Yevhen Krykavskyy,
Dc. Sc., Professor, School of Finance and Law, Poland
ORCID ID, 0000-0002-1847-586X
email: yevhenkrykavskyy@gmail.com

Olha Prokopenko,
Dc. Sc., Professor, Tallinn University of Technology, Estonia
Collegium Mazovia Innovative University, Poland
ORCID ID, 0000-0003-1362-478X
email: prokopenko.olha.w@gmail.com

Olena Shandrivska,
Ph.D., Associate Professor, Lviv Polytechnic National University, Ukraine
ORCID ID, 0000-0002-4335-2423
email: olena.y.shandrivska@lpnu.ua

Nadiia Vasyltsiv,
Ph.D., Lviv Polytechnic National University, Ukraine
ORCID ID, 0000-0002-4127-2163
email: nadiia.m.vasyltsiv@lpnu.ua

Sylwia Nycz-Wojtan,
Vistula University Warsaw, Poland
ORCID ID, 0000-0002-2350-7328
email: sylwia.nycz@gmx.de

Correspondence author: yevhenkrykavskyy@gmail.com

INNOVATIONS N MANAGEMENT OF THE COMPLEMENTARY DEVELOPMENT OF THE TERRITORIES ADJUSTED TO THE RIVER CARGO TRANSPORTATION

Abstract. *The paper deals with the results of the scientific discussion on the management of the complementary development of the adjacent territories to river freight. The main purpose is to substantiate the nature and directions of implementing the river transport potential in the country's logistics system by applying the concept of complementary development of the economy of port regions, focusing on the development of river ports as nodes of the country's logistics system. The relevance of the study is that the factors of radical growth of demand for inland waterway transportation from businesses and the state require a corresponding reorientation of logistics for many sectors of the economy, especially from the riparian territories. The research of the problems of river freight transportation concerning dimensional and functional economy restructuring of Ukraine's regions within logistics concept is carried out in the following logical sequence: the evaluation of the ability of river transport to form a direct and multiplicative effect of logistics, generated by gross regional product and export processes in the country's port regions; clustering of areas adjacent to river ports based on development potential (Gross Regional Product and exports); confirmation of the division of regions according to the mathematical algorithm of hierarchical clustering of adjacent regions; the evaluation of investment attractiveness of the country's port regions; managing the intensification of the impact of river transport for the development of surrounding areas; the evaluation of the potential of multiplier effect at the system of management of the river ports complementary development. The mathematical algorithm of hierarchical clustering of port regions using the SPSS software system and the heuristic approach to their structure (by author's method of forming clusters based on the contribution of river transport to the formation of the direct and multiplicative effect of logistics: formed GRP and export processes in the port regions of the country). The subject of the study is the port regions. The evaluation results of the contribution of river freight transport for the economy of the adjacent territories conducted based on regression analysis and analysis of the intensity of river transport use during 2007-2016 period, showed that river transport is not a market-forming factor of development of the adjacent territories. The results of the*

study can be useful for the Ministry of Infrastructure of Ukraine, Ministry of Economic Development, Trade and Agriculture of Ukraine, administration of river ports, logistics operators, business in port regions, other participants of the market of water transportation in the process of prioritization of the goals of combined freight transportation.

Introduction. The transformation of the territorial structure of the Ukrainian economy was caused by the Russian occupation of a part of Ukraine territory. It was intensified by the deployment of military operations in eastern Ukraine, as well as interference in the infrastructure of the Kerch Strait, the exhaustion of investment resources in local territories and the stagnation of traditional industries, etc. It has significantly affected the existing structure of the country's logistics system, its internal and transit material flows. This also affected the level and structure of the polarization of the development of the country's territorial socio-economic systems. Thus, the river transport direct influence potential on the economy of the country and its territory caused increasing the transport processes efficiency, as well as indirectly, through the development of the infrastructure of these processes, is updated in due course. This influence can be significant only if the potential of river transport is used more intensively in case it is provided with the corresponding potential of the river suprastructure (vessels) and infrastructure (river ports), which requires substantial investments. The objects mentioned above of river transport supra- and infrastructures can be investment-attractive for private investors only if there is a stable demand for river transportation from the business. For Ukraine, at the present stage, this means radical reorientation of logistics for many sectors of the economy, at least from the near-river territories. For instance, in many developed countries, river ports as full-fledged logistics centres have become the drivers of material flow restructuration towards the distribution of combined transportation as the most ecological ones.

The significant untapped potential of attracting domestic river transport into the logistics system of the country, and, hence, in the development of local areas resulted from the current unsatisfactory technical and technological conditions of the river transport complex, weak interaction of river and seaports, minor volumes of container transportation of goods by river transport and sea transportation, weak interest of various groups of stakeholders in enhancing investment and innovative development of river transport, low efficiency of the level of state industry regulation and tariffing of river traffic. The purpose of the article is to reveal the essence and directions of application of the river transport potential in the formation of the country's logistics system. It is based on the assessment of the impact of river transport on the economic development of the surrounding territories based on a systematic approach.

The authors put forward for verification of the main hypothesis: whether river transportation in the country can become a significant (influential) market-forming factor of the adjacent territories, and four low-level hypotheses, namely:

- whether the gross regional product in the medium term can influence the development of river transportation;
- whether the export orientation of the adjacent territories can have an impact in the medium term on the development of river transport;
- whether the presence of river ports affects the investment growth of adjacent regions;
- whether projected logistics centres based on river ports can become a multiplier for the development of adjacent territories.

Literature Review. The countries of Europe and the world, with significant potential for river traffic, often have significant and radical differences in terms of its use. Realizing its two important advantages, cost-effectiveness and environmental friendliness, many researchers focus on certain aspects related to

the formation of demand and supply of river transportation services, rarely – from the system approach, considering river transportation as a subsystem of the country's logistics system.

In particular, in work (OECD, 2016) (there was discussed the intensity of trucking industry and value or other use of this indicator for comparing countries and performance metrics. The intensity of transportation (or the intensity of trucking industry), as the authors believe (OECD, 2016) provides an indicator of how much freight activity «contributes» to the overall economy (or, conversely, how much it takes to reach a given level of production). As a rule, it is measured in units of transported freight per unit of economic output (GRP) or, conversely, GRP per tonne-kilometre of transportation. It should be agreed with the findings that the interpretation of these indicators strongly depends on the type of economy and geographical characteristics of the country. There are also problems with the use of such indicators to describe larger or more economically or geographically diverse countries with more specialized regional economies. The topographic conditions and the density of the transport network can also influence this indicator while comparing different regions of one country. If these factors are not controlled, comparisons of transport intensity are better indicators of productivity over time than for comparative analysis illustrated when compared indicators between countries. In that case, differences in geography, sector composition and overall economic development are more efficient or other factors, specific for freight. In Ukraine, economic analysis of river transport is carried out based on the interpretation of such indicators as the volume of cargo transportation (tons), cargo turnover of river transport or sometimes – freight transport work (tkm) and an average distance of cargo transportation (km) by river transport. The contribution to the development of the economy of the adjacent regions to river transport is estimated, in particular, by such indicators as river transport (UAH/tkm) and river transport capacity (tkm/UAH) as inverse to the river transport. It is known that the rate of return is determined by the ratio of GRP/per capita to the turnover of river transport. These studies highlight the specificity and complexity of applying the concept of regionalization to river transport in terms of structuring river regions according to the above indicators (OECD, 2016).

