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A COMPLEX SYSTEMS APPROACHES TO SUSTAINABLE WASTE MANAGEMENT: THE CASE OF A RECREATIONAL AND TOURIST REGION OF UKRAINE

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Introduction. Waste management is an important component of sustainable development of recreational and tourist regions. This determines the expediency of applying a system approach – in the context of determining the components of the waste management system, as well as information and organizational relationships between them; and an integrated approach – in view of the complexity of the object of study, namely the set of diverse economic, environmental, social and other factors mediated by waste management processes, and as a consequence, affecting the ecological status of the recreational and tourist region

Aim and tasks. The purpose of the study is to theoretically substantiate the management of waste in the recreational and tourist region on the principles of sustainability and on the basis of complexity and system.

Results. The article reveals the theoretical content of the provisions based on the application of systematic and integrated approaches in waste management at the regional level, in particular in recreational and tourist regions, which require stricter environmental policies. In view of the extensive nature of the current waste management system in Ukraine, which is reflected in the constant accumulation of production and consumption waste, with minimal action on their prevention and processing, the main element of the studied system is identified as transport and logistics component. Based on the development of a systems approach, it is proved that not only no less important, but also paramount is a detailed analysis of the relationships between elements of a particular economic, and even more economic and environmental system, compared to the analysis of the elements themselves.

Conclusions. The article substantiates that along with a set of sustainable development indicators, the calculation of which in the absence of primary information is difficult, it is necessary to implement comprehensive development systems of the region and industries, including recreation and tourism, within its territory. The problem of waste and its rational transportation in recreational and tourist regions affects a large number of other important economic, environmental, social issues that should be solved comprehensively, without artificial abstraction from each other, which in practice usually ends in significant damage, where the “boomerang” will affect to all other elements. In solving the issue of responsible waste management the focus is on interrelated multi-purpose tasks, which require the involvement of expert assistance and clear coordination of actions of all participants involved or interested in this area.

Keywords: waste management, sustainable development, recreation, tourism.

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1. Introduction.

Waste management is an important component of sustainable development of any area. Areas with a special status that require increased attention to environmental sustainability, such as recreational and tourist regions, should be responsible for waste. This determines the expediency of applying a systematic approach – in the context of determining the components of the waste management system, as well as information and organizational relationships between them; and an integrated approach – in view of the complexity of the object of study, namely the set of diverse economic, environmental, social and other factors mediated by waste management processes, and as a consequence, affecting the ecological status of the recreational and tourist region. Waste management in Odesa region, as a traditional and at the same time the most promising region in terms of tourism and resort recreation, is one of the most critical in Ukraine, which exacerbates economic and environmental and socio-environmental contradictions within its borders and determines the relevance of the research. Taking into account the specific situation in the region, which is related to the extensive nature of waste management, the focus of this research is on the transportation and logistics of waste and, accordingly, their impact on the recreational and tourist environment of the region.

2. Literature review.

The study summarized the sources that reveal theoretical aspects before substantiating the application of systematic and integrated approaches in waste management, in particular regarding the formation of its transport and logistics component, namely: economic and environmental contradictions and environmental regulation (Burkinskiy et al., 2005; Khumarova, 2005; Prokopenko, Petrushenko, 2013) and implementation Sustainable development goals (Shevchenko et al., 2021); logistics (in general and specific issues inherent in logistics in waste management (Kodzhebash, Krivencev, 2018)); transport in the context of transport economics and transport management (it is clear that logistics and transport are interrelated, in particular, in form of transport and logistics

component of waste management); fundamental approach to the formation and development of logistics processes (Murphy, Poist, Braunschweig, 1995); integrated and marketing approaches/paradigms for understanding and organizing logistics activities (Winkelhaus, Grosse, 2020); reciprocal approaches to transport logistics (Topolšek, Čižiūnienė, Ojsteršek, 2018); practically oriented empirical approach to the analysis of corporate logistics (Durach, Kembro, Wieland, 2021); the so-called reversible approach to understanding logistics processes in the area of industrial waste management (Kocheshkova, Trushkina, 2018); analysis of the effectiveness of reverse logistics in order to improve the organization and increase the percentage of recycling (Veiga, 2013); methods of environmental logistics implemented at the regional level in waste management (Kartava, 2014); generalization of models and methods of logistics management (Karatas-Cetin, Denktas-Sakar, 2013); as well as about the functioning of the recreational and tourist sphere, in particular, in terms of environmental impacts, disclosed in the researches (Shevchenko, 2017a; 2017b).

