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Lean-logistics in constructive geography: theoretical and methodological foundations

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ABSTRACT

Research problem introduction. The main research goal of this paper is to provide the lean-logistics geosystem research concept as a contemporary approach of constructive geography closely connected with industry as a part of the service sector based on leading scientific principles, GIS-technologies and remote sensing data processing software involvement, and to give some details about this concept applied implementation. All these arguments allow us to specify and to study in-depth the peculiarities, key types, and specificities of the lean-logistics.

In this paper, Lean-logistics is **understood** as an environmental service that helps to improve biodiversity and a stable environment. Lean-logistics itself can be developed as a type of modelling land use and land management activities. This activity can be even thought of as educational innovation with nature-based solutions.

The key geographic-centered ideas of the concept of Lean-logistics are integration, engineering, economization, ecologization, socialization, and humanization of modern human activities.

The methodological basis of Lean-logistics is presented by three sections, such as Section I. Theory of logistics (for instance, such aspects as general characteristics of logistics and its key features, Varieties of logistics and its classification, Lean logistics as a science: its place in logistics, key distinct features, etc.), Section II. Applied logistics (with such aspects as Military logistics, Business logistics, Environmental logistics, Urban logistics, and Logistics services), and Section III. Logistical construction (Lean-construction of commodity flows and Lean-construction in the field of services).

The practical basis of Lean-logistics is formed by logic modelling (studios). Logic modelling in Lean-logistics are called *logistics studios* and are understood as a form of active practical activities of researchers.

Summarizing and generalizing key ideas discussed in the text, the authors underline that **the conceptual framework** of the lean-logistics geosystem research is based on the implementation of four cross-cutting lines such as environmental security and sustainable development, health and safety, civic responsibility, business undertaking, and financial literacy. All of them aimed at forming a conscious citizen, all areas of activity of which are permeated by logistics chains.

Concluding the research, the authors emphasize that the lean-logistics concept may be quite useful within the proposed content of Lean-logistics as a page navigator E-collection in the form of a book trailer. Some pages of it contain examples of the multimedia scrapbook of interactive exercises (deal with some definite sections and/or topics) which are presented using the Print Screen-visualization of the logistics lotto. The use of such tools, forms, technologies, techniques in the study of the content of "Lean-logistics in geography", as E-collection, book-trailer, hotlist, multimedia scrapbook, mind mapping software, QR-coding, Print Screen-visualization, with active use of GIS, educational Internet services, modernizes the learning process and with systematic use in practice makes them necessary and appropriate in the knowledge about geography and constructive geography.

Keywords*: logistics, Lean-logistics, constructive geography, theory, methodology, practice, theoretical background, lean-logistics practices, lean-logistics scrapbook.*

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Research problem introduction. According to the United Nations Department of Economic and Social Affairs, more than half of the world's population lives in cities today, and by 2050 the share of urban residents will increase and exceed 66%. At the same time, studies and estimations of the United Nations experts (http://esa.un.org/) are highly relevant to the idea that if the whole world population continue to grow up, we may face the largest urban growth wave throughout the whole mankind history, which also concurs with the drastically rapid development of the logistics systems as well as information technologies, computer sciences, and geoinformatics. It is also a well-known fact that within several last decades the world has been transforming rapidly into a globalized information society. We may also accept that this

period of time has been featured by the continuing urbanization, infrastructure, and services process development in many countries. The problem of studying the mutual influence of all of them in constructive geography is very important because infrastructure development can be a factor in the development of certain industries in the service sector, and vice versa, the development of the service sector may stimulate infrastructure development to increase profits from the joint activity. Though, all mentioned factors have been continuing to influence developing logistics as an interconnected system in which different human activities are interrelated. Taking into account all mentioned aspects, it is thought that studying logistics and its environmentally based types is a very important contemporary scientific approach, especially in constructive geography for the purpose of territory planning implementation.

Recent research and publications analysis. For several recent decades, it has been recognized by many researchers that with the world population and urban growth more and more cities are operating and developing external and/or internal urban geosystems as more and more complicated [17] by logistics system [3, 7, 14, 25]. This complexity is also a key feature of the contemporary urbanization process that circumstance requires to be evaluated by taking into account not only spatial but purely geographic issues as well as according to the consideration a city as an urban geographic system entity (an external and/or internal urbogeosystem) [16, 17], which operates within a certain extent of the geographic space by logistics.

Another approach [27] for categorizing the forms of volatility and the world's organizing as a category of human and geographical knowledge is described in the context of human population connections and movements in relation to its social activities. For instance, based on the study of the transport networks in the Carpathian region of Ukraine, definitions of the concepts of a multimodal transport line, a multimodal route, a multimodal transport node, and related concepts have been given, the topology of the motor transport network and classification of the transport nodes have been carried out, the international transport corridors of the region in connection with the multimodal routes have been studied [28]. Transport is considered through various levels [22], including the level of interstate regulation, national government and how this affects forms of tourism, as well as marketing and management of transport operations.

Also increasing attention has been paid to distinct methodical in logistics aspects which were mentioned and depicted in some publications:

- vehicles analyzes which are used by the largest tour operators (in Poland), that based on in-depth analysis and use of tourism and transport resources [22], a large concentration of services for organized tourist traffic on a small number of wholesale transport intermediaries in the context of the analysis the leisure travel market as the early stages of development, and provides conclusions about the future of transport and tourism, including the management of environmental impacts and new forms of tourism related to the transport;
- the method of numerical estimation of transport and logistics potential index is proposed, and transport and logistics index has been calculated [12];
- the graph of the multimodal routes creation and the motor transport microposition in urban settlements analyzing are presented [30];
- a system of geographic and mathematical models of the hotel industry of the region, a method for calculating the integral indicator and relative indicators of the first and second levels of hotel establishments of the district for absolute indicators processing has been developed [29];
- a GIS which is used every day by everyone in the world for various, both routine and complicated operations with different spatial data formats, e.g. scanned images and their processing applications, vector map data – roads, rivers, contours; digital elevation models; raster map; aerial photos, satellite images; engineering data (surface and subsurface, etc.) [15, 17, 18];
- one innovative applied derivative solution – 3D City Cadaster, which intended to resolve complex property [17] and infrastructural situations, in which a traditional 2D digital cadaster is rather limited [1];
- the relations between transport and logistics activities and characteristics of the graph of the motor transport network [30].

The relevant methodological approach had been created [3, 4, 14], as well as the introduction of a GIS and GIS technique [6, 23, 24, 26] which was involved in logistics studies [5, 23]. Only somewhat later a GIS became a routine tool for municipal planning and logistics studies [5, 8], and a sustainable part of both ambitious developing programs [2, 5], as well as a subject of the university agenda for the time being [5]. Nowadays, GIS applications are largely used in transportation systems and logistics for territory planning [5] by using such approaches as Smart growth index (EPA), CommunityViz ("what if" scenarios & growth strategies), GIS for urban and regional planning case studies (ESRI), 3D analysis in GIS for transportation planning, Transportation injury mapping system (TIMS), Integration and application of GIS into pandemic flu response.

Distribution of logistic companies, the main logistical centers within them have been identified [12] as well as transport and distribution logistics subjects,

railway and automobile networks, features of the railway and automobile cargo flows have been studied.

Some types of transportation and their network, logistic mechanisms of international tourism activity within definite regions were presented in the context of studying factors of development of international tourism, characteristics of international tourist flows and financial flows in international tourism, the influence of international transport corridors on the development of logistics of international tourism [20], an impact on transport and logistics activities on landscapes [30], a direct relationship between global tourism growth and a significant increases of transport networks [10], GIS-data operating within the tradition of digital data handling and spatial representation at all levels – global, national, regional [11, 13, 28, 32] and local [32].

