International Journal of Applied Business and Economic Research

ISSN : 0972-7302

available at http: www.serialsjournals.com

Volume 15 • Number 22 (Part 2) • 2017

Green Logistics' Directions in the System of Urban Sustainable Development

Maryna Averkyna[1], Olena Karlova[2], Olena Kirian[3] and Tetiana Obydiennova[4]

[1]The National University of Ostroh Academy, Estonian Business School. Email: maryna.averkyna@oa.edu.ua

[2-4]Ukrainian Engineering Pedagogics Academy, Kharkiv, Ukraine. Email: [2]eakarlova@gmail.com, [3]3zk@ukr.net, [4]obyd_ts@ukr.net

ABSTRACT

The main aim of the paper is to develop the green logistics' direction for the urban sustainable development's maintenance. The importance of green logistics in the system of urban sustainable development is revealed in the paper. The author identifies a city as a logistics system which is the path breaker in the implementation of scientific and technological progress. The author notes that urban green logistics is an aggregation of logistical approaches to optimize directions of material flows, vehicles, natural, financial, information, energy and human resources with the use of advanced technologies in process of decision making by local governments to create an environment within which provided the population, increased efficiency of urban and reached a condition to minimize the negative effects of human intervention in the ecosystem of the city. Principles of the urban green logistics are defined. Foreign experience of urban green logistics solutions is analysed. Directions of urban green logistics development are proposed.

JEL Classification: O18.

Keywords: Green Logistics, Urban Sustainable Development, the Principles of Green Logistics, Green Logistics' Directions.

1. INTRODUCTION

Analysis of current trends in urban sustainable development shows that new technologies have caused new social relations. Anthropogenic impact is close to objective limits, unresolved environmental problems limit the development of many industrial branches. In many works devoted to environmental economics paradigm of maximizing social welfare is traditionally dominating. Industrial enterprises are the most active consumers of the natural resources in the national economic complex, causing many problems with the use

of natural resources and negative impact on the environment. These negative trends affecting the urban sustainable development. Nowadays, sustainable development is one of the most important commitment engaged by most of the countries in the world (A. Scipioni, A. Mazzi, M. Mason, A. Manzardo, 2009). The concept of sustainable development was formulated in response to a growing awareness that there are several important relationships between processes such as social and economic development, global, regional and local environmental problems, increase in population and urban built-up area a (Malkina-Pykh, 2002). At the international level, the first World Summit on Sustainable Development at Rio de Janeiro in 1992 established Agenda 21 and suggested that all countries around the world formulate economic policies with a minimum impact on the environment, and encourage social promotion of individuals and the community (UN, 1992a). Maintenance of the sustainable development of cities requires developing of green logistics' directions.

2. RECENT RESEARCH AND PUBLICATIONS ANALYSIS

The concept of green logistics was suggested by the end of the last century. As the American and European countries do this study earlier compared to other countries, so research on green logistics in Europe and America was deeper than other countries. (Xin Guan, 2015)

Theoretic aspects of the green logistics are presented in papers of N. Geroliminis (http://www.metrans.org/nuf/documents/geroliminis.pdf.), M. Jedliński (2014), Paul R. Murphy (findarticles.com/p/articles/ mi_qa3705/is_199601/ ai_n8748499), P. Rodrigue, B. Slack, C. Comtois (2001). Given the fact that output in the unfolding economic, social and ecological processes that determine the formation of the socio-economic situation in the territorial system of higher hierarchical order, problem management urban sustainable development areas issued undoubtedly relevant. The research objective is to develop the green logistics' direction for the urban sustainable development's maintenance.

3. KEY RESEARCH FINDINGS

Cities are dynamic open systems that continually evolve due to internal interactions and formal and natural constraints (X. Bai, 2003). The city as a logistics system is characterized by a system of input and output flows that occur through the consumption of the socio-ecological and economic resources, the availability of internal and external environment in which there are basic stages of the logistics process: procurement - production-distribution-consumption that actually confirms the position to review the city as a logistics facility (Z. Gerasymchuk, M. Averkyna, 2014).