Author Shiva Madani (2018) in one of her works, noted that transport intensity could be changed with time. In many developed countries, there is a «separation» of the intensity of freight traffic with the gross domestic product (abbreviated as GDP). They move to a more service-oriented economic structure and to the production of higher ratios of value to the volume of industrial goods. But the intensity can increase, and also fall. For example, in the countries of Eastern Europe after a sharp decline resulting from restructuring in the 1990s, the freight traffic intensity has increased since 2000. There is a correlation between several structural factors affecting aggregate indicators based on GDP and factors affecting trade that go beyond logistics. For example, regional trade integration is an important factor as the European Union deepens and expands its single market.

The conducted analysis of economic conditions of development of river regions along the Lower Vistula allowed substantiating the concept of a network of river logistics centres based there. The following analysis criteria were used for the analysis (Hann et al., 2014) as demographic potential (number of people living in the region); economic potential (volume of industrial production in the region); transport potential (quality of transport infrastructure that connects river ports and their depth). The concept assumes the location of river logistical centres of local and regional importance and their connection with port agglomerations. The locations are chosen to show the organizational and technological determinants of the development of river logistics centres. In particular, the subject of factor analysis was the efficient transport accessibility of logistics centres from water and the land.

In work (Schonfelder et al., 2015) the economic effect of the implementation of the European Union Strategy for the Danube Region development program was conducted. Using the Transtools and Adagio software, a river transport industry model was created and a scenario modelled following the European Union Strategy for the Danube Region. As a result of modulation, it was determined that the volume of

river transport would increase by 3.1%. The simulation predicted an increase in the number of jobs in the industry: by 600 and GDP growth of the river's bordering regions by 0.3%.

In the work by authors Nam and Win(2014) was investigated the competitiveness of inland water transport in comparison with road transport in the South Asia region basing on the example of Myanmar. The measuring of the volume of cargoes investigated the natural limits and compettitiveness of both types of transport, time of transportation, the value of transportation and multimodel of management were offered for covering the whole territory of the country by the transport channels net.

In the article (Chen and Jiang, 2013) was provided a quantitative and qualitative analysis of the economic impact that Wuhan Shipping Centre on development of the city of Wuhan and its surrounding area. The economic contributions of expanding the operation of the navigation centre to the development of the region are analyzed. Direct Economic Contribution refers to those regional and national economic contributions resulting from relative economic activities of ports, including the transportation, loading and unloading and production service provided by the ports. Development of compatible fields that participate in the procedures of infrastructure construction and navigation of the centre is the indirect economic contribution. Implicate economic contribution refers to the increase of the meeting social human needs of the region. In the article is used method of input-output analysis, explores the inter-depending relations between the input and output of all the industrial departments within the national economic system. This method demonstrated the functions of investment for regional economic growth in a more comprehensive manner.

In the article (Weijun Fei, 2011) is analyzed the economic impact of river transport of Yangtze on Asia-Pacific economic cooperation (APEC). Based on theory and analytical methods that include input-output analysis and multiplication analysis are determined the direct, indirect and consequential impacts on the development of the region. The direct impact includes port infrastructure and waterway transport. In turn, the indirect impact is the interconnection of river transport with the industries. Induced impact is the industrial influence on jobs. The purpose of the economic study is to provide a high quantitative estimation of the impact of river transport on the economy of the Yangtze River basin. The direct impact is the most influenced (from those three) on the regional development and increases gross domestic product. The input-output analysis helps to see the indirect impact on the economy, namely the economic effect in the cooperation of river transport with other fields.

In the document developed by World Bank is evaluated the economic impact of building Bangladesh-Bhutan-India-Nepal (DDIN) corridor on that region. The main objective of improvements in the connection between countries and increase trade, either by volume or by value. Evaluation of reducing logistics costs and increase the generation of additional trade volumes (internal and external) was developed. The evaluation was made on the changes in monetary and time costs to be brought about by the project interventions. Calculation of costs and profit was estimated due to the sensitivity analyses, that includes Economic Internal Rate of Return of the Project. The analysis includes economic impact on traffic that does not contain reducing of time on transportation, that increase impact on the development of regions.

The paper Ceniga and Sukalova (2019) deals with the analysis of the fulfilment of the state policy objectives in the field of transport and logistics and proposes recommendations for more efficient corporate management to promote sustainable development. Besides, the core network must ensure an effective multimodal link between the EU capitals and other major cities, ports, airports and key land border crossings, as well as other major economic centres. It should focus on completing missing links, especially in cross-border sections and bottlenecks, on modernizing existing infrastructure and developing multimodal terminals in river ports and on urban logistics consolidation centres. Long-distance transport requires a better connection between rail and airports.

In article Haddad et al. (2010), a spatial computable general equilibrium model to a transport network system, that simulates the impacts of increases in port efficiency in Brazil, is presented. The role of ports

is explicitly considered to grasp the holistic picture in an integrated interregional system. The measures of efficiency for the different port in the calibration are incorporated and used as the benchmark for it. Three scenarios are evaluated: an overall increase in port efficiency in Brazil to achieve international standards; efficiency gains associated with decentralization in port management; and regionally differentiated increases in port efficiency to reach the boundary of the national efficiency frontier.

In the article (Wiegmans & Konings, 2015) a spatial computable general equilibrium (CGE) model that is integrated to a transport network system to simulate the impacts of increases in port efficiency in Brazil is presented. The role of ports of entry and ports of exit are explicitly considered to grasp the holistic picture in an integrated interregional system. Measures of efficiency for different port locations are incorporated in the model calibration and used as the benchmark in our simulations. Three scenarios are evaluated: 1) an overall increase in port efficiency in Brazil to achieve international standards; 2) efficiency gains associated with decentralization in port management in Brazil; and 3) regionally differentiated increases in port efficiency to reach the boundary of the national efficiency frontier.

In the paper (Ionescu, 2016), the analysis focused on assessing the current status of inland water transport and its future goals in the context of new challenges for the EU28. As the large economic disparities between the Member States have led to large disparities in the inland water fleet and infrastructure, it is argued that inland waterway transport will not be able to recover and develop in the short and medium-term.

Ukraine is characterized by a decrease in the volume of river transport of goods. It is caused primarily by a change in the export regions of the transported goods, a decline in the industry's infrastructure, and the lack of market levers of management in the industry.

According to the authors of the publication, the modern concept of regional development of river ports should provide the joint development of logistics regulations and the concept of landscaped areas on the principles of sustainable development, its symbiosis influencing the economic development of the regions adjacent to the river port.