On the other hand, there is still a lack of fundamental research of logistics and its types as a useful aspect of nature orientated activities with only a few exceptions, which would combine the strong spatial aspect of the urban system analysis [17] with the GIS application advantages, and study of the transport networks in the Carpathian region of Ukraine, the problems of their territorial organization [28], while, for example, a general trend of the system approach, in the research of both logistics, and environmental systems were conclusively outlined in the subject literature [21, 25].

The relevant illustration from papers, we have just mentioned and referred to, has been used by the authors as the background for outlining the reasons for the lean-logistics concept introduction. The key reasons for this are: 1) drastically changes of spatial characteristics of logistics; 2) development of logistics process which leads to more and more complicated infrastructure appearance, while logistics territories have been enlarged with a high speed; 3) fast-growing regions with extensive urban constructions which lead to extensive roads constructions; 4) more complicated techniques which are used for infrastructural objects creation; 5) logistics systems studies development and importance to nature/landscapeological based methods introduced within it; 6) a need for precise environmental surveys and accurate terrain models for regional planning and related spatial data processing (Fig. 1).

The main **research goal** of this paper is to provide the lean-logistics geosystem research concept as a contemporary approach of constructive geography closely connected with industry as a part of the service sector based on leading scientific principles, GIS-technologies and remote sensing data processing software involvement, and to give some details about this concept applied implementation as a definite aspect of regional and landscape/territory planning. All these arguments allow us to specify and to study in-depth the peculiarities, key types, and specificities of

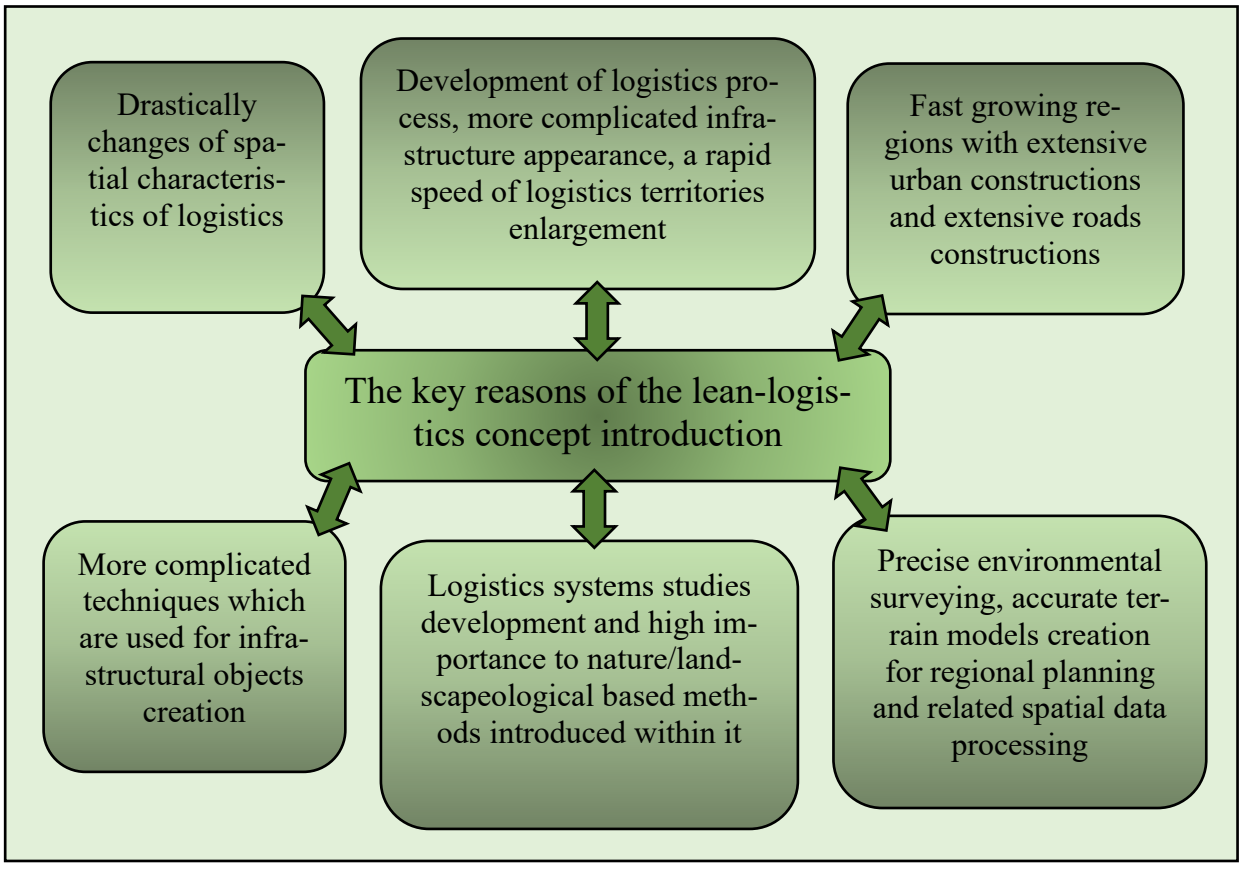


Fig. 1. The reasons outlining of the lean-logistics concept introduction
(The figure is completely the authors' original one)

the lean-logistics.

Our paper recognizes the conceptual research approach relevant to the lean-logistics geosystem, its data geoprocessing, modelling, and visualizing on the basis of either open or municipal attributive data. It is obvious that an emphasized spatial aspect of the lean-logistics research implies the geospatial procedures, tools, and operations involvement, which we attempt to examine briefly in the text below.

Results.

The conceptual framework of the lean-logistics geosystem research is based on the implementation of four ***cross-cutting lines*** [34] such as environmental security and sustainable development, health and safety, civic responsibility, business undertaking, and financial literacy (Fig. 2). All of them aimed at forming a conscious citizen, all areas of activity of which are permeated by logistics chains. That is why it is logical to pay much more attention to this issue especially in the context of constructive geography development.

The mentioned above conscious citizens and rapid urbanization growth allow us to accept consideration of a city as an urban geographic system entity that operates within a certain extent of the *geographic space by logistics*.

We accept the concept of logistics as the core part of the broader constructive geography methodology within which it is understood as a totality of linear objects that determine types of interactions between some doted elements of external and/or internal urban geosystems (Fig. 3).

We understood ***lean-logistics*** as an environmental service that helps to improve biodiversity and a stable environment. Lean-logistics itself can be developed as a type of modelling land use and land management activities (Fig. 4). This activity can be even thought of as educational innovation with nature-based solutions.

The key ***geographic-centered ideas*** of the concept are integration, engineering, economization, ecologization, socialization, and humanization of modern human activities (see Fig. 2). The last one is thought of as a pragmatic one. That is why one more key idea can be added – the idea about a new form of study in constructive geography – logic studios/modelling.

The leading ***purpose*** of studying logistics in general and lean-logistics, in particular, is an improve ideas about logistics flows and establish the concept of logistics. In this context, logistics is thought of as a science-based on integrated and complex approaches in the formation of geographical thinking and a holistic worldview.

The key ***objectives*** of lean-logistics in constructive geography are (see Fig. 2):

- to improve and deepen the geographical, economic, social, and social-cultural aspects of the concept of logistics as a science;
- to study the history of logistics and stages of its development;
- to study functions of logistics, its role, and place in various spheres of human life;
- to classify and study types of logistics and logistics flows;
- to develop focusing on the individualization and independence in the process of making logistics decisions;
- to develop identification of individual logistics skills and abilities of specialists, to cultivate a culture of their communication; to develop an idea about conditions needed for them to realize themselves as logisticians;
- to develop geographical, spatial, and creative thinking of logisticians [31];
- to form and develop a geographical, economic, ecological culture and comprehensive geographical worldview of logisticians.