At the same time, the impact of waste management processes on such areas as recreation and tourism, which contain social and natural resources and directly depend on the state of the environment and the quality of natural recreational resources, and it requires further research and development.

Thus, the purpose of the research is to theoretically substantiate the management of waste in the recreational and tourist region on the principles of sustainability, on the basis of complexity and system.

3. Results.

Regions of resort and recreational-tourist significance form a policy of sustainable development with special emphasis on environmental and, precisely, socio-environmental aspects. The data presented in Table 1, according to indicators of waste generation by type of economic activity in Odessa region (Krivenceva, 2021a), show a state of waste management in which the environmental situation is generally regulated, but the problem of waste is not eliminated.

Table 1. Waste generation by types of economic activity at enterprises and households in Odessa region, 2015-2020

Type of activity	2015	2016	2017	2018	2019	2020
Agriculture, forestry and fishing	15011,7* 77,0**	23282,7* 419,5**	9623,2* 28,6**	9105,0* 30,5**	4291,4* 47,1***	3782,7* 88,1***
Extractive industries and quarrying	0,4 –	– –	2,3 1,4	1,3 0,8	0,1 7,7	– –
Recycling industry	77222,0 851,4	120437,0 3073,4	220881,3 1210,7	216907,3 809,7	134218,8 61,9	111837,8 83,3
Power, gas, steam and air conditioning supply	6973,2 310,2	2715,2 69,9	7247,4 40,7	5504,9 32,7	2488,2 45,2	5559,1 223,4
Water supply; sewerage, waste management	8287,8 30,2	19992,4 140,5	6719,4 113,3	6264,5 117,5	5894,3 94,1	1935,7 32,8
including: water intake, purification and supply	6184,8 6,3	1606,8 53,8	5249,1 8,6	655,8 3,3	4502,0 686,5	862,0 19,1
sewerage, drainage and wastewater treatment	981,8 0,8	100,4 0,3	920,1 0,4	5090,4 5,5	938,7 18,4	838,0 89,3
waste collection, treatment and disposal; restoration of materials	1121,2 23,1	18285,2 86,4	550,2 104,3	518,3 108,7	453,6 87,5	235,5 51,9
Construction	140,4 8,5	4919,2 14,6	175,6 30,0	175,1 13,4	82,0 46,8	84,9 103,5
Other types of economic activity	94542,0 2111,7	48505,9 4371,9	81394,7 1205,7	82730,1 877,9	92583,7 111,9	87198,3 94,2
Households	400399,9 –	427656,1 –	413814,9 –	407839,0 –	399239,1 97,9	245836,9 61,6
Total:	602577,4 3389,0	647508,5 8230,3	739858,8 2743,7	728527,2 1882,4	638797,6 87,7	456235,4 71,4

* I-IV classes of danger; ** including I-III classes of danger; *** in % to the previous year

Source: based on Main Department (n.d.); Kotvytska (2018)

This approach is unacceptable, especially for a region that has the image of not only a national but also an international tourist center. The main problem (due to the new volumes of waste) is still a huge amount of it in landfills and unauthorized landfills, which do not get the appropriate environmental requirements.

Therefore, an important component for the current solution of these issues is the transport logistics involved in waste management. Waste transportation is carried out mainly by special means of freight transport, which in turn is a component of general statistics (on the example of Odessa region (Krivenceva, 2021b)) – Table 2.

Table 2. Cargo transportation by mode of transport in Odessa region, million tons, 2015-2020

Type of transport	2015	2016	2017	2018	2019	2020	
Automobile	Million tons	22,2*	22,6	24,1	29,0	28,8	29,3
	%	41,0**	40,3	41,4	46,8	49,9	53,0
	% to the previous year	105,6***	102,0	106,8	120,2	99,3	101,7
	Cargo transportation on average per day, th. tons	60,7****	61,7	66,1	79,5	78,9	80,3
including auto companies	7,6	6,1	7,5	8,1	–	–	
	14,1	10,9	12,9	13,1	–	–	
Total:	54,0	56,1	58,4	62,0	58,6	55,3	
	100,0	100,0	100,0	100,0	100,0	100,0	
	105,9	103,9	104,0	106,2	94,5	94,4	
	147,9	153,3	159,9	169,8	94,5	94,4	

* Million tons; **%; ***% to the previous year; **** Cargo transportation on average per day, thousand tons

Source: based on Main Department (n.d.); Kotvytska (2018).