From an economic point of view, direct and equal access to potential consumers of logistics services to inland waterways and land must be ensured. Therefore, from logistics, river ports must be located in logistics centres, providing such access. It will increase the competitiveness of logistics centres at the regional level and enterprises that are located in adjacent territories by attracting an additional type of transport, the ability to transport bulky cargo, unloading road and rail transport, reducing the load on the ecosystem. However, the regional transformation of most river ports towards the formation of logistics centres to expand the provision of services is limited by certain factors. The following factors have been established as the main ones inherent to Ukraine.

Need for significant investments in the development of the infrastructure of river ports to expand their functions to those provided by logistics centres. The functioning of rivers with navigable depths should also be maintained. For example, in Europe, the entire network of rivers and canals aimed at the transportation of raw materials and finished products is used for continental navigation. The importance of active shipping is emphasized by the fact that during the drought in October 2018, the German government used strategic fuel reserves to avoid a long-term crisis in the region from Duisburg to southern lands. For reference, it is one of four cases of the discovery of strategic reserves in the last 40 years in Germany.

In Poland, the development of shipping is recognized as one of the largest projects that can cost 60-150 billion zlotys. However, despite owning a developed network of navigable routes in terms of the length of roads (3.572 km) and density of the river network at 11.6 km per 1000 km², in 2016 only 6.209 thousand tons of goods were transported by Polish inland waterways, and 832.4 million tonne-kilometres of freight turnover were carried out. The average distance of 1 ton of cargo in international traffic was 233.8 km, in inland transport — 24.8 km and a total of 134 km (Głowny Urzad Statystyczny, 2017). The former transport routes were fragmented, which made it impossible to carry out regular shipping over long distances. The

reasons could be seen in the exclusion of the water arteries from the transport policy of Poland, recorded in the Operational Program «Infrastructure and Environment» (2007-2013), according to which shipping routes were excluded from investment plans.

1. In Ukraine, the use of rivers with navigable depths has decreased by almost 2.5 thousand kilometres for the past 25 years. For reference: the length of roads in Ukraine is 2.2 thousand km; the average density of the river network of Ukraine is 3,40 km/ 1000 km^2; the average transportation distance of 1 ton of cargo is 402 km (Official site of the State Statistics Service of Ukraine).

2. The inclusion of river ports in the country's logistics system as nodes of a logistics system requires the resolution of organizational issues for the implementation of inland waterways into a combined transport system. The adaptation of inland waterways with international standards, investment in the development of waterways and the construction of logistics centres based on the logistic system of the country of river ports etc. are required as well. For example, in Poland, only the port in Gliwice has a chance to be included in the logistics system. Other larger ports, especially the Kostrzyn port and the ports of Wroclaw, due to their convenient location in European transport corridors, can perform only limited logistical functions (Rydzykowski & Rolbiecki, 2005).

3. The feasibility of stimulating demand from business entities for the active involvement of river ports in the logistics flows of their goods, including professional global logistics operators in the context of including them in their own scheme of nodal points of logistics flow processing.

Methodology and research methods. To achieve the goals of publication and to obtain substantiated conclusions, the authors applied the method of system research involving observation of the objects of study, hypothetical-deductive method and statistical analysis.

In the context of using the system research method, the state and dynamics of river transportation, macroeconomic factors and the behaviour of business entities according to the dominance of sustainable development goals are taken into account as well as the weak structure of most processes and low formalization suitability.

Therefore, to a certain extent, a systematic approach results in substantiating experience, paradigms and intuitions about the feasibility of attracting the potential of river transport to the country's logistics system.

For verifying the outlined hypotheses, the corresponding statistical material was collected, and economic-mathematical modelling and structural analysis were carried out. The order of the research is determined as follows.

1. A. Apply a heuristic approach and cluster the areas adjacent to the river ports, based on the potential of development (gross regional product and exports, including per capita).

2. B. Apply mathematical algorithm for hierarchical clustering of port regions of the country using SPSS software system.

3. Verification of clustering results is carried out based on comparison with the investment growth of port regions.

4. Assessment of the contribution of river transport in forming GRP and confirmation of the credibility of the statement about the low impact of river transport on the development of local territories.

5. Assessment of the multiplicative potential of river ports with adequate institutional and infrastructural support. The sequence of study stages is presented in Figure 1.

According to Figure 1, the first stage of the study (s. 1.1; 1.2; 1.3; 1.4) was carried out in previous papers of authors (Krykavskyi et al., 2017), etc. In addition to this methodology, determination of economically justifiable strategic management areas (s. 1.2) is suggested to carry out based on innovation-synergetic design methodology elaborated in the paper (Prokopenko et al., 2019) to ensure the security and stability of the country's and its regions' development. Furthermore, taking into account requirement to follow the

sustainable development principles, it is suggested to assess the competitiveness of the river transport (s.1.4) level with consideration of it ecological properties (see in more detail Prokopenko et al., 2012).
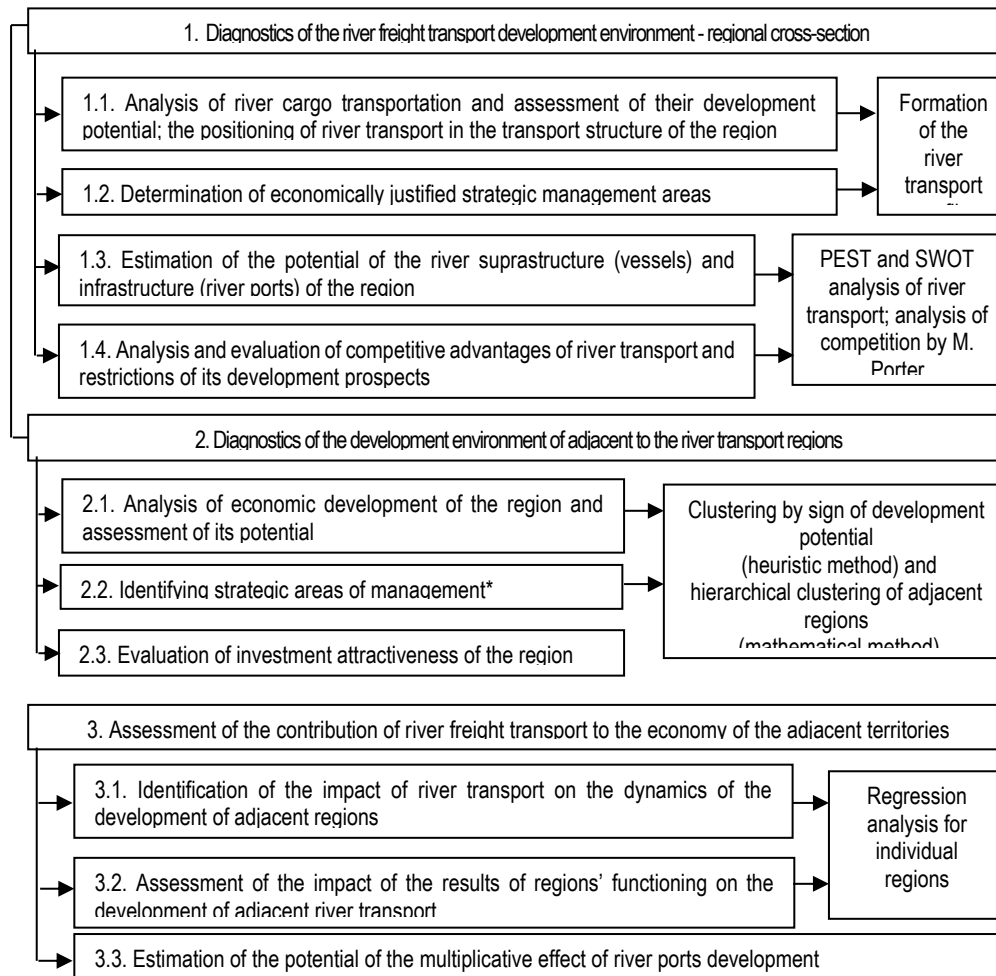
Figure 1. The consequential management of the development of the adjacent territories potential in the conditions of river freight transportation activation

Sources: developed by the authors.