The methodological basis of lean-logistics is formed by three sections, such as Section I: Theory of logistics, Section II: Applied logistics, Section III: Logistical construction (see Fig. 2). For instance, Section I "Theory of logistics" includes such aspects as general characteristics of logistics and its key features, Varieties of logistics and its classification, Lean logistics as a science: its place in logistics, key distinct features, etc. Section II "Applied logistics" deals with such aspects as Military logistics, Business logistics, Environmental logistics, Urban logistics, and Logistics services. Section III "Logistical construction" means Lean-construction of commodity flows and Lean-construction in the field of services (explanations for all of them see below).

The practical basis of lean-logistics is formed by logic modelling. Logic modelling in lean-logistics also can be called *logistics studios* and understood as a new form of active practical activities of researchers.

The content of lean-logistics, depictured in the context of four cross-cutting lines (environmental security and sustainable development, civic responsibility, health and safety, business undertaking, and financial literacy), includes the concept of logistics, its history, stages of development, functions, types, roles, and places in human life, practical skills of applied modelling. It deals with the use of logistic knowledge and introduction to word circulation of such concepts, as (see also Fig. 2):

- ✓ *logistics* as planning, management, control, regulation of the movement of material and related information flows in space and time, starting from the primary source and ending with the place of final consumption;

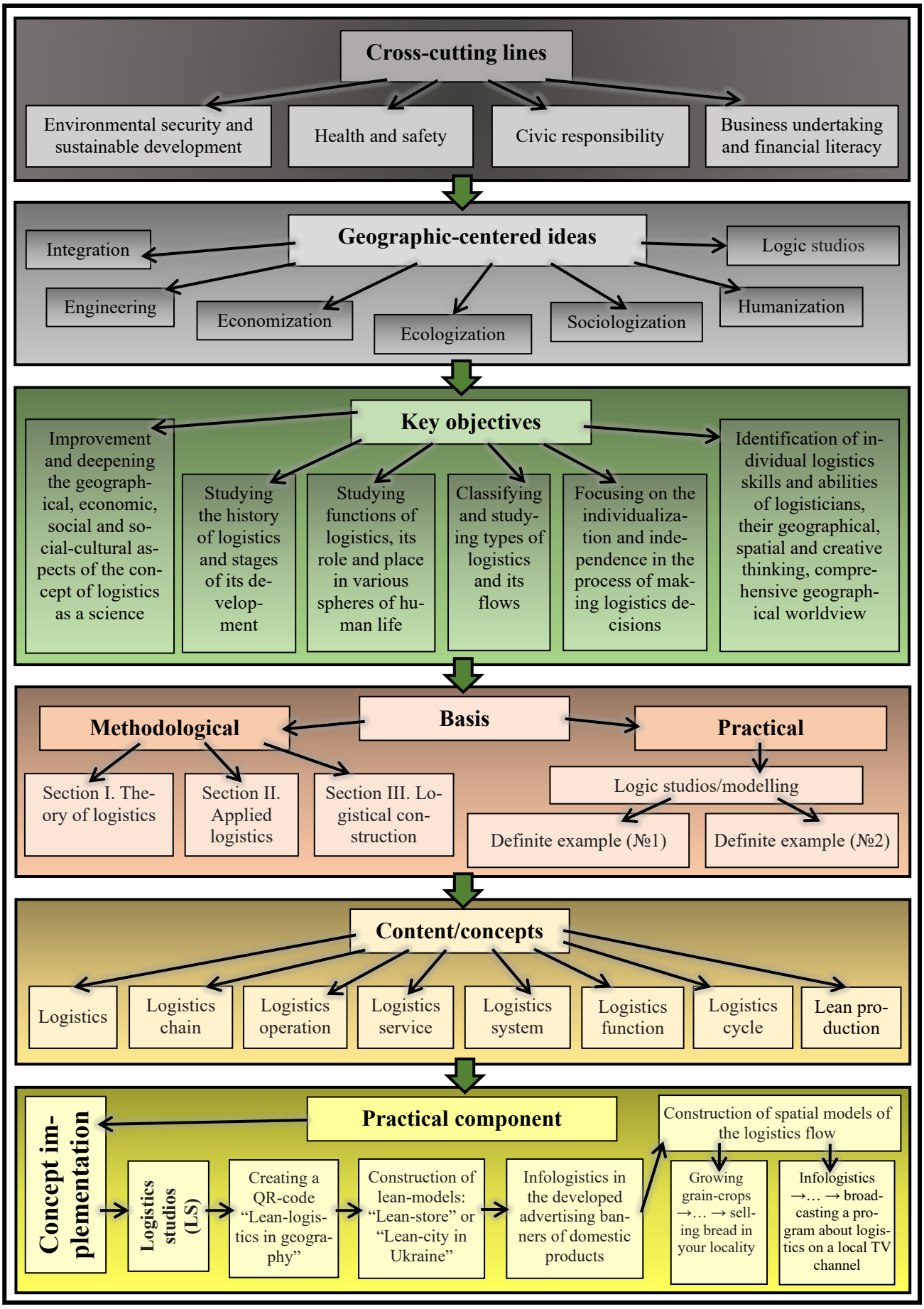


Fig. 2. The lean-logistics conceptual aspects *(The figure is completely the authors' original one)*

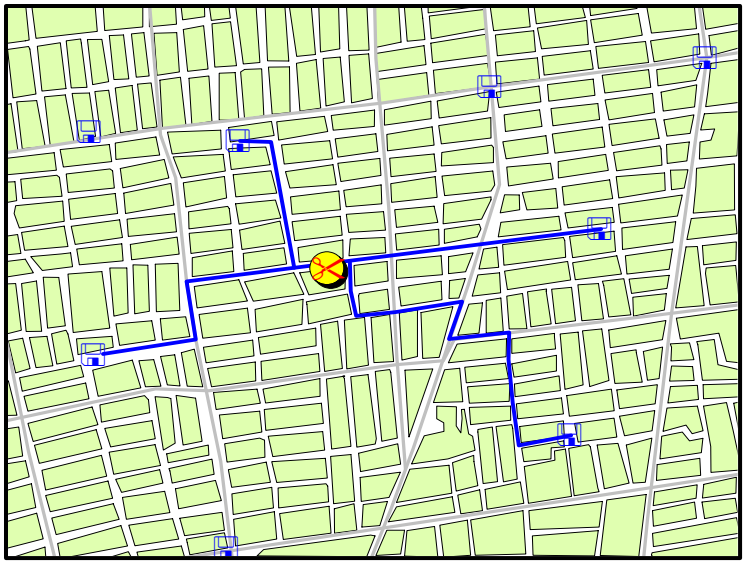


Fig. 3. Closest facilities model (when the lean-logistics is much more than transportation)
(This illustration content was originally combined by the authors of this paper)

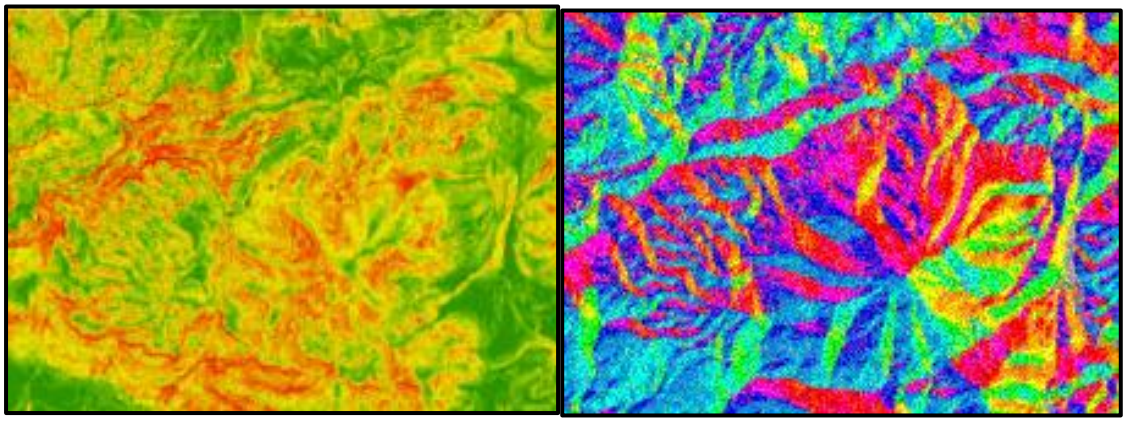


Fig. 4. Landscape structure modelling basis and surface analysis for use slope and their aspects in lean-logistics as an environmental service
(This illustration content was originally combined by the authors of this paper)