Since we characterize the city as a logistical system, we should isolate subsystems, including functional subsystems direction of the city and, depending on their role in logistics processes. M. Averkyna (2014) define backbone (residential, industrial and serving, medical and educational and cultural) subsystem and supporting (power distribution, transport, distribution and information and communication) subsystem city. Thus, urban backbone subsystems consume and reproduce socio-ecological and economic resources, and supporting subsystems consume and move the socio-ecological and economic resources between the backbone urban subsystems .

1. Residential urban subsystem city functionally provides urban public housing, ensures comprehensive improvement of housing, as well as comfort living in urban areas, including the

consumption of public facilities. Effective organization of residential subsystem is achieved by financial affordability for residents in obtaining housing, reducing the cost of its creation and the optimal organization of communication interfaces, allowing reducing costs for housing and transportation needs.

2. Industrial urban supporting subsystem covers companies, offices, financial, banking, insurance and credit institutions and performs production of goods and services to be consumed city residents.

3. Medical urban subsystem provides physical reproduction of residents, thus ensuring other urban subsystem with qualitative social resources and contains medical facilities that provide primary, secondary and tertiary health care.

4. Educational and cultural subsystem city (preschool, school educational institutions, high educational institutions, cultural institutions, sports facilities) aims to create a base for training of the qualified social resources in proportions and quantities necessary to use the backbone and supporting urban subsystems, to raise public awareness, the development of harmonic consciousness, conservation and enhancement of cultural heritage, development of physical culture and sports.

5. Power distribution supporting subsystem (gas, electricity, water supply and drainage systems, communication networks) plays a key role in the logistics system because it provides distribution of energy resources of the cities through all subsystems and influences reduction in consumption of the urban environmental and economic resources, due to rational organization of this subsystem, in particular by reducing losses during transportation.

6. Urban transportation subsystem is one of the most important supporting subsystems and includes external transport facilities and non-urban routes and commuter links, urban street and road network. Basic functions of this subsystem are: organization of the public, and other intercity transport, organization of external passenger and freight transportation.

   Effective performance of the transportation urban subsystem will ensure the flows' movement in the shortest time and at the lowest cost. This can be performed in the framework of the transportation subsystem functioning, where the whole range of services is minimized with respect to loss of time, socio- ecological and economic resources, and all the necessary related services will be provided for customers. Problems associated with insufficient transport services and uncertain transportation terms, may adversely affect the logistics maintenance of the urban sustainable development as a whole.

7. Distribution subsystem is an aggregate of interacting and integrated set together elements (shops, and restaurants, kiosks, permanently stationed markets). Their operation allows providing optimal and rational organization of goods transfer from the supplier to the consumer through the logistics chain at minimal cost, which promotes the rational use of socio-ecological and economic urban resources. Effect of a distribution subsystem in the logistics maintenance of the urban sustainable development is determined in being designed to meet consumer needs for goods and services with minimal investment of time and resources (transport, material) as a result of construction of urban logistics distribution network.

8. Information and communication subsystem provides management of the information flows (formed on individual objects) in the processes of supply- production-distribution-consumption in line with improving of governance in economic activity, health care, improving education and cultural activities, law enforcement, eliminating emergencies. Therefore, it should be noted that information and communication subsystem has significant influence on the logistics maintenance of the urban sustainable development.

Mentioned above subsystems are interconnected by logistics flows. Thus the logistic flow (a set of homogeneous elements that move in space and time at a certain speed and intensity) does not arise directly in supporting (logistics) subsystems, it occurs in static backbone subsystem as result of consumption of socio-ecological and economic resources (spatial basis, capital goods, equipment, machinery, equipment, buildings, transport, finance, population, employment potential, human and intellectual capital). In supporting subsystems flow just moves between the "destinations points" (system-subsystem). Definitions of backbone and supporting subsystems and their particular operation, confirm the fact that the city is also a logistics system.

Cities are the path breakers in the implementation of scientific and technological progress in order to develop strategic competitive prospects of its sustainable development and quality living standards (O. Moroz, www.nbuv.gov.ua/portal/soc_gum/en_re/2008_5_4/zbirnnuk_RE_4_398.pdf).