Let's move on to consider those theoretical aspects of the system approach (in particular, research (Luhmann, 2004; Muradian, Pascual, 2018) and in combination with the natural factor – research (Vos, Meelis, Ter Keurs, 2000; Petrushenko, 2011; Benami et al., 2021), which will form a holistic basis for the formation of transport and logistics systems together in the area of responsible waste management. In order to do this, we should look at the deep, psychological essence of the systems approach. Thus, according to the well-known systems researcher Luhmann (2004), the concept of “general systems theory” is widely used in a multidisciplinary environment, from economics and sociology to evolutionary theory, biology, ecology and psychology. However, there is no fully formed science of general systems theory, although in the sociological, political science and economic literature there are supporters of this theory, who consider it completely done.

Today, although the need for basic systems research is almost non-existent, most scientists who apply a systems approach and general systems theory to their research first return to starting points. As a rule, it is considered that the beginning of a systems approach related to the concept of equilibrium. First, it had a mathematical basis, mathematical analysis, which later began to be used in economics. If we look at the systems approach even more deeply, we should mention the so-called systems thinking, which is related to the philosophical vision of the world and solving the problems that arise in it. The above idea of equilibrium is characterized by a difference, namely – between a stable state and a violation. As a rule, the emphasis is on stability, and the balance is established as stable, responding only to disturbances, and in such a way that the previous balance is restored or a new state of equilibrium is reached.

The idea of equilibrium can be considered as a theory that determines and localizes the receptivity of the system: the individual knows what to do if you want (to achieve the desired state) to upset the balance. An important question in equilibrium theory is to what extent it is possible to increase the ratio of perturbations and stability so that the system remains stable despite the high risks of destruction. When this position is projected into

the mathematical plane, the interest is focused on the question: with the help of which mathematical equations in each specific situation of finding equilibrium can be formalized such a relationship.

The idea of economic equilibrium, the balance of various economic factors is formulated in a similar way in economic theory. Naturally, there are doubts about whether such a balance is possible, which leads to a stable state, if it includes an objective (uncontrolled and probably constantly and unpredictably changing) reality; if we talk not only about mathematical functions, but about real systems: economic (production) and so on (Luhmann, 2004).

Accordingly, in the economic and environmental spheres, in particular with the introduction of strict restrictions on waste management in the recreational and tourist region, along with the system, the necessary condition for creating a basis for the formation of effective tools of influence is complexity. In other words, the basis of an integrated approach is the complexity, which is, first of all, that there is a difference between the system and the environment in which it exists and can be developed (at this stage of conceptualization of transport and logistics activities in waste management there is an understanding of the need to apply a systems approach that has historically been transformed, in particular, into a socio-natural approach) (Krivenceva, 2021a).

Another thing from systems theory, which is directly related to the problem of waste, concerns what happens when two complex systems interact with each other, when they do not have the ability to duplicate in their own system the complexity of another system. The system assumes that it can influence the other. It responds to signals (control impulses), but not in such a way that it would be possible to calculate the certainty of another system, but in a way unpredictable.

This point in the context of this research deserves special attention, because conceptually and in practice the most difficult in organizational terms is to establish two systems (transport and logistics system and waste management system), so as to maintain, above all, environmental orientation of their collective operation.

In some way, the properties of complex systems described above relate to the problem of rationality. Rationality is not formulated by the concept of complexity and has been formed as a historical concept. Rationality is only about the system, not the environment. In this sense, with the help of a systematic approach, it is possible to theoretically substantiate the deep nature of environmental problems (Kostetska et al., 2021): the individual is isolated from the environment and the problems of its pollution (including directly through the fault of the individual), because it is a system that establishes links with the surrounding natural and other environment, based on their own interests, which, in the individual's opinion, will ensure stability and the pleasure of life. In this case, the system (individual or group of people) acts indifferently to the environment, because it acts rationally: environmental problems remain outside the system.