- ✓ *logistics chain* as a linearly ordered set of participants in the logistics process, which carry out logistics operations to bring the external flow from one logistics system to another;
- ✓ *logistics operation* as a separate set of actions for the implementation of logistics functions, aimed at transforming the material and/or information flow;
- ✓ *logistics service* as a set of logistics operations that provide maximum demand for consumers in the management process of logistics flows at the optimal level of costs;
- ✓ *logistics system* as an organizational and structured interconnection of elements-links, which are united by internal and external goals;
- ✓ *logistics function* as a set of grouped logistics operations aimed at achieving the goals of the logistics system;
- ✓ *logistics cycle* as a period of time between ordering and delivery of ordered products (services);
- ✓ *lean-production* which is understood as a management concept based on the optimization of business (production, services) to minimize losses with maximum focusing on the consumers (their demands, needs).

Thus, a geographer-logisticians needs to develop both a reliable ***research approach*** and advanced innovative ***technological tools*** to identify the nature and spatial peculiarities of the logistics process in a given area. We accept that this concept methodology and its applied derivative solutions are widely using GIS tools: meets the necessity for more efficient *logistics mapping*, *infrastructure understanding*, and *municipal management* as a result. Practical additions to the proposed below the content of Lean-logistics in constructive geography are a page navigator E-collection in the form of a book trailer which contains examples of the multimedia scrapbook of interactive exercises (deal with some definite sections and/or topics) which are presented

using the Print Screen-visualization of the logistics lotto and such tools, forms, technologies as E-collection, book-trailer, hotlist, multimedia scrapbook, mind mapping software, QR-coding, Print Screen-visualization, with active use of GIS tools, educational Internet services, etc.

All mentioned domains may be combined in one innovative development – *3D Roads Cadaster*, intended to resolve those complex property and infrastructural situations, in which a traditional *2D digital cadaster* is rather limited. The last one derives from the point of view that the new virtual and spatial images elaboration with all GIS-data extend our "world" and allow us to think about logistics and infrastructure in many remarkable ways. In this context, GIS data operating is simply one part of a larger tradition of digital data handling and spatial representation at all levels – global, national, and local [9, 19].

GIS applications can be largely used in transportation systems and logistics for territory planning by using such innovative approaches as *Smart growth index* (EPA), CommunityViz ("what if" scenarios & growth strategies), *GIS for urban and regional planning case studies* (ESRI), *3D analysis in GIS for transportation planning*, *Transportation injury mapping system* (TIMS), etc. (Fig. 5).

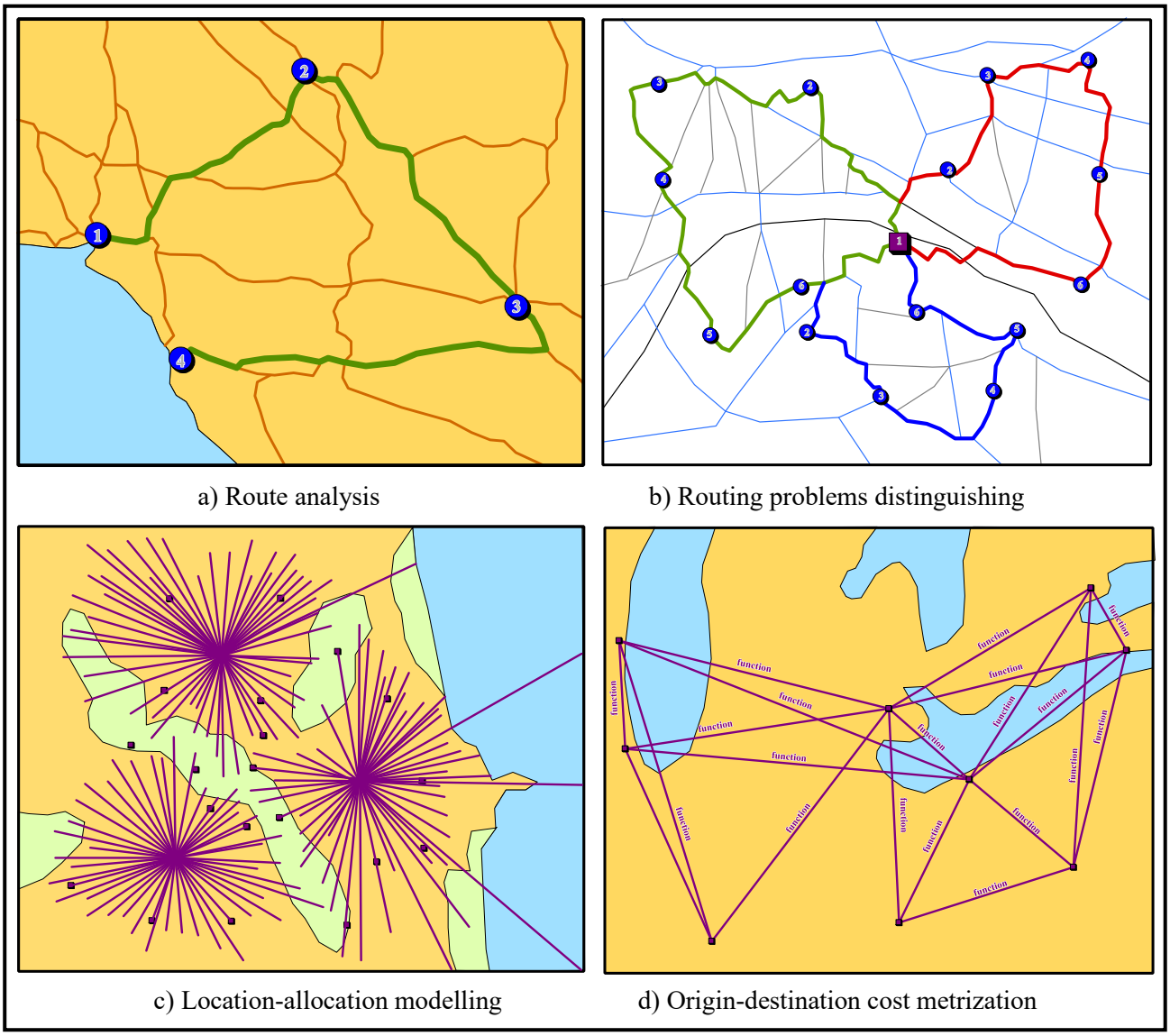


Fig. 5. GIS approaches in transportation systems and logistics modelling for territory planning
(This illustration content was originally combined by the authors of this paper)

Here we agree with [17] that the advanced GIS applications are able to solve the partial differential equations of the unsteady urban and logistics area expansion and relevant population movement by numerical techniques and describe properly different spatial regularities of logistics types based on the models developed.

Implementation of the content of the Lean-logistics involves the use of *logistics studios* and such its elements as active and interactive forms of practical

activities of researchers while modelling some processes. In order to implement the practical component of the Lean-logistics, a new form of work − logistics studios modelling (*logistudio*) (see also Fig. 2) is proposed as a means of active learning and pragmatic form of creative activities to practice logistics skills. According to the structure of the Lean-logistics, 5 such studios are offered. All of them due to the framework nature of the lean-logistics components can be done creatively because logisticians can implement its content, selecting needed objects of study, K-direction tasks [33], and appropriate case study examples at the regional level.