Results. Assessment of the economic development of the country regions adjacent to river transport.

A. It is suggested to apply a heuristic approach and assessing the structure of the regions of Ukraine, where river transport is located, in terms of gross regional product and exports, included calculation per person. Among the number of indicators proposed for selection, the following indicators are chosen, given that both internal economic flows and external ones can generate demand for river transport (see Table 3).

On this basis, it is stated that the direct effect of river freight transportation, given the specific structure of production, export and import of goods and services in Ukraine, is generated by the dominant industrialized regions of the country. These regions have large volumes of production and, therefore, require large freight transportation, for export as well, significant volumes of fuel consumption/delivery, logistics services etc. Certain river port regions are relatively active in the transportation of cargo for the agricultural sector. For example, in 2018, the export structure was dominated by cereals – 15.3%; ores, slag and ash – 6.4%; ferrous metals – 21%; electric machines – 6.2%, that is, products of industrialized and agrarian regions, which can be actively involved in river freight transportation. Instead, the structure of imports (2018 data) is dominated by mineral fuels; petroleum and its distillation products – 23.4% of the total, chemical and related industries (12.3%), polymeric materials, plastics and articles thereof (6.2%), which are, generally, transported by rail, road and pipeline (Official site of the State Statistics Service of Ukraine).

In addition to the direct effect, river transport in the regional economy generates a multiplicative (concomitant) effect through the creation of new jobs in transport construction, mechanical engineering and other related sectors of the economy. Own research has suggested that the growth of transportation services can multiply revenue by 3 to 5 times. That is, one place of job in river transportation can create additional jobs (unit of effect) in the sector of infrastructure construction and related superstructure. In our rationale, we also rely on the provisions of the National Transport Strategy for 2030. Following its regulations, at least 20 000 new and 80 000 related jobs for every $ 10 billion in investment are declared in the transportation industry. Also, the operation of river transport generates several benefits for the economic well-being of the port regions. These include: expanding access to commodity markets and increasing export opportunities; improving transport accessibility, increasing freight traffic, and, consequently, reducing the specific cost of freight, increasing intermodal transportation, and so on.

The advanced features of the clustering of the port regions make it possible to obtain direct and multiplicative effects by river transport. It assumes that the share of GRP in aggregate GDP reflects the direct influence of river transport potential on GRP. In turn, the share of exports in aggregate exports of the country reflects the multiplicative impact of river transport potential in the region on the economy of transport and logistics processes in the export activity of the country. In the clusterization, the criterion does not deliberately take into account the import sphere, given the structure of imports where the river transport potential is negligible, while transport-related processes (raw materials, grains, metal, etc.) predominate in the field of export.

It should be noted that in Ukraine, given the specific nature of the goods subject to river transportation, the formation of a direct effect on the sector of the river transportation is not significant. It is due to the low weight of the sector in total gross output. However, a significant multiplier effect of river transport in adjacent industries is expected to result from an increase in river transport and other benefits for adjacent industries. The multiplier effect created by the increase in river traffic is expected to be less than the similar multiplier effect in the road or rail freight sector in these regions due to higher nominal growth in volume transportation by these sectors.

Thus, the ability of river transport to formulate the direct and multiplier effect of logistics generated by GRPs and export processes in the port regions of the country is taken into account. The estimation of these effects in relative units (parts) ensures the correctness of the cluster analysis calculations according to mathematical and heuristic methods).

The task distribution port regions of Ukraine proposed to formalize as a model that describes a set of decisions regarding the specialization of a port region of Ukraine:

$$\{PRS_i\} = \begin{cases} \sum \dfrac{GRP_i^N}{GDP^N} \cup \dfrac{Ex_i^{gs}}{Ex^{gs}} > 40 \Rightarrow \text{absolute leader} \\[2mm] 8 \leq \sum \dfrac{GRP_i^N}{GDP^N} \cup \dfrac{Ex_i^{gs}}{Ex^{gs}} \leq 40 \Rightarrow \text{export-oriented} \\[2mm] 6 \leq \sum \dfrac{GRP_i^N}{GDP^N} \cup \dfrac{Ex_i^{gs}}{Ex^{gs}} < 8 \Rightarrow \text{industrialized} \\[2mm] \sum \dfrac{GRP_i^N}{GDP^N} \cup \dfrac{Ex_i^{gs}}{Ex^{gs}} < 6 \Rightarrow \text{local status} \end{cases} \qquad (1)$$

where PRC_i – decision on the specialization of the port region of Ukraine.

The formulas for the intermediate calculations of the study are presented in Table 1.

Table 1. Auxiliary indicators for assessing the potential of the region's development for mathematical and heuristic approaches

№	Indicator, unit.	Calculated formula	Explanation of formula
1	Gross regional product per head of a region, GRP_i^N, UAH, and for:	$GRP_i^N = GRP_i/N_i$	GRP_i – Gross Regional Product, mln.UAH; N_i – population of a region, mln. ppl.
-	Kyiv and Kyiv region, $GRP_{Kr.K.}^N$, UAH	$GRP_{Kr.K.}^N = (GRP_{Kr} + GRP_K)/(N_{Kr} + N_K)$	Kr – Kyiv region; K – Kyiv
2	Coefficient of import goods coverage by the export of a region, C_i^g	$C_i^g = Ex_i^g / Im_i^g$	Ex_i^g – The export volume of goods, mln.doll. USA; Im_i^g – Import volume of goods, mln.doll. USA
3	Coefficient of import services coverage by the export of a region, C_i^s	$C_i^s = Ex_i^s / Im_i^s$	Ex_i^s – Services export volume, mln.doll. USA; Im_i^s – Services import volume, mln.doll. USA
4	Total shares in GDP (Gross Domestic Product) and export of a region, A, %	$A = \sum \dfrac{GRP_i^N}{GDP^N} \cup \dfrac{Ex_i^{gs}}{Ex^{gs}}$	GDP^N - gross domestic product per head, UAH; Ex^{gs}, Ex_i^{gs} – the volume of export of goods and services for Ukraine of a region, mln.doll. USA
5	River transport efficiency of the region, TE_i^R UAH/ mln.tkm	$TE_i^R = GRP_i^N/V_i$	V – cargo turnover of a region, mln.tkm

Sources: developed by the authors.