Nevertheless, the resonance in the system begins to increase due to the external environment, which has changed and therefore changed its impact on the system. Thus, there is a paradoxical movement: from isolation to forced inclusion. This trajectory is not rational, but such behavior of the system is explained by the rationality of its actions to ensure its own stability (Luhmann, 2004).

Since in the economic and social spheres the value of the relationship is not less, but even greater than the value of the element, we also consider the proposed by Muradian, Pascual (2018) typology of relations, which is built in such a way that for all its shortcomings, it performs the main function – system formation. However, scientists have also chosen system design as the only criterion for classifying universal relationships in systems.

Therefore, the classification is:

- Interaction connections, which are divided into property and object connections. There are also cooperative and conflicting connections;

- Genetic connections. When one object acts as the basis for the life of another object;

- Transformation connections, among which one can distinguish: transformation connections that are realized through a certain object that provides or sharply accelerates this transformation, and transformation connections

that are realized through the direct interaction of two or more objects, in the course of which they pass from one state to another;

- Structure connections;

- Functional connections that ensure the real life of the object; these objects together perform a specific function that can characterize the object;

- Developmental connections that can be interpreted as a modification of functional connections; with the difference that the functioning and development are usually different, because development is a change in the state of the object that receives development, but most importantly: the content of development as a process consists of significant changes in the structure of the object. In addition, functioning is a movement within one level, which is associated with the redistribution of elements and functions within the object. Development, on the contrary, is not just the self-realization of the object, but such a change of state, which is based on the impossibility for one reason or another to maintain existing forms of functioning;

- Management connections, which depending on their type can form a variety of either functional connections or developmental connections.

The study of the relationships in economic systems related to security factors requires the use of an agent-oriented approach (Shevchenko, Reznik, 2015).

Specific features of transport and logistics systems, in particular, when we are integrating them in waste management, are set out in the following works. Thus, in the article (Cherchyk, 2016) the author's approach to the formation of the system of socio-ecological and economic security at different levels is proposed. This system is considered as public: the conditions in which it operates are taken into account. In order to have the potential to withstand a threatening external environment, the security system has the internal ability to ensure the implementation of its own development goals.

At the same time, both the internal structure of the system and the interests of other economic entities should be taken into account.

In research formulated definition of the system of socio-ecological and economic

security, namely how: “a set of institutions, principles, levers, methods and tools of influence aimed at optimizing relations in the system “society-nature” to ensure such conditions for the functioning of a particular object, which maintains or improves its internal qualitative and quantitative parameters (characteristics) and not allowed (minimized) destructive impact on the external environment”. The internal elements of the regional transport system are examined in the monograph (Zablodska et al., 2016).

The author of the research (Khrutba, 2013) revealed the managerial specifics of the formation of projects and programs for waste management in the transport and road complex. The problem of waste management is solved on the basis of a systematic approach taking into account the criterion of environmental efficiency, using a combination of methods of project and environmental management.

In research (Kucheruk, 2011), we can see logistics systems and their relationship with transport services. It is important to understand that not only technological features of procedures and processes of cargo transportation cause the integrated approach to the organization of logistics and transport and so on, but also by finding optimal ways to increase economic efficiency.

The authors of research (Maselko, Shevchenko, 2007) study the problematic issues of domestic transport and logistics management from the standpoint of a systematic approach, focusing on their European integration. In research (Braginsky, 2011) “The transport and logistics system is an integrated set of subjects of transport and logistics activities and objects of transport and logistics infrastructure that interact with each other to optimize the movement of cargo flows” door to door “at minimum cost on the most favorable terms”. It is not easy to find the definition of “transport and logistics system” (Popova, 2016). Usually the transport system or logistics system is considered separately. If in information sources there is a concept of “transport and logistics system”, then more often it is understood as a logistics system. Emphasis is placed on the unifying role of this system, namely on all modes of transport at the regional level in order

to most effectively use the benefits of technological features and spatial organization.

Accordingly, the main factors that determine the formation of the proposed regional system are:

- branch-territorial structure and characteristics of the existing infrastructure of the national economy;
- socio-economic and environmental content of internal relations within the region and individual territorial-administrative units;
- features of settlement within the region: in its urban and rural areas;
- geopolitical position of the region.