Cities are complex systems affected by diverse social, economic and environmental factors, with many conflicts and interactions among these factors. Simultaneously, cities are sources of global environmental pollution and ecological damage, and serve as major sinks for materials, energy, information, capital, and population. In the broader sense, sustainable development means the capacity to meet the needs of the present without compromising the ability of future generations to meet their own needs. Urban sustainable development does not mean the sustainable development of any single economic, social, or environmental subsystem, nor simply adding to the sustainability of these subsystems. Instead, it attempts to balance economic growth, ecological construction, environmental protection, and social progress, and the difficulty of this challenge has made it a major focus of current research around the world. (F. Li, X. Liu, D. Hu, R. Wang, W. Yang, D.Li, D. Zha, 2009).

From our position urban sustainable development is described with positive, quantitative, qualitative, directed, irreversible changes in the supply-production-distribution-consumption that allow to adapt to the effects of endogenous and exogenous factors ensure higher rates of reproduction of resources relatively to the rate of consumption, while eliminating disturbing of the socio-ecological and economic security as a result of a balance between the consumption and reproduction of resources.

It is obvious that logistics is closely connected with the structure of the city: transport networks, urban zones, nodes, i.e., the architecture and urban planning, as well as the environment (I. Smirnov, 2002). Since there is an urgent need to minimize pollution, improve efficiency of logistics resources, optimization of management decisions on the use of material, financial and other resources, it is necessary to use the principles of urban green logistics.

The value of urban green logistics as a tool for maintenance of the urban sustainable development grows; it is an example of socially useful and profitable business symbiosis ecology and economy, which satisfies the conditions as environmental protection and growth of economic activity (N. Geroliminis).

Green logistics is a form of logistics which is calculated to be environmentally and often socially friendly in addition to economically functional. It describes all attempts to measure and minimize the ecological impact of logistics activities. This includes all activities of the forward and reverse flows of products, information and services between the point of origin and the point of consumption. It is the aim to create a sustainable company value using a balance of economic and environmental efficiency (R. Saroha, 2014).

"Green logistics" − the term containing costs, yet did not appear on financial reports and on the environment and society (A. Kumar, 2015). According to Rodrigue et. al., (2012), the term "green logistics" is defined as supply chain management practices and strategies that reduce the environmental and energy footprint of freight distribution, which focuses on material handling, waste management, packaging and transport while according to Mesjasz-Lech (2011), green logistics consists of all activities related to the eco-efficient management of the forward and reverse flows of products and information between the point of origin and the point of consumption whose purpose is to meet or exceed customer demand. S. Lee, R. Klassen (2008) describe green logistics as Green Supply Chain Management that can be defined as an organizations activity taking into account environmental issues and integrating it into supply chain management in order to change the environmental performance of suppliers and customers, while according to A. Sibihi, R. Eglese (2009), green logistics activities include measuring the environmental impact of different distribution strategies, reducing the energy usage in logistics activities, reducing waste and managing its treatment. From the sustainable development point of view, green logistics can be defined as, "producing and distributing goods in a sustainable way, taking account of environmental and social factors".

According to Marcus Thiell (2011), the framework for green logistics will comprises green transport; green warehousing; green packaging; green logistics data collection and management; waste management, while according to D. Rogers (1998), the general character of the green logistics system is employing advanced technology and equipment to minimize environmental damage and increase the utilization of the resources. Reserve logistics is covering transportation, warehousing, and value added services in the context of redistribution of end-of life products and residuals along with their collection, product inspection, dismantling and separation, reprocessing of secondary materials and products, and distribution into productive processes (K.-I. Voigt, 2004).

In our view, urban green logistics is an aggregation of logistical approaches to optimize directions of material flows (including flows of waste and secondary resources for treatment), vehicles, natural, financial, information, energy and human resources with the use of advanced technologies in process of decision making by local governments to create an environment within which provided the population, increased efficiency of urban and reached a condition to minimize the negative effects of human intervention in the ecosystem of the city.

The basic principles of urban green logistics' are:

1. System approach. Treating city as a system is the main feature of urban green logistics. The maximum effect can be obtained only when urban material flows are optimized throughout the supply chain, not only within individual enterprises.
2. The principle of rational localization of production facilities. Production facilities should be placed as close as possible to the city which provides skilled laborers, while being distanced

enough from the urban sanitary protection zone, with regards to urban perspective development plans.