Distribution of port regions by GRP per capita and the level of exports in 2016-2017 are shown in Table 2, Figure 2.

The city of Kyiv and Kyiv region (2017) took the first place in terms of share in the overall structure of exports (26.55%) and terms of GRP per capita compared to the average Ukrainian indicator (4.679). The city is a leader in the intensity of foreign trade exchanges and is assigned to the first cluster. The total share in GDP and exports is 55.25%.

Dnipropetrovsk, Zaporizhzhia and Poltava regions belong to the second cluster, which consists of an export-oriented group of regions. Cumulatively, the GRP per capita concerning the average Ukrainian indicator in this group (2017) was 2.933 or 19.95% in the total export structure. The total cluster share in GDP and exports is 47.45%.

Table. 2. Distribution of port regions by GRP per capita and the level of exports in 2016-2017

№	Region	Share in GDP of Ukraine, %		Export share, %		Sum of parts of GDP and export, %		Speciali ty	Sum of parts of GDP and export,%
		2016	2017	2016	2017	2016	2017		
First cluster									
1	Kyiv and City of Kyiv	28.83	28.70	28.55	26.55	57.38	55.25	Absolut e leader	More than 50
Second cluster									
2	Dnipropetrov sk	10.2	10.52	16.13	16.3	26.33	26.82	Export oriented	From 10 to 50
3	Zaporizhzhia	4.4	4.37	6.31	6.9	10.71	11.27		
4	Poltava	4.9	5.06	3.94	4.3	8.84	9.36		
Third cluster									
5	Mykolaiv	2.5	2.32	4.58	4.4	7.08	6.72	Industria lly develop ed	From 5 to 10
Fourth cluster									
6	Cherkasy	2.5	2.45	1.30	1.4	3.8	3.85	Local status	Less than 5
7	Chernihiv	1.8	1.90	1.19	1.4	2.99	3.3		
8	Kherson	1.6	1.60	0.68	0.7	2.28	2,3		
-	Sum	56.73	56.92	62.68	61.95	119.4	118.9	-	-

Source: developed by the authors based on (Official site of the State Statistics Service of Ukraine).

Mykolaiv region represents the third cluster – the industrially developed region, which in terms of share in the overall structure of exports was 4.4%, in terms of GRP per capita to the average Ukrainian figure was 0.775. The total cluster share in GDP and exports is 6.72% (2017).

Cherkasy, Chernihiv and Kherson regions have formed the fourth cluster – regions with local status (2017). Cumulatively, the GRP per capita concerning the average Ukrainian indicator in this group is 2.662% or 3.5% in the total export structure. The total cluster share in GDP and exports is 9.45%.

The results of the heuristic approach to clustering the port regions coincided with the well-established division of regions of Ukraine into export-oriented, industrially developed regions with local status and cities with special status – Kyiv, which together with Kyiv region lead in the intensity of external and internal traffic.

The structuring of the regions according to the heuristic approach most precisely reproduces the processes of generation of demand for river transport, and, therefore, in the future authors will be guided by the results of the heuristic approach.

A mathematical algorithm should support the results of a logical and intuitive approach to the structuring of port regions for their clustering.

B. For evaluating the economic development of the adjacent to the ports regions, we apply a mathematical algorithm for hierarchical clustering of the port regions using the SPSS software system. For solving the problems of hierarchical clusterization, the classical k-medium method is used, since the hypothesis is preliminarily based on the number of clusters. From the set of proposed initial data for cluster analysis of port regions for 2017 (GRP/per capita, UAH; capital investments per capita, UAH; coefficient of coverage of export of import of goods; export coverage ratio of import services; direct investment (equity), USA thous. dollars; wholesale trade turnover of wholesale trade enterprises, UAH million; retail

turnover, UAH million; share of capital investments in transport in total investments; share of the average number of regular transport workers from the total number of employees aged 15-70; the share of transport from the total number of enterprises on the net profit indicator), the verification for multicollinearity allowed to select for the further analysis such indicators as: GRP/per capita, UAH; coefficient of coverage of export of import of goods; export coverage ratio of import services; wholesale trade turnover of wholesale trade enterprises, UAH million; retail turnover, UAH million; capital investments, UAH billion.
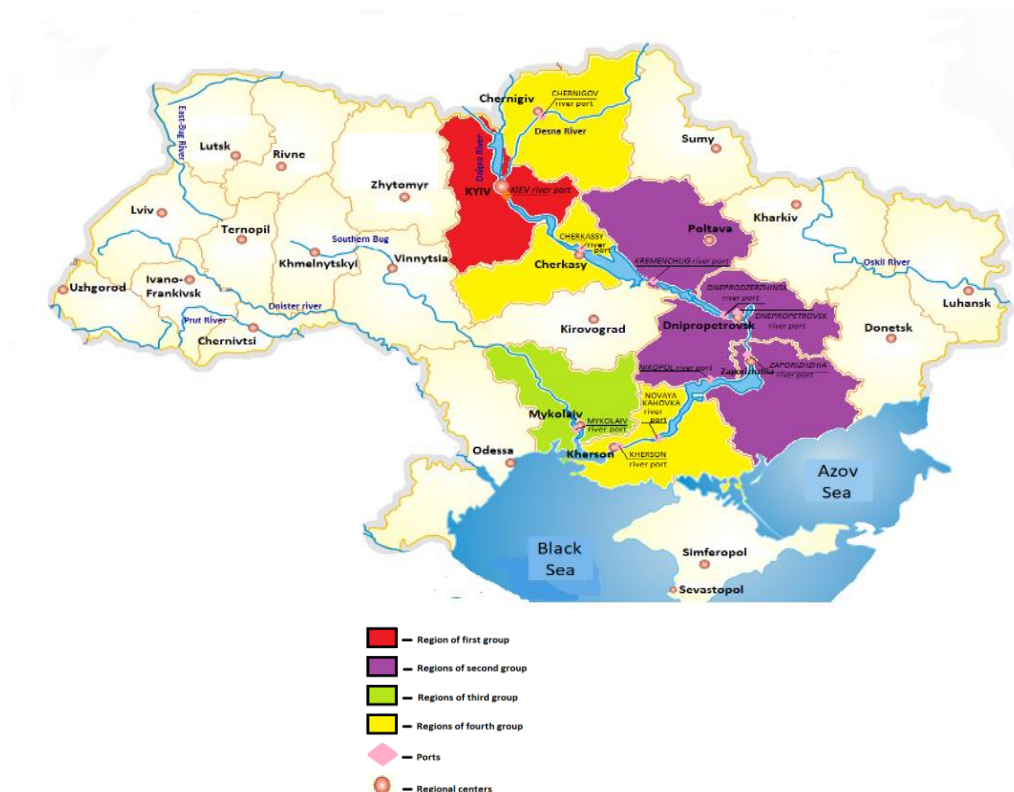

Figure 2. Graphic representation of clusterization of port regions of Ukraine in a heuristic approach
Source: developed by the authors based on (Official site of the State Statistics Service of Ukraine).