It is also noted that regional transport and logistics systems are considered as integral elements of the economic structure of the relevant socio-economic territorial systems, but natural factors in practice are less and less taken into account for the formation and development of such systems. In our opinion, this trend is temporary and wrong, because only when we balance economic, social and environmental factors it is possible to build stable facilities.

Therefore, taking into account the above, the conceptual approach to waste management in the recreational and tourist region includes the following:

- waste management system, which includes elements (with managerial nature), such as the goal for improving efficiency and coordination;
- improving relationships between participants of waste management process, including special attention to entities engaged in transport and logistics activities;
- functions and tools presented as having ecological and economic content, which is explained by the inclusion of the problem of waste in national and regional environmental policy, and waste itself;
- transport and logistics system, which after integration into the waste management system can be considered as part of this system; includes: processes; vehicles; waste storage and warehousing facilities; information flows; logistics schemes; relevant cross-sectoral and intra-sectoral links;
- components that describe the theoretical principles of the system, reflected in the initiative and effective (motivated) waste management: the concept of motivated

responsibility; the concept (and subsystem) of environmental management; relationships between waste management functions and tools, as well as between the environmental policy of the state and the organization (transport companies, etc.).

The issues of implementation of environmental management deserve special attention, because the international system of ISO 14000 standards is voluntary, proactive and effective and is, so to speak, a “prototype” of motivational tools needed in waste management, in particular in relation to its transport and logistics component. The principle of continuous improvement is also important, which also meets the requirements not only of improvement, but also the reconstruction of the entire domestic sphere of waste management.

The main thing is the concept of responsibility, which is an invariable attribute of environmental management systems, regardless of the area or industry in which they are applied. In view of this, the environmental management system is considered to us not just as one of the tools for waste management or impact on transport and logistics activities, but as an important subsystem, that includes not only practical but also conceptual features.

Within the framework of environmental policy in Ukraine, the problem of waste is regulated by the law “Basic principles (strategy) of the state environmental policy of Ukraine for the period up to 2030” (Law, 2019).

Among the indicators of its implementation in waste management proposed in this strategy, only one indicator is “part of the landfilled waste”, which clearly does not motivate to expand the information base about waste at the level of competent public authorities or waste-generating enterprises, focus on progressive management methods (recycling, composting) or at least sort the waste. However, the targets for reducing waste generation are optimistic, namely: 2020 – 45%, 2025 – 40%, 2030 – 35% of total generated waste.

According to the National waste management strategy (Order, 2017), improvements in waste management include the following:

- preparation of legislative projects about decommissioning of vehicles used in waste management processes (first stage);

- preparation of regulatory documents for informational and logistical operations on the mining and using of natural resources, and also waste handling (second stage);

- development of an electronic information and logistics scheme for the development of natural resources, possession of the product from them, as well as by-products and outputs, which is passing through the stages of processing and utilization (third stage);

- formation of a cluster of waste transfer stations, which will reduce the cost of transportation of solid waste (third stage);

- strengthening control and monitoring measures in the process of industrial waste transportation, paying attention to safety and environmental protection during their transportation (third stage);

- planning and organization of a set of systemic measures for the separation and transportation of waste I-III hazard classes (third stage);

- development of technical and technological documentation for the collection, storage and transportation of waste (third stage);

- development and implementation of economic motivational tools aimed at transport and logistics waste management processes of agro-industrial complex (plant origin) as an alternative energy source for thermal power plants (third stage);

- formation of an economic mechanism to encourage the collection and transportation of plant waste that is suitable for the production of animal feed (third stage);

- development of transport and logistics approaches, as well as research monitoring of infrastructural objects for rational agro-industrial waste management of animal origin (third stage);

- implementation of conceptual and practical approaches to extended producer responsibility, which will provide: requirements for maintaining the state register of producers – business entities engaged in transport and logistics operations for waste management of electrical and electronic equipment; organizational measures within the framework of extended producer responsibility (third stage);

– preparation of a legislative project about batteries, accumulators and accumulators in accordance with the best practices of the EU countries and the requirements of Directive 2006/66 / EU of the European Parliament and of the Europe Council from the 6 of September 2006 “About batteries and accumulators and used batteries and accumulators”, which provides the requirements of state registration of economic entities involved in transport and logistics processes of handling used batteries, accumulators and accumulators (third stage);

– planning and organization of measures for monitoring and control of actions that affect at the accounting of the indicator “number of licenses / permits issued for the collection and transportation of medical waste, units”.