Let's have a look at the tentative content of the Lean-logistics in constructive geography in the context of the implementation of cross-cutting content lines with a projection on the results of creative modelling activities of logisticians.

In an "Introduction" we propose to look at the meaning of "logistic", and study logistic as a science (Fig. 6a), logistics as an industry (function) of a corporation, symbolism of the image of the logistics business, the cognitive and constructive-geographical role of the logistics in the modern world, logistics in geography and in constructive geography, sources of knowledge about logistics.

In the context of an introductory part implementation we propose to accomplish logistudio №1 – Creating a QR-code "Lean-logistics in geography". The last one should depict and explain information about the meaning of "logistics", the importance of logistics in geography and constructive geography, the key features of logistics as a science and industry (function) of a corporation; give examples of sources of knowledge about logistics and symbolic image of the logistics business, determine the cognitive and constructive role of logistics in the modern world and in constructive geography, evaluate the practical significance of logistics for humans.

This part of the lean-logistics studying deals with such cross-cutting lines mentioned above as formation of a lean attitude to the environment and environmental safety, awareness of the importance of sustainable development and the constructive role of the logistics in the modern world; formation of a tolerant member of society through collective work by means of a logistics studios; formation a secure logistics environment around us; providing logisticians with a better understanding of the practical aspects of the logistics, their own logistics capabilities.

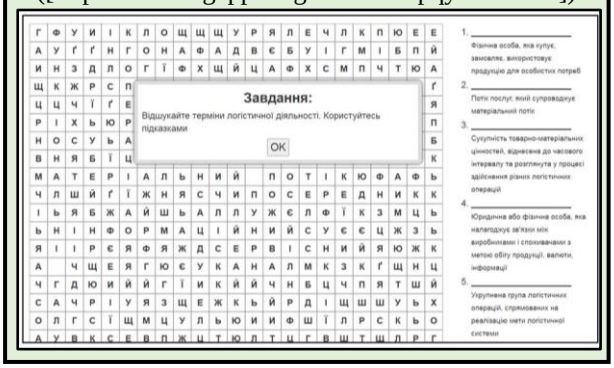
In Section I. "Theory of logistics" we propose to look at three next aspects: 1) General characteristics of logistics, 2) Varieties of logistics, 3) Lean logistics.

For instance, *Aspect I.1. General characteristics of logistics* deals with meaning, understanding and studying such concept as logistics system, logistics chain, logistics operation, object of logistics operations, origin and history of the term "logistics", stages of logistics development, and logistics functions (Fig. 6b). This aspect depicts and explains information about the meaning of the concepts "logistics system", "logistics chain", "logistics operation", give definite examples of objects of logistics operations and characteristics of the stages of logistics development, describe the functions of logistics; determine logistics own judgments about the object of logistics operations in geography and constructive geography, logists awareness about the applied value of knowledge in logistics. This part of studying deals with such cross-cutting lines as the formation of critical thinking about the prospects of environmental development in the context of the functioning of logistics systems, formation of a tolerant attitude to peers in making judgments about the importance and object of logistics operations in geography, and implementation of tasks on security and risks of logistics operations, the development of the ability of logisticians to operate successfully in a rapidly changing technological environment.

Aspect I.2. Varieties of logistics depicts types of logistics, classification groups of logistics, military logistics, business logistics, material and information flows in logistics, logistics costs, urban logistics, ecological logistics, and tasks and problems of logistics in the world, in geography and in constructive geography. This aspect deals with the explanation of information about the meaning of the concept of "logistics costs", the classification types of logistics groups, differences between the key types of logistics, the essence of the military, environmental, urban, and business logistics (Fig. 6c); the key characteristics of logistics costs; differences between material, and information flows; comparison the problems of logistics in the world and geography; awareness about the feasibility of implementation of "lean-"direction in environmental, urban, business and military logistics. This part of studying deals with such cross-cutting lines as forms of social activity, ecological consciousness by means of military, urban, ecological, and business logistics; formation of a tolerant, responsible member of society by means of military logistics; performing practical tasks with data operation on safety and health, material and information flow of logistics in the world, in geography, and in constructive geography; providing logisticians with an understanding of the practical aspects of financial issues by means of business logistics, solving practical problems to determine logistics costs (see Fig. 3).

Aspect I.3. Lean-logistics depicts thrifty (lean) production, basic principles of lean-production, history of lean-production (Fig. 6d), the key aspects of lean-production, methods and concepts of lean-production, types of lean-production costs, industry opti-

a) Studying Logistic as a science
([https://learningapps.org/watch?v=pqyz47f5519])



b) Studying General characteristics of logistics
([https://learningapps.org/watch?v=pswgqw3xk19])

c) Studying Varieties of logistics
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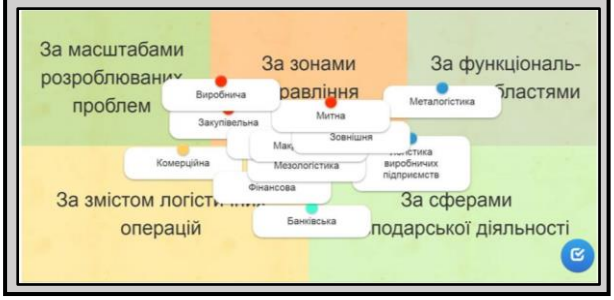

d) Studying Lean-logistics
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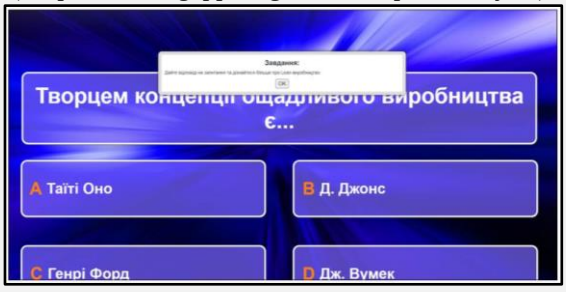

e) Studying Military logistics
([https://learningapps.org/watch?v=pca081bcj19])

f) Studying Environmental logistics
([https://learningapps.org/watch?v=po2ijctcn19])

g) Studying Lean-construction in the field of services
([https://learningapps.org/watch?v=poxndy1a319; https://learningapps.org/watch?v=pxsbj357219])

Fig. 6. Examples of the pages of the E-collection "Lean-logistics in geography"
(The figure is completely the authors' original one)

ons for lean-productions, lean-logistics, thrifty health care, lean-mail, lean construction, thrifty management, lean-city. In the context of this aspect implementtation, we propose to accomplish logistudio №2 – Construction of lean-models: "Lean-store" or "Lean-city in Ukraine" (Fig. 7).