There was used Ward's method, an interval measure of similarity (Euclidean distance) was chosen, and a method of data standardization was applied: the Z-value, combinatorics of which allowed the obtaining of clusters with the most distinct characteristics. Figure 3 and Table 3 show dendrogram and agglomeration steps in determining the clusters.
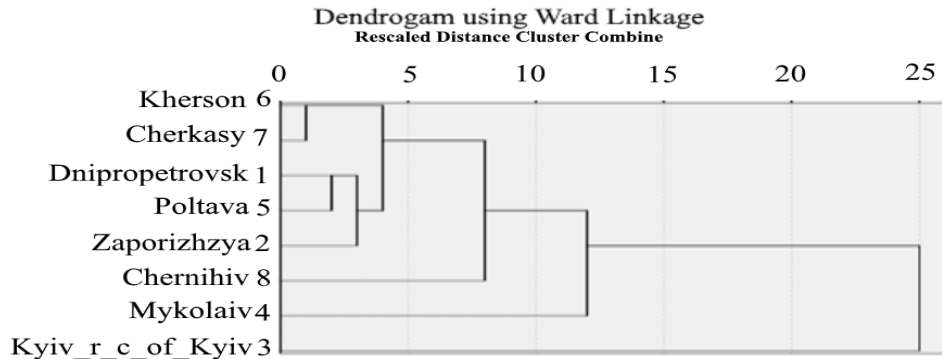
Figure 3. Dendrogram: visualization of clustering results of port regions, 2017
Source: developed by the authors.

The analysis of the agglomeration order allowed us to determine the optimal number of clusters. The criterion of separation is the increase in the coefficient of the distance between objects. The first significant increase («leap coefficient») occurred at the transition to the fourth stage of clusterization – from 1.386 to 2.252. Therefore, the cluster consensus is 4 (the number of objects is 8; the ordinal number of the next, after the «jump» – 4). The main results interpretation of clusterization (dendrogram and agglomeration order) allowed forming the following clusters:

1) Kherson and Cherkasy regions;
2) Dnipropetrovsk, Poltava and Zaporizhzhia, Chernihiv regions;
3) Kyiv region;
4) Mykolaiv region.

Table.3. Steps of agglomeration in the process of identifying clusters

Phase	Cluster combined with		Coefficients	The phase of the first appearance of the cluster		Next phase
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	6	7	0.227	0	0	4
2	1	5	0.695	0	0	3
3	1	2	1.386	2	0	4
4	1	6	2.252	3	1	5
5	1	8	3.730	4	0	6
6	1	4	5.892	5	0	7
7	1	3	10.212	6	0	0

Source: developed by the authors.

The structuring of regions by a logical and intuitive approach is identical to the structure of regions according to the mathematical distribution, the SPSS method, except the Chernihiv region. According to its logical and intuitive approach, it belongs to the fourth cluster, consisting of Kherson, Cherkasy and Chernihiv regions. Mathematically, it is assigned to the second cluster, which consists of Dnipropetrovsk, Poltava, Zaporizhzhia, and Cherkasy regions. Structuring regions by a logical and intuitive approach most reproduces the processes of generating demand for river transportation. Therefore, in the future, the authors will focus on the results of this approach.

Verification of results from the previous clustering. The structure of the port regions of Ukraine according to attracting capital investments for 2017 is induced in Table 4.

Table 4. Grouping of regions of Ukraine based on attracting capital investment in 2017

Region	Investments			
	million UAH	n % to the total volume	per capita, UAH	per capita to the average Ukrainian value
First cluster				
City of Kyiv	136044.8	30.3	47093.3	4.4
Kyiv	34494	7.69	19840.4	1.9
Sum	170538.8	38.0	66933.7	6.3
Second cluster				
Dnipropetrovsk	42908.5	9.6	1329.8	1,3
Poltava	15855.6	3.5	11225.3	1,1
Zaporizhzhia	15879.7	3.5	9176.2	0.9
Sum	74643.8	16.6	33696.3	3.3
Third cluster				
Mykolaiv	11178.0	2.5	9762.3	0.9
Fourth cluster				
Kherson	7362.2	1.6	7012.4	0.7
Cherkasy	8144.2	1.8	6663.8	0.6
Chernihiv	7351.1	1.6	7219.7	0.7
Sum	22857.5	5.0	80870.1	2.0
Ukraine	448461.5	100.0	10598.0	-

Source: developed by the authors based on (Official site of the State Statistics Service of Ukraine).

The analysis of the volume of capital investments directed towards groups of regions per capita, distributed by the value of the ratio of the indicator to its average Ukrainian value, made it possible to form the following conclusions in 2017.

In the first cluster (Kyiv), the volume of investment per capita to the average Ukrainian value is 4.4 (the volume of investment per capita in Kyiv exceeds the average Ukrainian figure). For export-oriented regions, in the second cluster (in which in Dnipropetrovsk and Poltava regions the volume of investments per capita exceeds the average Ukrainian indicator), the total volume of capital investments per capita compared to the average Ukrainian indicator was 3.3. For the third cluster (Mykolaiv region), the volume of capital investments per capita to the average Ukrainian indicator was 0.9. In the fourth cluster (all areas of which are characterized (50-75%) by the volume of investments per capita to the average Ukrainian indicator), the total volume of capital investments per capita to the average Ukrainian indicator was 2. The results of grouping the regions of Ukraine into clusters according to the flow of capital investments confirm the previously carried out clusterization of port regions of Ukraine.

Management of the influence intensification of the river transport for the local territories development. It is defined that the management system of the adjacent territories economy strategic development to the navigable waterways of Ukraine should be ensured by a high level of river transport attraction as a part of the support system for leading industries of specialization. Besides, it should determine the appropriate place of individual regions in the interregional division of labour. Moreover, the national system of the river transport should be integrated into transnational transport system based on the green corridor concept (see in more detail Hunke and Prause, 2013; Prause and Hunke, 2014; Prause and Hoffmann, 2017)

Analysis of the contribution of river transport to the economy of the adjacent territories (2016). Official site of the State Statistics Service of Ukraine has shown the considering clusters in transport performance terms (which indicates how much product per capita produced in the region accounts for 1 million tons of cargo turnover performed by river transport). Thus, Mykolaiv region (the third cluster) occupies a leading position (5009 UAH/million tons), Zaporizhzhia and Dnipropetrovsk regions (the second cluster) – the

second place – 2817.4 and 1821.2 UAH/million tkm; Kyiv (the first cluster) – the third place (1278.2 UAH/million tkm). In Cherkasy and Kherson regions this figure was 211.8 UAH/million tkm and 166.2 UAH/million tkm respectively. The growth rate of transport efficiency for the Cherkasy region (the fourth cluster) and the city of Kyiv (the first cluster) was the largest (45.4 and 37.2, respectively); the lowest growth rate was for the Kherson region (the fourth cluster) – 3.3. The ratio of growth rates of transport performance indicator in Kyiv (the first cluster) in the period of 2007-2016 is 7.7 times higher than in the Kherson region (the fourth cluster). Analysis of river transport performance showed a sharp decrease in the rate of use of river transport compared with the growth rate of GRP in the analyzed regions.