4. Conclusions.

The article reveals the theoretical content of the statements based on the application of systematic and integrated approaches in waste management at the regional level, in particular in recreational and tourist regions, which require stricter environmental policies. Since the extensive nature of the current waste management system in Ukraine, which is reflected in the constant accumulation of production and consumption waste, with minimal action on their prevention and processing, the main element of the researched system is the transport and logistics component.

Based on the development of a systems approach, it is proved that detailed analysis of the relationships between the elements of a particular economic, and even more so the economic and environmental system, is very

important, compared with the analysis of the elements themselves. Accordingly, it can be concluded that along with a set of indicators of sustainable development, the calculation of which in the absence of primary information is difficult, it is necessary to implement comprehensive (cluster, network, etc.) development systems in the region and industries, including recreation and tourism, within its territory.

The problem of waste and its rational transportation in recreational and tourist regions affects a large number of other important economic, environmental, social issues that should be addressed comprehensively, without artificial abstraction from each other, which in practice usually ends in significant damage, which will affect all other elements by “boomerang”. For solving the problem of responsible waste management, the focus should be on interrelated multi-purpose tasks, which require the involvement of expertise and clear coordination of actions of all participants involved or interested in this area.

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REFERENCES

- Benami, E., Jin, Z., Carter, M. R., Ghosh, A., Hijmans, R. J., Hobbs, A., ... & Lobell, D. B. (2021). Uniting remote sensing, crop modelling and economics for agricultural risk management. *Nature Reviews Earth & Environment*, 2(2), 140-159.
- Braginsky, V. V. (2011). Development of the transport-logistics system as a form of realization of the transit potential of Ukraine. *Public administration: theory and practice*, 2.
- Burkinskiy, B. V., Stepanov, V. M., & Kharichkov, S. K. (2005). Economic and environmental foundations of regional nature management and development. Odessa: Feniks.
- Cherchyk, L. M. (2016). Conceptual bases of formation of socio-ecological-economic safety system. *Economic Forum*, 2, 167-175.
- Durach, C.F., Kembro, J.H., & Wieland, A. (2021). How to advance theory through literature reviews in logistics and supply chain management. *International Journal of Physical Distribution & Logistics Management*, 51(10), 1090-1107. <https://doi.org/10.1108/IJPDLM-11-2020-0381>
- Karatas-Cetin, C., & Denktas-Sakar, G. (2013). Logistics research beyond 2000: Theory, method and relevance. *The Asian Journal of Shipping and Logistics*, 29(2), 125-144.
- Kartava, O. F., Kartaviy, A. G., & Khrutba, V. O. (2014). Introduction of ecological logistics methods in regional waste management programs. *Scientific notes*, 45, 240-244.
- Khrutba, V. O. (2013). Fundamentals of project management and waste management programs in the transport and road complex: monograph. Kyiv: National Transport University.
- Khumarova, N. I. (2005). Purpose ecological programs in the system of government regulation of environment use. *Scientific Bulletin*, 15.6, 187-194.
- Kocheshkova, I. M., & Trushkina, N. V. (2018). Reverse logistics of industrial waste. *Bulletin of Economic Science of Ukraine*, 2, 105-108.
- Kodzhebash, A., & Krivencev, A. (2018). Transport and logistics components of waste management strategies in the context of implementing resource-saving and environmental policy. *Economics. Ecology. Socium*, 2(4), 91-102. <https://doi.org/10.31520/2616-7107/2018.2.4-9>.
- Kostetska, K., Gordiichuk, Y., MovchaniukA., Vdovenko, N., Nahorny, V., & Koval, V. (2021). Inclusive development of social entrepreneurship in nature management. *Journal of Geology, Geography and Geoecology*, 30(3), 500-511. <https://doi.org/https://doi.org/10.15421/112146>
- Kotvytska, L. E. (Ed.). (2018). *Statistical Yearbook of Odessa region in 2017*. Odesa: GUS in Odessa oblast.
- Krivenceva, A. P. (2021a). An integrated approach to waste management, on the example of recreational and tourist region. *Hraal Nauky*, 10, 29-33. <https://doi.org/10.36074/grail-of-science.19.11.2021.001>.
- Krivenceva, A. P. (2021b). Influence of transport logistics on the recreational environment, on the example of Odessa region. *Ricerche scientifiche e metodi della loro realizzazione: esperienza mondiale e realta domestiche: "ΛΟΓΟΣ"*: European scientific platform, Associazione Italiana di Storia Urbana, 1, 14-16. <https://doi.org/10.36074/logos-12.11.2021.v1.03>.
- Kucheruk, G. Yu. (2011). The place of transport services in logistics systems. *Bulletin of Transport and Industry Economics*, 36, 66-71.
- Law of Ukraine. On the basic principles (strategy) of state environmental policy of Ukraine for the period up to 2030. February 28, 2019, 2697-VIII. <https://zakon.rada.gov.ua/laws/show/2697-19>.
- Luhmann, N. (2004). *Einführung in die Systemtheorie*. München: Carl-Auer-Systeme Verlag.
- Main Department of Statistics in Odessa region: official site. (n.d.). www.od.ukrstat.gov.ua/.
- Maselko, T. E., & Shevchenko, S. G. (2007). Problems of transport-logistics systems management of Ukraine and prospects of development in the context of European integration. *Scientific Bulletin*, 17.2, 301-305.