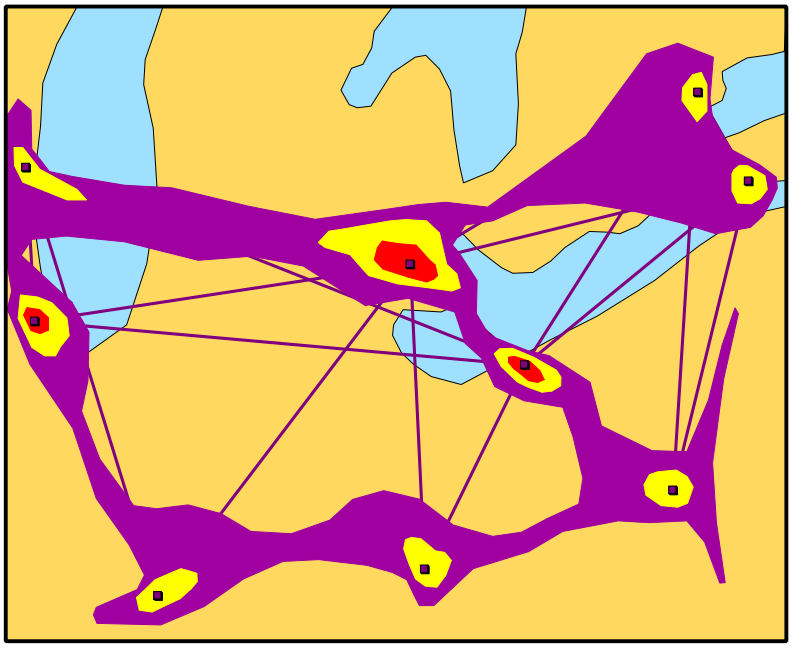

Fig. 7. Example of business analyst in lean-logistics customer segmentation for territory planning
(This illustration content was originally combined by the authors of this paper)

All together Aspect I.3 deals with information about the meaning of "lean-logistics", the origin and history of lean-productions, features of lean-production, giving examples of lean-productions in the world and in Ukraine, concepts, and methods of lean-production. Also, it takes into account such components as the basic principles of lean production, characteristics of the main aspects of lean production, substantiation of the types of costs of lean-production; industry's options for lean production; projects of lean-shop, lean-mail, lean-city creation, and modelling; determination: the role of lean logistics in the world, the importance of economical production, lean-construction, lean-management, lean-health care for humans; evaluation the practical significance of the lean-city (post office, store) for human life, the importance and prospects of lean-logistics in Ukraine. This part of studying deals with such cross-cutting lines as fulfillment of logistical tasks on modelling of lean-city, lean-production, lean-shop, etc.; formation of civic tolerance by means of a logistics studios; performing tasks with data operation about economic health care, practical exercises for modelling lean-productions, lean-city, lean-shop, lean-mail, etc.; the formation practical skills in calculating the costs of lean-production, recognizing industry options for lean-production, modelling cost-effective construction and providing logisticians with a better understanding of practical aspects of logistics, logistics aspects of financial issues (savings, investment, insurance, loan, credit, etc.).

In Section II. "Applied logistics" we propose to look at five next aspects: 1) Military logistics, 2) Business logistics, 3) Environmental logistics, 4) Urban logistics, 5) Logistics' services.

For instance, *Aspect II.1. Military logistics* deals with meaning, understanding, and studying such a concept as "Military logistics" as a type of logistics, history of military logistics, logistics system of military logistics, military logistics flows in history and modernity, rear provision, logistics in topography (Fig. 6e), elements of military logistics in the geography of settlement of continents and land conquest. This aspect deals with the explanation of information about the meaning of the concept of "military logistics" and understanding its importance, the history of military logistics, the system of military logistics and rear logistics provision, the military logistics flows in the historical perspective, the instruments of obtaining logistical information from topographic maps, examples of military logistics currents of modernity; the importance of knowledge of military logistics for peaceful purposes, adhering the peaceful coexistence. This part of studying deals with such cross-cutting lines as the formation of logisticians' responsibility for sustainable peaceful coexistence in society; a tolerant attitude to others, a conscious citizen by means of studying military logistics; fulfillment of practical tasks with elements of military logistics in topography, geography settlement of continents and land conquest; the use of knowledge of military logistics for business undertaking benefit and financi-

al literacy increasement.

Aspect II.2. Business logistics depicts logistics systems of business logistics, logistics management tasks, purchasing logistics, distribution logistics, obtaining logistics, transport logistics, customs logistics, logistics of reserves, storage facilities logistics, infologistics, complex logistics, logistics flows of business logistics, lean-business-logistics, business logistics in the Ukrainian economy. In the context of this aspect implementation, we propose to accomplish logistudio №3 – "Infologistics in the developed advertising banners of domestic products". All together Aspect II.3 deals with information about the meaning of "lean-business logistics" and the explanation of its key features; examples of info-logistics in the world and in Ukraine; business logistics systems; characteristics of the key features of purchase, distributional, transportation, customs, sales, information, integrated logistics; the tasks of logistics management; the logistics flow of business logistics descriptions; projects modelling of advertising banners of domestic products on the basis of infologistics; awareness of the importance of logistics supplies for people, knowledge of business logistics for consumers of goods and services; assessment the practical importance of business logistics in the Ukrainian economy. This part of studying deals with such cross-cutting lines as performance of practical tasks on sales logistics with real data operation about natural resources, their conservation, multiplication; formation of civic tolerance by means of logistics modelling, implementation of practical tasks related to business logistics in the Ukrainian economy; formation of a safe living environment; the formation of logistics skills, entrepreneurship, financial literacy in the development, understanding infoload advertising banner of domestic products based on infologistics, understanding of business logistics and its components.

Aspect II.3. Environmental logistics depicts information about ecological logistics and ecological security of the world, production processes and production waste, utilization; unauthorized emissions; lean-conservation and ecologically appropriate human behavior; logistics flow of ecological logistics; lean-logistics of ecological attractiveness of regions of Ukraine; logistics and geographical forecasting (Fig. 6f). Also, this aspect deals with the explanation of the meaning of the concept of "eco-logistics", production processes, the relationship between production processes and production waste; meaning and characteristics of the flows of environmental logistics; causative links in the systems: "environmental logistics ↔ environmental security", "environmental security ↔ logistics", "logistics ↔ geographical forecasting"; description the options for disposal of industrial and household wastes, applying the acquired knowledge in practice; selection examples of unauthorized waste emissions in the world and in Ukraine; realizing the importance of knowledge of lean-logistics in ecological attractiveness of the regions of Ukraine; critical attitude to careless waste disposal and environmentally appropriate human behavior. This part of studying deals with such cross-cutting lines as formation of ecological consciousness, ecologically expedient behavior by means of ecological logistics and performance of practical tasks on modelling of variants of the utilization of industrial and household waste; formation of civic consciousness about the ecological attractiveness of the regions of Ukraine; implementation of practical tasks to determine the environmental attractiveness of the regions of Ukraine, safety for a living taking into account the risks to human life and health (Fig. 8); the formation of an economical attitude to natural resources, training culture of savings through eco-packaging and ecologistics.

Aspect II.4. Urban logistics depicts information about such type of logistics as "city-logistics", urban and rural population, the infrastructure of cities, the metropolis and agglomeration, urbanization; types of cities, their functions, and problems; urban lean-logistics; lean-logistics of demographic processes and demographic policy; lean-logistics of your locality (Fig. 9). Also, this aspect deals with the explanation of the meaning of the concept of "city-logistics", "metropolis", "agglomeration" (Fig. 10), "urbanization"; the differences between urban and rural population; recognizing the types of cities in the context of lean-logistics; characteristics the functions of cities and their problems; selection examples of megapolises, agglomerations, their location on the geographical map; awareness about the importance of knowledge of urban lean-logistics for cities development; making judgments about the effectiveness of lean-logistics of demographic processes; evaluation the infrastructure of the regional center from the standpoint of lean-logistics. This part of studying deals with such cross-cutting lines which were mentioned above as formation of critical thinking, awareness of the importance of sustainable development for future generations; formation of a responsible member of the community, settlement; formation of an emotionally stable resident (guest, visitor) of a metropolis; providing logisticians with a better understanding of the practical aspects of financial issues of successful existence in the urban world, the formation of a surplus family budget of a resident of a modern city (village).

