pollutants reaches 90%.

Ecological standards of harmful substances emissions of transports EURO were introduced by UNECE in 1993. One of the biggest problems is an inconsistency of these standards about transport that is used in Ukraine. However, step by step the national legislation restricts the use of outdated and environmentally dangerous transport. Thus, from 1st of January 2016 in Ukraine introduced a prohibition on the import and registration of both new and used transport that are below the normal ecological standard «Euro 5». And in 2018 in our country should take an effect environmental standards «Euro 6». Also, the roads are a source of dust formation in the surface layer of air, and while transport driving there is an abrasion of road surfaces and of car tires, wearing out products of which are mixed with emissions.

Another environmental issue of transport development is the increased noise. The noise is created not just by land transport, but also by aviation aircraft engines, auxiliary power units of airplanes, various motor transport and equipment of stationary objects which are used to maintenance and repair of aircraft.

Directive 2002/49/EU on noise in the environment is an important part of efforts to establish common noise policy.

The problem of transport noise can be solved by borrowing Polish experience of using the new technologies of production bitumen with rubber impurity, which materials are shredded tires. This allows to take a benefit of sweating out rubber wastes and also to increase the safety and durability of the road surface.

However, it should be noted that in Ukraine there is a delay of roads and transport network development, especially the development of public roads on the rate of motorization of the country. Technical standards of roads in Ukraine do not meet EU standards for quality and for the weight filling, so there is a need to direct it to the EU requirements.

4. Environmental logistics solutions

In the implementation of environmental policies, among other principles, EU guides two main policies, which should be laid to the basis of the ecological methodology of logistic system in Ukraine (Barro, 2012).

The first principle "polluter pays" – has been significantly strengthened with the adoption in 2004 the Directive 2004/35 / EU about the civil responsibility for pollution of environment: the polluter provides a compensation of the damage caused to the environment. This principle can be applied in solving the problems of financing industrial infrastructure in Ukraine. Thus, the sale of permits for emissions into the atmosphere will provide additional funds, which will be used to reconstruct the capital of the logistic system.

The second principle "preservation" – is recognized in many international agreements. For logistic system of Ukraine it may be implemented, among other areas, in the development of environmentally friendly transport. It is not only about electric cars, which are spreading in our country, but also about some new types of transports as a monorail transport and monocar, electric bicycles, heliotransport.

Nowadays in the Europe there is a spreading of the concept of «sustainable transport» (or «green transport»), which is used to describe any type of transport with a low environmental impact. In Ukraine there are signs of implementations of the principle of prevention in the field of environmental policy about sustainable transport. Thus, on 26 June 2015, Ukraine signed a protocol about sustainable transport to the Convention on the Protection and Sustainable Development of the Carpathians.

In cities, switching to cleaner transport is facilitated by the lower requirements for vehicle range and higher population density. Public transport choices are more widely available, as well as the option of walking and cycling. Cities suffer most from congestion, poor air quality and noise exposure. Urban transport is responsible for about a quarter of CO2 emissions from transport, and 69% of road accidents occur in cities (Jeon, Amekudzi, 2005).

The gradual phasing out of "conventionally fuelled" vehicles from the urban environment is a major contribution to significant reduction of oil dependence, greenhouse gas emissions and local air and noise pollution. It will have to be complemented by the development of appropriate fuelling/charging infrastructure for new vehicles (White Paper on Transport, 2011).

Also, a social security component of the sustainable development of the logistic system in Ukraine can not be leaved out of account. This is due to the unsatisfactory

level of security of traffic. In average in car accidents die more than 20 and injure about 200 traffic participants per day. The level of road accidents in Ukraine exceeds the corresponding figure in European countries for several times.

5. The warehouse technologies. RFID-technology in logistic

Modern logistic centers are characterized by a large amount of realized services, by a wide range of the operations and by a significant list and level of turnover of nomenclature positions. This intensity of the logistic activity is dictated by the transformation processes which are taking place in the market of logistic services under the influence of global trends in globalization and integration processes. A special distribution in this time is being received transport-distribution centers that allow consolidate geographically dispersed local logistic markets. The main object here is a control of multi-directional material and accompanying information and financial flows. Therefore, there is a need to increase the number of companies that automate logistic functions based warehouse management systems. Traditionally barcoding is using to perform this task. Modern innovative solution in this area is the use of RFID-technology (radio frequency identification), it refers to the automatic identification of objects of logistic flow via the radio signals.

RFID technology provides unique opportunities to the subjects of logistic management, allowing retrieve data from the material flow quickly at all stages of its movement. The system can reduce labor costs, and most importantly - reduce the probability of accounting errors. Unlike bar codes, RFID enables automatic identification of objects without placing the object near the reader.