- For confirming the statement representativeness concerning the relatively low level of river transport attraction in the local territories economic development, a regression analysis has been used to assess its impact on the dynamics of the development of the region of their location in the period of 2007-2016. The following indicators for evaluating the impact of river transport on the dynamics of the region's development have been selected:
- cargo turnover of river (in the absence of statistics – water) transport, t-km (independent variable, x);
- gross regional product per capita, UAH (dependent variable y).

Table 5 shows the results of the regression analysis on the river transport impact on dynamics of the regional development of its location.

Table 5. The regression analysis results of the river transport impact on dynamics of the region of its location development in the period of 2007-2016

Region /function	Determination coefficient, R^2	The estimated value of the Fisher criterion, F	Statistical significance of model coefficients			
			t_0	t_1	t_2	t_3
Table values: F_{cr} = 5.32; $t_{polynomial}$ = 2.447 (p = 0,95); t_{linear} = 2.306 (p = 0,95)						
First cluster						
City of Kyiv, river transport						
y = -66459·x + 139204	0.5436	9.53	8.5	-3.09	-	-
y = -4686.1·x^3 + 85324·x^2 – 187893·x + 164427	0.6174	3.23	3.5	-0.61	0.17	-0.02
Second cluster						
Dnipropetrovsk, river transport						
y = -186.46·x + 58329	0.3846	5.00	7.5	-2.24	-	-
y = 0.0031·x^3 – 1.0229·x^2 – 92.739·x + 56125	0.3854	1.25	2.01	-0.08	-0.08	0.08
Zaporizhzhia, river transport						
y = -422.65·x + 41907	0.0828	0.72	3.4	-0.9	-	-
y = 9.7484·x^3 – 809.33·x^2 + 20395·x – 121449	0.4474	1.62	-1.0	1.1	-1.04	0.9
Third cluster						
Mykolaiv, water transport						
y = -1021.7·x + 46363	0.5199	8.66	6.3	-2.94	-	-
y = 10.123·x^3 – 612.46·x^2 + 10076·x – 10438	0.6817	17.13	-0.31	1.51	-1.57	1.48
Fourth cluster						
Kherson, water transport						
y = 62.016·x + 9205.8	0.1243	1.14	0.97	1.1	-	-
y = -0.0069·x^3 + 4.5795·x^2 – 824.97·x + 58985	0.2887	0.81	0.60	-0.36	0.28	-0.19

Continued Table 5

Cherkasy, river transport						
y = -11.235·x + 31458	0.3987	5.30	7.35	-2.30	-	-
y = -0,000025·x³+0,10·x²-120·x+53502,27	0.63	3.44	4,30	-1,96	1,58	-1,39

Destinations: p – the degree of probability; t_i – t-statistics

Source: developed by the authors.

For Kherson and Zaporizhzhia regions, the obtained results indicated that all the models constructed were inadequate to statistical data, since $F<F_{cr}$, $t_i<t_{tabl}$, $R^2<0.5$. The inadequacy of the constructed linear regression equations to statistical data was revealed for Cherkasy and Dnipropetrovsk regions ($F<F_{cr}$; $R^2<0.5$), despite exceeding gained t_i according to the table value module t. The obtained linear regression equations for Mykolaiv region and Kyiv ($R^2>0.5$; $F>F_{cr}$; $t_i>t_{tabl}$) could be interpreted as such that indicate the absence of dependence between water (river) transport turnover and GRP per capita. It evidenced by the resulting sign «minus» of the regression coefficient.

A polynomial function for Kyiv indicates the development with the variable deceleration of the growth rate of the time series levels (since a_3 = -4686.1) because of $F<F_{cr}$, $t_i<t_{tabl}$ (except t_0). Therefore, the model is considered inadequate to the statistical data and cannot be used to estimate the dependent variable y. For Cherkasy region a polynomial function was obtained with the parameters: $R^2 > 0.5$; $F < F_{cr}$; $t_i < t_{tabl}$, except t_0, which also indicates the impossibility of its use for the analysis of the dependent variable y. For Dnipropetrovsk region the obtained polynomial equation ($R^2 < 0.5$; $F < F_{cr}$, $t_i < t_{tabl}$) similarly indicates the inadequacy of the model and the impossibility of its further use for analyzing the variable y. The data obtained led to the conclusion that river transport is not a market-forming factor in the development of the region concerned. So, we received confirmation that at present the activities of river transport and ports have almost no effect on the GRP of the areas in which they are located.

Following the research results and all other unchanged conditions (in terms of investment, state influence, etc.), the development of river transport in Ukraine, as well as in the EU 28 (Ionescu, 2016), has low prospects for development in the short and medium-term.

Consequently, it is confirmed that nowadays the activities of river transport and ports almost do not affect the GRP of adjacent regions, at the level of isolated clusters and Ukraine as a whole. Hence, there arise questions that have no answers.

1) Do river shipments produce a scanty influence on the country's logistics? Should it remain the same in the future?

2) Can the activation of river traffic significantly affect the reorientation of logistic flows in the country, in the region, including transit material flows in the future?

3) If so, what should be done to make it happen faster?

4) Can regions be the initiators of infrastructure development? Which industries, cargoes are most suitable for the use of river transport?

The estimation of the multiplicative effect potential at the system of consequential management of the river ports development. Under determining the priority of sustainable development goals in ensuring the growth of the country's economy and its regions, it is obvious to consider the environmental motivation potential of the river ports development in the estimation of the multiplicative effect potential at the system of consequential management of the river ports development. To this end, the methodological approach to the assessment of the potential for motivation of greening innovation activity and the relative socio-ecological and economic efficiency of motivation tools of greening innovation activity, which is described in the paper (Prokopenko et al., 2015), is suggested applying.

Furthermore, the authors suggested forming the logistics systems in the region based on a high level of river transport attraction to support leading industries of specialization and strengthen the role of port

regions in the interregional division of labour. It would result in increasing the economic security of Ukraine and its regions, considering the heterogeneity of the far-reaching implications of the migration process (Shkola & Shcherbachenko, 2011).

The development of regions based on enhancing interaction and exchanges by attracting river transport is possible due to the development of logistic infrastructure on their territory, which should be considered a framework for integrating the region's logistical system based on existing territorial agglomerations, which makes it possible to form new connections and activate these regions in social, environmental and economic areas. Such sites as river and seaports, cargo transportation centres, airports etc. should be the nodes of the regional logistics system.

The influence of river transport on the economic development of the adjacent territories to the navigable waterways of Ukraine at the national and regional levels using the logistic concept can become a multiplier for the development of these territories and should provide the following issues.

1. Considering elasticity, an abundance of labour and reliance on the industry the main structural indicators of economic recovery in the regions of Ukraine, the contribution of river transport to economic recovery in the regions has significant potential due to the development of targeted systemic measures to reform the industry.

2. Providing the river port with the position of a centre for the economic development of local territories will strengthen the economic interaction between the group of river ports and the seaport with other elements of the transport complex in servicing cargo from adjacent territories and transit cargo. It will result in the spatial and functional concentration of the river transport complex clusters, will transform the river port in the direction of performing a wide range of logistic operations of creating additional value. It will also allow positioning the river port as a transport hub at the intersection of transport corridors; as a centre for initiating economic development and the revitalizing the productive forces of the region. Thus, GNP growth in regions adjacent to rivers and their investment attractiveness is expected.