Aspect II.5. Logistics services depicts information about outsourcing and audit in logistics; logistics providers, logisticians, and managers of logistics: professions, professional qualities; logistics educational institutions; museums of logistics, etc. This

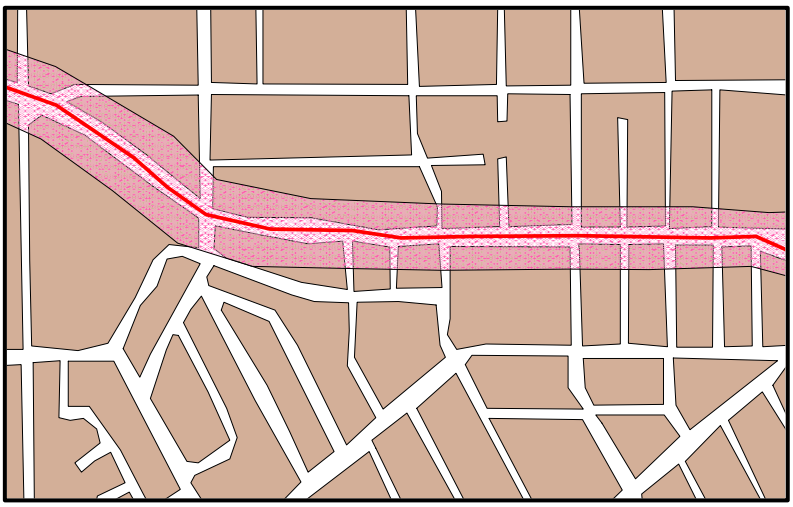

Fig. 8. Example of safety for a living analyst (parcels of the road) of lean-logistic for territory planning
(This illustration content was originally combined by the authors of this paper)

Fig. 9. Lean-logistic of the locality analyst and hot spot analysis

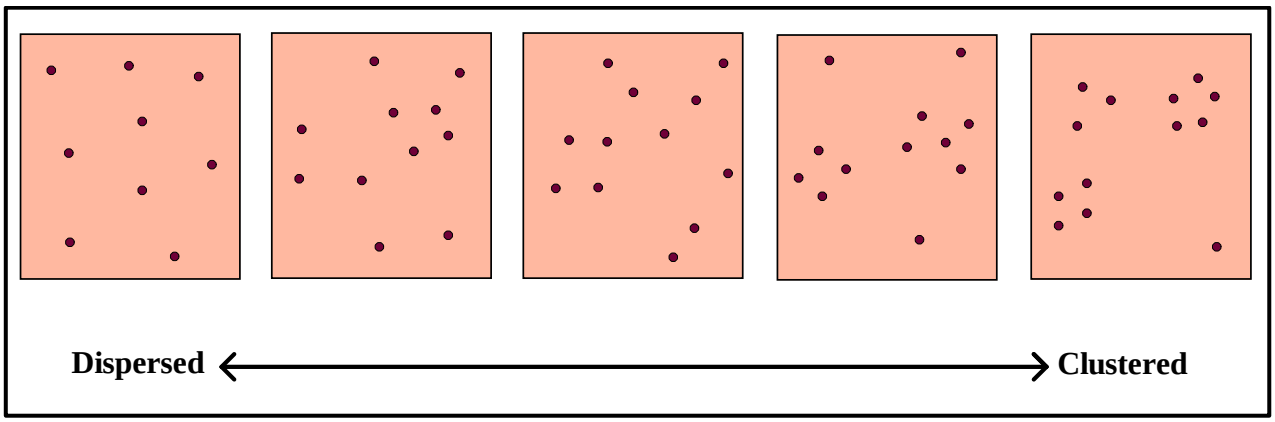

Fig. 10. Agglomeration analyst example of average nearest neighbor for lean-logistic modelling
(This illustrations content was originally combined by the authors of this paper)

aspect also deals with the explanation of the meaning of the term "logistician", knowledge of the institutions and museums of logistics; observation and distinguishing essence of the actions of providers and logistics managers; characterizing outsourcing and audit in logistics; realizing the importance of the profession of logistician in society; evaluation from the "lean-"position the logistics to personal professional self-determination. This part of studying deals with such cross-cutting lines as formation of the ability to critically assess the prospects for the development of the environment and man in the context of outsourcing and audit; formation of a civic position about the importance of the logistics profession in Ukrainian society; becoming a logistician as an emotionally stable member of society; fulfillment of practical tasks for modelling the actions of providers and logistics managers.

In Section III. "Logistical construction" we propose to look at two next aspects: 1) Lean-construction of commodity flows, and 2) Lean-construction in the field of services.

For instance, *Aspect III.1. Lean-construction of commodity flows* deals with meaning, understanding, and studying such a concept as "construction" in geography and logistic construction; spatial models;

logistics flow in the field of economy, logistic flows in the production of goods, logistics flows in the agro-industrial complex; lean-construction of commodity flows; logistics risks and logistics advantages, logistics shortcomings; global "chains of additional costs" and "chains of logistics": common and different specificities. In the context of this aspect implementation we propose to accomplish logistudio №4 – "Construction of spatial models of the logistics flow "Growing grain-crops →… → selling bread in your locality" based on lean-logistics". All together Aspect III.1 deals with information about the relationships between logistics flows in production and sales of products; the features of spatial models; the functions of logistics construction; examples of logistics flows in the production sphere; identification and characteristics of the features of logistics in industry and agriculture, making comparative tables; substantiation logistics advantages and risks; finding commonalities and differences between chains of additional costs and chains of logistics; development of spatial logistics skills and abilities; construction spatial models of logistics flows based on lean-logistics, identification their advantages and disadvantages; evaluation the logistics advantages and disadvantages in the process of constructing spatial models of the logistic flow; analyzing and realizing the importance of lean-logistics in the construction of effective spatial models of logistics flow (Fig. 11). This part of studying deals with such cross-cutting lines as formation of awareness of the importance of sustainable development of industry and agriculture; formation of civic tolerance by means of a logistics modelling; fulfillment of practical tasks for construction spatial models of logistics flow, training consistency in decision-making on logistics construction; becoming a logistician as an emotionally stable member of society, performing practical tasks of the logistics studios on constructing spatial models of the logistics flow (e.g. "Growing grain-crops →… → selling bread in your community"), which can evoke joyful emotions; fulfillment of practical tasks on a calculation of the added costs, planning of economic activity and the family budget in a point of purchase, sale of bakery products, etc.

Aspect III.2. Lean-construction in the field of services deals with meaning, understanding, and studying such a concept as "lean-construction", "the field of services"; logistics flows in: the service sector, the transport sector, the financial sector, in education, science, culture, tourism, and sports; political geography and logistics (Fig. 6g). In the context of this aspect implementation we propose to accomplish logistudio №5 – "Construction of spatial models of the logistics flow "Infologistics →… → broadcasting a program about logistics on a local TV channel" based on lean-logistics". All together Aspect III.2 deals with information about the the specificities of lean-construction; the relationships between logistics flows in the service sector and the quality of services