The main benefits of using RFID-technology in logistic:

1. The ability to rewrite – the data RFID-tags can be recorded and supplemented many times, while the data on bar code can not be changed because they are recorded in the stage of printing.
2. There is no need for line of sight – RFID-reader does not need line of sight the label to take its data. At least it is needed to get into the area of registration long enough to read the data, even while moving and at a big speed.
3. Big reading distance – RFID-tag can be read at bigger distances than bar code. Depending on the model of the tag and the reader, read range can be up to several hundred meters.
4. Large amount of data storage – RFID-tag can store much more information than a barcode.
5. Multiple tags reading – industrial readers can simultaneously read over thousands of RFID-tags per second.
6. Resistance to the environmental influence – there are RFID-tags that have high strength and resistance to harsh conditions of working environment. Passive RFID-tags almost have unlimited service life.
7. Intelligent behavior – RFID-tag can be used for other tasks, except to the tool of carrying data. Barcode not programmable and is only a means of data storage.
8. The high level of security – a unique permanent identification number, which is assigned to the tag in the stage of production, guarantees a high level of protection against counterfeiting the tags. Also, data on the tag can be encrypted. Radiofrequency tag has the ability to close the operation and reading data by password, and encrypt their transmissions.

It is fair to note that along with advantages, particularly in the context of globalization, RFID-technology has one drawback: relatively high cost compared with bar coding. Therefore, despite the ten-year presence in the logistic market of Ukraine, for many companies this tool is still in the plans.

6. Warehouse management systems (WMS)

Another area of spreading the use of IT technologies in logistic solutions is a comprehensive automated warehouse management systems (WMS), which not serve only for information support of the movement of inventory, but in real-time control the material, cash and information flows that pass through the warehouse. WMS allow to provide a control of inventory at all technological stages considering all the features and requirements for storage.

In developed countries the development and implementation of systems of automated control of warehouse complexes occupied by hundreds of specialized firms. There are plenty of different configurations systems that allow to adjust to the demands of the consumer.

WMS integrate with barcoding equipment and radio terminals, and in addition combine with production management systems of MRP classes (Material Requirement Planning), ERP (Enterprise Resource Planning), CSM (Chain Supply Management) (Bowersox, Closs, Cooper, 2009).

According to various estimates in the Ukrainian market there are from 20 to 70 adapted to our conditions of solutions that can be classified as WMS of foreign and domestic production. "Accounting WMS» is the first domestic development of WMS which is implemented in Ukraine.

Today, there is an active interest in the automation means of logistic operations, including in stock. But it is too early to talk about structuring the demand for new technologies of work in Ukraine. In general, users of WMS can be divided into two classes:

1. Consumers of logistic services. These are companies with their own management structures for their products, the main business of which is related to the production, importation or distribution of products.
2. Providers of logistic services. These are companies whose business is based on providing services, including storage and warehouse processing of products that are belong to customers of logistic services. This is actually a professional logistic companies that manage warehouse

logistic function as part of the product flow management of the client.

It should be noted that WMS is realized not in all cases and in "full program", because this systems requires appropriate hardware and software that is why they are quite expensive. Often, in Ukraine is using various warehouse management systems, which combine manual and computerized control methods, and many companies are trying to organize automated account their warehouses by their own.

Experts recommend to introduce a system of class WMS in those companies for which the number of nomenclature positions more than 300 units and the storage area of over 2000 square meters, and the turnover rate of products in the storage less than 30 days (Bowersox, Closs, Cooper, 2009).

In this context the minimum system requirements of automation can be defined as the ability of WMS:

- to rule product and its packaging schemes;
- to rule warehouse operations (receiving, location, inventory, internal displacement, selection, shipment of matched orders);
- to rule documents of the storage (internal warehouse flow of documents and synchronization with external documents);
- to control of employees (effective distribution of employees);
- to rule warehouse equipment (effective distribution of equipment).

In addition to these minimum requirements powerful control systems of management and automation of the storage have additional specific functions such as customer management, traffic management of the storage, etc. Some developers of WMS offer additional modules to manage procurement (purchase orders) and sales (orders for shipment and delivery).

In general, after the effective implementation of modern WMS, in the storage there is less of reducing products, increases the accuracy of accounting of stored products and also reduces operation time of acceptance, placement and selection of products. It becomes possible to conduct an inventory of non-stop work and to plan and monitor the resulting indexes of the storage based on operational, accurate and complete reporting.