3. The principle of logistical coordination. Processing management of material flows in the city, it is necessary to ensure coherence in time for all parts of the logistics chain. This principle involves the development of coordinated plans for management of material flows within the city and beyond, the development of standards and technical conditions for logistics operations, forecasting supply inventories and capital goods without creating congestion in the city system and the minimum acceptable level of impact on the ecosystem.
4. The principle of stability and adaptability. Logistics system performing its functions in a relatively wide range shall not adversely affect the sustainability of the city.

Applying principles of green logistics in the system of the city mainly depends on local authorities that the active interaction with other entities to initiate the formation of new institutional framework of a new urban model, where economic, social and environmental factors are combined. Since the economic impact assessment of the ecological state of the city and its population is crucial.

When adapting green logistics there could be some inconsistencies that might arise. The issue is that green logistics is supposed to be environmental friendly, but logistics in itself is not very green because of pollution and waste that it creates. So when adapting green logistics there are some paradoxes that arise as given below (R. Saroha, 2014):

- *Cost:* Companies wants to get the cheapest way to do things but at the same time they should choose options that are green, which sometimes are more costly to the company. The purpose of logistics is to minimize costs, notably transport costs. The cost-saving strategies that are pursued by logistics operators are often at variance with environmental considerations.
- *Time/Flexibility:* The modern integrated supply chains and JIT provide adjustable and competent physical distribution systems but on the other hand extended production, distribution and retailing models are consuming more space, energy and generate more emissions (CO2, particulates, NOx, etc.).
- *Reliability:* At the heart of logistics is the overriding importance of service reliability. Its success is based upon the ability to deliver freight on time with the least threat of breakage or damage while the least polluting modes are generally regarded as being the least reliable in terms of on-time delivery, lack of breakage and safety. Ships and railways have inherited a reputation for poor customer satisfaction, and the logistics industry is built around air and truck shipments... the two least environmentally-friendly modes.
- *Warehousing:* A reduction in warehousing demands is one of the advantages of logistics. This means however, that inventories have been transferred to a certain degree to the transport system, especially the roads. Inventories are actually in transit, contributing still further to congestion and pollution. The environment and society, not the logistical operators, are assuming the external costs.
- *E-commerce:* The explosion of the information technology has led to new dimensions in retailing - e-commerce. However, changes in physical distribution systems by e-commerce have led to higher levels of energy consumption.

Due to the practice of foreign countries, the emphasis of implemented logistics solutions was moved to overcoming such phenomena as air pollution by particulate matter of diesel fuel, nitrogen oxides, hydrocarbons, noise, road networks, and transport over saturation.

Accordingly, the reasons were identified that have shaped above listed problems:

- chaotic placement of a large number of loading/unloading terminals through the city (e.g. 6200 points only in central part of Madrid);
- poorly designed routes for transferring of material resources in the city, which leads to constant stopping and starting while the internal combustion engine works in most non-economic regime;
- inefficient use of transport resulting in insufficient loading of the last trips in public transport;
- transferring of material resources in the city are made of heavy diesel vehicles used of release;
- transferring of material resources in the city made in hours of maximum load of the road network.

In overcoming the above problems, city authorities have taken the following measures (Gerasymchuk Z.V., Averkyna M.F., 2012):

- in Copenhagen (Denmark) it was identified a clear list of areas and pints where stops of commercial trucks for unloading are permitted;
- in Stockholm (Sweden) was created urban distribution centers located outside the city, material resources to the distribution centers received heavy traffic and in the city they are carried by trucks carrying up to 3.5 tones, routes which, upon the request of the final recipients, so that calculated from center truck proceeded to the city the most loaded;
- in Stockholm, Gothenburg, Malmö and Lund (Sweden) areas are limited traffic of trucks over the age of 8 years;
- in Barcelona (Spain) streets with heavy traffic and constant commercial activities have separate lane accesible for traffic from 8.00 to 10.00 and from 17.00 to 19.00, accessible for loading and unloading operations from 10.00 to 17.00, and accessible for parking from 19.00 to 8.00;

In Rotterdam (Netherlands) and Osaka (Japan) transport companies are stimulated to greater use of transport in hybrid and electric trucks in the construction, so that they are able to operate in areas prohibited for vehicles with combustion engines;

- in Zurich (Switzerland) it is introduced the use of existing networks of electric (trolley) transport for garbage collection for disposal;
- in Barcelona (Spain) it is offered to transfer urban material resources at night, during which there is two trips - at 23.00 and at 5.00, which by their loads equivalent to seven trips during peak times.