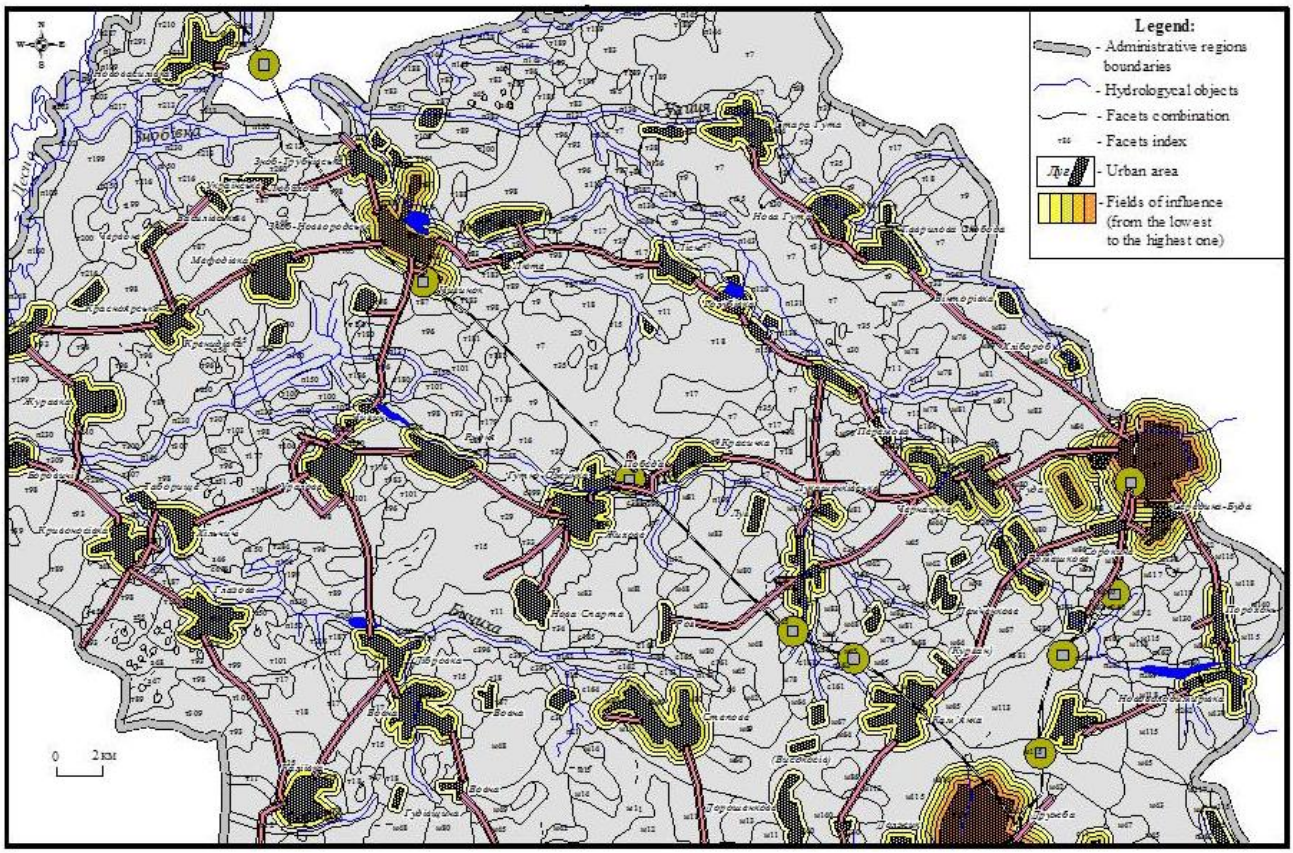

Fig. 11. Construction of spatial model of the logistics flow [32]

received by the consumer; the features of spatial models; characteristics the features of logistics in transport and financial sphere; researches results and substantiations logistics flows in the field of education, science, culture, tourism and sports; construction spatial models of logistics flows on the basis of lean-logistics; identification the relationship between logistics and political geography; evaluation the logistical advantages and disadvantages in the process of constructing spatial models of the logistic flow; awareness of the importance of lean-logistics in construction effective spatial models of logistics flow; formulation a personal "lean-"concept of the rationality of logistics actions (information, goods, services, etc.) in society and space; realization the value of the acquired knowledge of "lean-logistics in geography". This part of studying deals with such cross-cutting lines as formation of awareness of the importance of sustainable development of services; formation of civic tolerance by means of logistics studio, political geography, and logistics; fulfillment of practical tasks on the construction of spatial models of a logistic flow; training of sequence in decision-making on logistic construction of infologistics censorship; formation of a logistician as an emotionally stable member of society, fulfillment of practical tasks on constructing spatial models of logistics flow; fulfillment of practical tasks on modelling of consumer attractiveness, planning of economic activity and family budget in the point of purchase, sale in the sphere of services.

Conclusions. The main results of this paper and their provision are the lean-logistics geosystem research concept as a contemporary approach of constructive geography based on leading scientific principles, some details about this concept applied implementation as a definite aspect of regional planning. For this purpose, a few examples (case studies) of its modelling and practical application were provided.

Altogether, the content of the proposed structure of "Lean-logistics in constructive geography" contributes to the learning geography at the profile level, because it deepens knowledge of logistics and its derivatives, QR-coding (its creation and use), Lean-logistics itself, outsourcing, auditing, and development of such skills as distinguishing spatial models, describing the features of logistics in space and time; formation of skills in designing, modelling, constructing, working with cartographic material, etc.

In addition, the implementation of the proposed content of Lean-logistics is aimed at revealing facts, processes, phenomena from the perspective of the four cross-cutting content lines (environmental security and sustainable development, civic responsibility, health and safety, business undertaking, and financial literacy), the formation of key, general subject, subject geographical competencies.

Along with this, practical addition to the proposed content of Lean-logistics in constructive geography is a page navigator E-collection in the form of a book trailer. Some pages of the book trailer contain examples of the multimedia scrapbook of interactive exercises (deal with some definite sections and/or topics) which are presented using the Print Screen-visualization of the logistics lotto. The use of such tools, forms, technologies, techniques in the study of the content of "Lean-logistics in geography", as E-collection, book-trailer, hotlist, multimedia scrapbook, mind mapping software, QR-coding, Print Screen-visualization, with active use of GIS tools and technologies, educational Internet services, modernizes the learning process and with systematic use in practice makes them necessary and appropriate in the knowledge about geography and constructive geography. Logistics lotto print screen "Lean-logistics in geography" illustrates the construction of intelligence models in the knowledge of logistics by means of test exercises, sequence and correspondence, cartographic modelling, info-construction, and example of tasks of the bank of questions, forming an appropriate training complex to disclose the proposed content of Lean-logistics in constructive geography. Also, all given theoretical and methodological aspects of lean-logistics will be a basis for the future monograph and definite case study elaboration.

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Lean-логістика у конструктивній географії: теоретичні та методологічні засади

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З метою подальшого розвитку та впровадження у практику планування територій новітнього концептуального підходу та напряму конструктивно-географічних досліджень − Lean-логістики представлена стаття була присвячена висвітленню її фундаментальних засад. У представленому доробку Lean-логістика визначається як такий напрям сучасних наукових пошуків, який спрямовано на дослідження особливого типу актуальних геосистем – логістичних, поява яких зумовлена всезростаючим впливом логістики на територію, ускладненням логістичних процесів та логістичної інфраструктури, розширенням просторових їх меж як результату екстенсивного містобудування та спорудження шляхів сполучення, удосконаленням технологічних процесів, задіяних у логістиці, посиленням енвайроментальної та ландшафтознавчої складових під час здійснення логістичних досліджень тощо. При цьому, Lean-логістика уявляється як така концепція прикладного спрямування, розвиток якої тісно пов'язаний з концептуальними засадами конструктивної географії та ГІС-технологіями, а провідними її аспектами визначено: у складі фундаментально-методологічного блоку пошуків − «теорія логістики», види логістики та їх відмінності, «прикладна логістика», зокрема, військова, бізнес, екологічна та міська логістика, надання логістичних послуг, та «логістичне конструювання» (товарних потоків та потоків у сфері послуг), а у складі практичного блоку – низка «логі-моделювання» (приміром, з QR-кодування, побудови моделей lean-магазину чи-то lean-міста, інфологістики, конструювання просторових моделей логістичного потоку інструментами lean-логістики тощо). Разом з тим, запропоновано приклад впровадження lean-логістичних досліджень у вигляді Е-збірника (бук-трейлера), окремі сторінки якого містять приклади мультимедіа скрепбуку інтерактивних вправ та логістичного лото, розроблених відповідно до сформованої структури Lean-логістики.

***Ключові слова**: логістика, Lean-логістика, конструктивна географія, теорія, методологія, практика, теоретичні засади, lean-логістичне моделювання, lean-логістичний скрепбук.*

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