An accuracy of accounting increased to almost 100%, which is especially important for products with little shelf life. The accuracy of selection increases to 99.5%. In average 30% staff productivity increases, allowing direct extra resources on development.

Thus, historical infrastructures, or logistic system, – the automobile/gasoline/roadway system, electrical grids, railways, telephony, and most recently the Internet – become ubiquitous, accessible, reliable, and transparent as they mature. The initial stage in infrastructure formation is system-building, characterized by the deliberate and successful design of technology-based services. Next, technology transfer across domains and locations results in variations on the original design, as well as the emergence of competing systems. Infrastructures typically form only when these various systems merge, in a process of consolidation characterized by gateways that allow dissimilar systems to be linked into networks. In this phase, standardization and inter-organizational communication techniques are critical. As multiple systems assemble into networks, and networks into webs or "internetworks," early choices constrain the options available moving forward, creating what historical economists call "path dependence" (Edwards, Jackson, Bowker, Knobel, 2007).

7. Conclusions

Thus, we can define the main directions of the national logistic system integration on the basis of sustainable development:

- development and creation of environmentally secured objects in transport infrastructure;
- using of modern environmental constructional building materials, logistic technologies;
- introduction of energy saving technologies of protecting the environment from transports pollution;
- reducing the energy intensity of transport flows;
- optimization of processes of routing trucking for environmental criteria;
- increasing environmental security of transit, distribution piggyback.

The use of smaller, lighter and more specialised road passenger vehicles must be encouraged. Large fleets of urban buses, taxis and delivery vans are particularly suitable for the introduction of alternative propulsion systems and fuels. These could make a substantial contribution in reducing the carbon intensity of urban transport while providing a test bed for new technologies and opportunity for early market deployment. Road pricing and the removal of distortions in taxation can also assist in encouraging the use of public transport and the gradual introduction of alternative propulsion (Edwards, Jackson, Bowker, Knobel, 2007).

So, infrastructural development is always a contested process, tied as it is to questions around access, power, and the life chances of groups and individuals. Would-be developers of infrastructure work within pre-constituted fields, and regularly encounter actors, both entrenched and emergent, who will see in the development of infrastructure opportunities for both gain and loss – and gauge their responses accordingly. This aspect of infrastructure has obvious implications for equity, participation, and a range of other broad social goals (including those expressed in NSF's Cyberinfrastructure Vision for the 21st Century). It is also an issue of strategic management, fit, and long-term sustainability. Systems that fail to acknowledge and accommodate the tensions they inherit or provoke will have little chance to attract and sustain a broad scale base of users over time – and therefore little chance of rising (or sinking) to the level of infrastructure. In the world

of cyberinfrastructure to date, we have often seen such tensions play out over the production, curation, and sharing of data – though just as often such data tensions serve as proxies for conflicts of a disciplinary, institutional, biographical, or broadly "cultural" sort. Here again, our workshop findings point to the need for more and better research into such dynamics (Edwards, Jackson, Bowker, Knobel, 2007).

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СОВРЕМЕННЫЕ ТЕНДЕНЦИИ ИНФРАСТРУКТУРНОГО РАЗВИТИЯ

Аннотация. *Целью статьи* является обобщение теоретических основ процесса интеграции национальной системы промышленной инфраструктуры на основе логистических преобразований. *Методология исследования*. Теоретические и методологические основы исследования составляют научно-исследовательские работы отечественных и зарубежных ученых по вопросам интеграции социально-экономических систем. В статье использован диалектический метод познания, а также следующие методы: системного и структурного анализа, логического обобщения - изучение формирования научных позиций и формирования методологических основ развития производственной инфраструктуры. *Результаты*. Осуществлено теоретико-методологическое обоснование реализации трансформационных изменений инфраструктурного потенциала в контексте устойчивого развития региональной экономической системы. Трансформация пропускной способности инфраструктуры в регионе определяется как процесс глубоких изменений количественных и качественных характеристик Поливекторность развития инфраструктурного комплекса осуществляется на принципах устойчивого развития в направлении достижения оптимальной, с учетом потребностей региональных параметров его работы, с учетом глобальных тенденций и унаследованного опыта. Авторы построили концептуальную основу интеграции, основанную на преобразовании инфраструктурного сектора, связанных с транспортом, деятельность которых оказывает воздействие на окружающую среду. Наиболее важными эффектами из которых являются влияние на изменение климата, загрязнение воздуха на местном уровне, уровень шума, истощение биоразнообразия и природных ресурсов. *Практическая ценность*. Данные выводы имеют практическое значение в разработке региональных стратегий и программ развития в контексте вектора европейской интеграции.