Some companies implemented principles of green logistics. DHL is an international logistic company, active in over 220 countries across the globe. It is also part of the world's leading postal and logistics Group,

Deutsche Post DHL, encompassing three different divisions: DHL Express, DHL Global Forwarding, Freight and DHL Supply Chain. Since 2009, DHL is focused on Corporate Social Responsibility and sustainability, having developed the following programs: PPGoGreen, dedicated to environment protection; PPGoHelp, dedicated to disaster management; PPGoTeach, dedicated to the spread of education in the world. In terms of sustainability, DHL believes that sustainable and environmental-friendly services can contribute to long-term competitiveness improvement. Thus, sustainability will also have a positive influence on new customers' acquisition and on existing ones retention. The most important sustainable actions are related to the optimization of transport routes, the use of vehicles with alternative drive systems, and energy-efficient warehouses. DHL offers a great number of green products and services oriented to CO_2, and greenhouse gas emissions reduction, according to a general logic of green optimization. Concluding, the company believes that environmental protection and business success are not only compatible, but also closely related (S. Cosimato, O. Troisi, 2014).

IKEA is a global furniture store that provides "cheap furniture that as many as possible can afford". Ikeas company view of green logistics is firstly to remove the wooden pallets from the entire supply chain. Instead of wooden pallets they are using Paper/cardboard pallets and so called ledges. Underneath these ledges there are a plastic leg underneath the goods. Because of this approach they are dramatically decreasing transportation, CO_2 emissions, PP/LL can be packed with less space than with normal wooden pallets. Also IKEAs Iway monitoring system steer transport partners to use low Co2 equipments. The Iway monitoring system is IKEAS own measuring system. The goals for IKEA within green logistics are as the following (https://www.linkedin.com/pulse/green-logistics-its-significance-modern-day-systems-prashant-dedhia):

- 2012 60% total flow integrated to non wooden pallets;
- 2014 100% of total flow integrated to non wooden pallets;
- 2015 all transport partners are fulfilling the Iway standards.

B. Beskovnik, L. Jakomin (2010) point that the European green logistics initiative is very strong and very well positioned at macro level. A vast number of different decisions and goals were performed in the last fifteen years. Consequently, environmental issues, tasks and goals are incorporated in the European institutions, enabling EU to give proposals and constantly measure the adoption of proposals in all member states. Moreover, the European green logistics policy made a step forward, with the goal of developing a model of European sustainable logistics. This concept covers three main fields: society, economy and environment, with different activities:

1. *Society:* Safety, health, access, equity.
2. *Economy:* Employment, competitiveness, efficiency, growth, choice.
3. *Environment:* Air quality, noise, land use, biodiversity, waste and climate changes.

We develop the direction of green logistics for maintenance of the urban sustainable development consider that city is a logistic system, features maintenance of the urban sustainable development, the basic principles of urban green logistics and the study of foreign experience in applying the principles of green logistics (Figure 1).