Muradian, R., & Pascual, U. (2018). A typology of elementary forms of human-nature relations: a contribution to the valuation debate. *Current opinion in environmental sustainability*, 35, 8-14.

Murphy, P.R., Poist, R.F., & Braunschweig, C.D. (1995). Role and relevance of logistics to corporate environmentalism. *International Journal of Physical Distribution & Logistics Management*, 25, 5-19.

Order of the CMU. National Waste Management Strategy in Ukraine until 2030. November 8, 2017. 820-r. <https://zakon.rada.gov.ua/laws/show/820-2017-%D1%80#n8>.

Petrushenko, M. M. (2011). Necessity and features of application of game theory in modeling of natural-resource conflicts. *Bulletin of SSU*, 3, 42-48.

Popova, N. V. (2016). Transport-logistics system: definition and components. *Business Inform*, 1, 169-173.

Prokopenko, O. V., & Petrushenko, M. M. (2013). Systems-synergetic thinking to the environmental conflicts management at the territorial level. *Marketing and Management of Innovations*, 1, 254-266.

Shevchenko, H. M. (2017a). Forecasting of recreation development in Ukraine: socioeconomic equilibrium: monograph. Sumy: University book.

Shevchenko, H. M. (2017b). Regulatory policy and optimization of investment resource allocation in model of functioning recreation industry. *Baltic Journal of Economic Science*, 3(1), 109-115. <http://dx.doi.org/10.30525/2256-0742/2017-3-1-109-115>.

Shevchenko, H. M., Reznik, O. M. (2015). Ensuring state economic security in the area of taxation: agent-based and subject-based legal approaches. *Actual Problems of Economics*, 168(6), 167-172.

Shevchenko, H., Petrushenko, M., Burkynskyi, B., & Khumarova, N. (2021). SDGs and the ability to manage change within the European green deal: The case of Ukraine. *Problems and Perspectives in Management*, 19(1), 53-67. [http://dx.doi.org/10.21511/ppm.19\(1\).2021.05](http://dx.doi.org/10.21511/ppm.19(1).2021.05).

Topolšek, D., Čižiūnienė, K., & Ojsteršek, T. C. (2018). Defining transport logistics: a literature review and practitioner opinion based approach. *Transport*, 33(5), 1196-1203.

Veiga, M. M. (2013). Analysis of efficiency of waste reverse logistics for recycling. *Waste management & research*, 31(10), 26-34. <https://doi.org/10.1177/0734242X13499812>.

Vos, P., Meelis, E., & Ter Keurs, W. J. (2000). A framework for the design of ecological monitoring programs as a tool for environmental and nature management. *Environmental monitoring and assessment*, 61(3), 317-344.

Winkelhaus, S., & Grosse, E. H. (2020). Logistics 4.0: a systematic review towards a new logistics system. *International Journal of Production Research*, 58(1), 18-43.

Zablodska, I. V., Buzko, I. R., Zelenko, O.O., Khoroshylova, I. O. (2016). Infrastructural support for the development of the transport system of the region. Severodonetsk: V. Dahl's SNU.