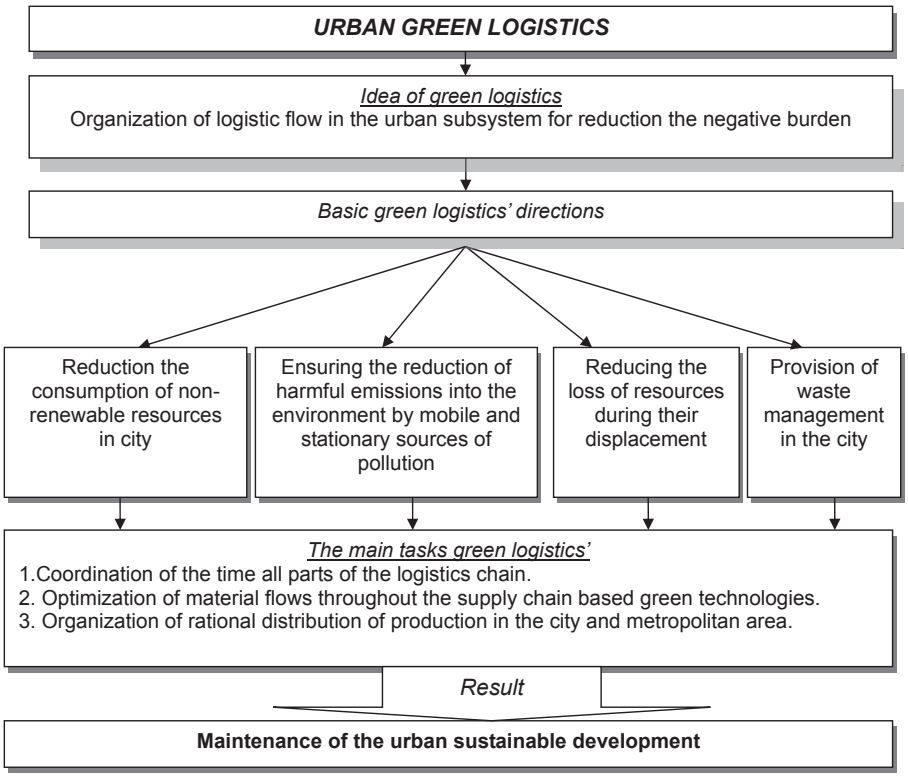

Figure 1: Main directions of green logistics (developed by the authors)

The developing main green logistics' directions to maintenance of rational consumption of socio-ecological and economic resources of the city, reproduction of socio-ecological and economic resources of the city, socio-ecological and economic security. Institutional support for green logistics in the urban system is necessary for providing green logistics' directions in cities.

4. CONCLUSIONS

The study of foreign experience in the green logistics application one can argue that the role of institutional support of green logistics in the system management has become crucial. It is noteworthy that for most cities in Ukraine are characterized by use of the green logistics' direction. One of the major reasons for this is lack of institutional support green logistics in the system of the city. That is why the mechanism responsible for implementing of the green logistics' directions in the city doesn't exist.

The main factor of institutional support for green logistics on the stage of market transformation is the institutions that form a coherent system, with interacting elements. In order to implement the institutional potential it is necessary to eliminate misuse of institutions, to overcome the lack of institutions, to transform the institutional framework into determining factor in sustainable development.

Summarizing, one could argue that crucial to maintaining sustainable development are using directions of urban green logistics. However, the realities of current trends show that in all cities in Ukraine is no mechanism for implementing green logistics' directions in the city that negatively affects the urban sustainable development. Therefore it is necessary to develop a mechanism for institutional support of urban green logistics in the city.

References

Averkyna M.F. (2014). Functioning performance features of a city as a logistics system. *Actual Problems of Economics*. no 10 (160) : 210–213.

Bai X. (2003). The process and mechanism of urban environmental change: an evolutionary view. *International Journal of Environment and Pollution*, no 19 (5) : 528–541. doi: https://doi.org/10.1504/ijep.2003.004319

Beskovnik B., Jakomin L. (2010). Challenges of Green Logistics in Southeast Europe. *Promet – Traffic&Transportation,* Vol. 22, No. 2 : 147-155

Cosimato S., Troisi O. (2014). The Influence of Green Innovation in Logistics Competitiveness and Sustainability. The DHL Case Study. 17th Toulon-Verona International Conference. Excellence in Services : 95-111.

Gerasymchuk Z.V., Averkyna M.F. (2014). Theoretical and methodological foundations for maintaining of sustainable development of the cities and metropolitan agglomeration. *Scientific Bulletin of National Mining University*. no 5 (143) : 134–141.

Gerasymchuk Z.V., Averkyna M.F. (2012). Institutional support for urban green logistics. *Actual Problems of Economics*. no 11 (137) : 161–168.

Geroliminis N. A review of green logistics schemes used in cities around the world: [Internet recourse] / access mode: http://www.metrans.org/nuf/documents/geroliminis.pdf.

Green Logistics & its Significance in Modern Day Systems: [Internet recourse] / access mode: https://www.linkedin.com /pulse/green-logistics-its-significance-modern-day-systems-prashant-dedhia.

Jedliński M. (2014). The position of green logistics in sustainable development of a smart green city. *Procedia – Social and Behavioral Sciences* 151 : 102–111.

Paul R. Murphy, Richard F. Braunschweig, D. Charles Green logistics: Comparative views of environmental progressives, moderates, and conservatives. *Journal of Business Logistics*. [Internet recourse]. - access mode: http://findarticles. com/p/articles/ mi_qa3705/is_199601/ ai_n8748499/

Kumar A. (2015). Green Logistics for sustainable development: an analytical review. IOSRD International Journal of Business. Volume 1, Issue 1, April 2015, Pages 07-13.

Li Feng, Liu Xusheng, Hu Dan, Wang Rusong, Yang Wenrui, Li Dong, Zha Dan (2009). Measurement indicators and an evaluation approach for assessing urban sustainable development: A case study for China's Jining City. *Landscape and Urban Planning* 90 (2009) : 134–14.

Lee, S.Y. and Klassen, R.D. (2008). Drivers and Enablers That Foster Environmental Management Capabilities in Small- and Medium-Sized Suppliers in Supply Chains, Production and Operations *Management Society*, Vol. 17, No. 6 : 573-586.

Malkina-Pykh, I.G. (2002). Integrated assessment models and response function models: pros and cons for sustainable development indices design. *Ecol. Indic.* 2, 93–108.

Mesjasz-Lech, A. (2011). Forecasting of demand for direct production materials as the element of supply logistics of thermal power plants. LogForum 7, 2, 5 : 51-61.

Moroz O. Experience of nymechchyny in creation of regional logistic centers: [Internet recourse] / access mode: http:// www.nbuv.gov.ua/portal/soc_gum/en_re/2008_5_4/zbirnnuk_RE_4_398.pdf.

Rituraj Saroha (2014). Green Logistics & its Significance in Modern Day Systems. *International Review of Applied Engineering Research*. Volume 4, Number 1 (2014), : 89-92.

Rogers, D.S., Tibben-Lembke, R.S. (1998). Going backwards–reverse logistics trends and practices. *Reno, NV: Reverse Logistics Executive Council*. Downloaded from www.rlec.org/reverse.pdf.

Rodrigue J-P., Slack B., Comtois C. (2001). Green logistics (the paradoxes of), The handbook of logistics and supply chain management; [A.M. Brewer, K.J. Button, D.A. Hensher]. – London : Pergamon. : 339-350.

Sbihi A., Eglese, R. (2007). The relationship between vehicle routing and scheduling and green logistics - a literature survey (Management Science Working Paper Series). Lancaster University: The Department of Management Science.

Smirnov I.G. (2002). "Green logistics": ecology-geografy dimension. *Ukrainian geography magazin*e. No. 2 : 49–52.

Scipioni A., Mazzi A., Mason M., Manzardo A. (2009). The Dashboard of Sustainability to measure the local urban sustainable development: The case study of Padua. *Municipality. ecological indicators* 9: 364–380.

Thiell, M., Zuluaga, J.P., Montañez, J.P., & van Hoof, B. (2011). Green Logistics: Global Practices and their Implementation in Emerging Markets. In Z. Luo (Ed.), *Green Finance and Sustainability: Environmentally-Aware Business Models and Technologies* (pp. 334-357).

UN, 1992a, Agenda 21, United Nations, General Assembly, Rio de Janeiro. http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm.

Voigt K.-I., Thiell, M. (2004). Industrial reverse logistics systems–a model-based analysis of alternative organizational forms using the example of the automotive industry. In Prockl, G., Bauer, Pflaum, A., & Müller-Steinfahrt, U. (Eds.), Entwicklungspfade und eilensteine moderner Logistik – Skizzen einer Roadmap (pp. 389– 418). Wiesbaden

Xin Guan (2015). Green logistics development and evaluation of the carbon footprint. *VAASA* 2015. 96 p.