3. It is advisable to note the relevance of the development of feeder container lines in the context of the coordinated development of various types of transport. There are obstacles to the development of containerization of goods, which include: low-tech composition of raw materials; low handling speed of containerized cargo in ports; the disproportion between the levels of development of port facilities for cargo handling and the railway infrastructure adjacent to them; high risks of multimodal operators in the process of organizing transportation; the absence of a developed network of logistic centres and the institution of multimodal (logistic) operators in Ukraine.

4. It is expected that technological development, which increases profitability, in sectors adjacent to river transport, will spread to the river transport sector.

The river port gaining the position of an economic development centre would contribute to realizing the potential of regional economic development of the respective territories. The reasons of that are as follows: the growth of employment in these and related industries, increased tax revenues, unloading of automobile and railway infrastructure, the development of industry and inter-industry competition, the development of industries for the production of complementary goods, targeted impact of external forces in the formation of the logistics systems of the region with the involvement of industry and local communities. Thus, that allows river ports to become active participants and partners in the process of the ecological and economic development of regions and their connection to global markets.

Conclusions. The authors of the publication tried to evaluate the prospect of developing river transport in Ukraine from the perspective of the spacious-functional restructuring of Ukraine's economy. With this goal, the port regions have divided into clusters and rated according to their ability to generate the demand for river freight transportation. The research of the structure of river cargo transportation in Ukraine has allowed choosing two indicators of separation. With this goal, the port regions have divided into clusters and rated according to their ability to generate the demand for river freight transportation. The

first is the share of GRP per capita in GDP, which identifies the direct impact of river transport on the economy of the surrounding region. The second is the share of goods and services exports in the region in the overall structure of exports. It generates a multiplier effect of territorial development. Because products exported from Ukraine have low added value, and, therefore, have a high probability of transportation by the river. The share of imports of goods and services of the region in the total structure of imports is not taken into account. Imports of goods and services to Ukraine with high added value, as a rule, are transported by other modes of transport. The use of two clustering methods has confirmed the port regions' distribution according to logico-intuitive and mathematical methods except the Chernihiv region.

The results of the estimation of the contribution of river freight transportation to the economy of the adjacent territories, which is carried out based on regression analysis, indicated that river transport is not a market-forming factor of the development of the adjacent territories. It is confirmed by the corresponding analysis of river transport (intensity of use). In particular, the analysis of the contribution of river transport to the economy of the adjacent territories for the period of 2007-2016 showed significant differences in the intensity of the use of river transport in different regions. It has been established that the rate of increase of the transport efficiency indicator was the largest for the cities of Kyiv and Cherkasy region (37.2 and 45.4, respectively)and the smallest – for Kherson region (3.3). There was a sharp decrease in the rate of river transport use in comparison with the growth rate of GRP in the studied regions.

The conclusion indicated the significant disproportions and limitations in the development of river transport in short and medium-term. It is proposed to involve river transport in technologies of combined transportation, which, considering the environmental and sustainable development goals of the society. It requires the state to use a direct and indirect (stimulating) function to invest in the development of river transport infrastructure (river ports) and bring river roads and the development of craft to working conditions.

Prospects for further research. Generally, it is argued that despite the chosen strategy for the territories development adjacent to the river, the growth of the inland waterway transport market would depend on the intensification of the use of river transport potential under increasing river transport demand and investment support for river superstructure and infrastructure. The formation of an increasing demand policy for river transport in the direction of the spread of combined transportation, including through integration with sea freight (which is the subject of further research), would give an impetus to the realization of the port regions potential and full integration of the river transport to the logistics system.

Author Contributions. The research conceptualization of the problems of complementary development management of the territories adjacent to river transportations – O. P and Y. K.; The methodology of the river transport contribution to the spatial and functional restructuring of the Ukrainian Economy – Y. K. and O. S.; Software and utilization of SPSS (Statistical Software Program) and excel methods in clustering of port regions according to mathematical and logical-intuitive methods (used SPSS) – S. N. W; The research results validation – Y. K.; Formal analysis – N. V.; Visualization of the study – N. V.; administration of the research project – O. P. and Y. K.

References

Ceniga, P. & Sukalova, V. (2019). Sustainable Development of Transport and Logistics in Slovakia. Transport Means 2019: Proceedings of the 23rd International Scientific Conference, Kaunas University of Technology, Lithuania, 2, 192 – 200

Chen, X., & Jiang, H. (2013). Analysis of the Economic Benefit of the Inland River's Shipping Centre. *Procedia-Social and Behavioral Sciences*, *96*, 625-632. [Google Scholar] [CrossRef]

Document of The World Bank (2016). *International Development Association.* Retrieved from http://pubdocs.worldbank.org/en/955651466671969590/text/P154511-BD-Regional-Waterway-Transport-Project-1-PAD-FINAL-to-SECPO-2016-05-25.txt

Głowny Urzad Statystyczny (2017). *Transport wodny srodladowy w Polsce w 2016 r.*Retrieved from https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5511/4/7/1/transport_wodny_srodladowy_w_polsce_w_2016_roku.pdf

Haddad, E. A., Hewings, G. J., Perobelli, F. S., & dos Santos, R. A. (2010). Regional effects of port infrastructure: a spatial CGE application to Brazil. *International Regional Science Review*, *33*(3), 239-263. [Google Scholar] [CrossRef]

Hann, M., Piotrowski, L., & Wos, K. (2014). Adaptation of the Oder River for the purposes of inland water transport. *Logistyka*, *6*, 13313-13321. [Google Scholar]

Hunke, K., & Prause, G. (2013). Management of green corridor performance. *Transport and Telecommunication Journal*, *14*(4), 292-299. [Google Scholar] [CrossRef]

Ionescu, R. V. (2016). Inland waterways' importance for the European economy. Case study: Romanian inland Waterways transport. *Journal of Danubian Studies and Research*, *6*(2). [Google Scholar]

ITF-OECD. (2016). *Logistics Development Strategies and Performance Measurement International Transport Forum..* Retrieved from https://www.itf-oecd.org/sites/default/files/docs/logistics-strategy-performance-management.pdf.

Krykavskyi, Y., Shandrivska, O., & Wysocki, M. (2017). Investigation of strategic perspectives of development of river ports in Ukraine. *Technology audit and production reserves*, *6*(4 (38)), 8-16. [Google Scholar]

Madani, S. (2018). *Global Seaport Competitiveness: A Resource Management Perspective* (Doctoral dissertation, RMIT University). [Google Scholar]

Nam, K., & Win, E. (2014). Competitiveness between road and inland water transport: the case of Myanmar. *Transport Problems*, *9*. [Google Scholar]

Official site of the State Statistics Service of Ukraine. Retrieved from http://www.ukrstat.gov.ua/.

Prause, G. (2014). A green corridor balanced scorecard. *Transport and Telecommunication Journal*, *15*(4), 299-307. [Google Scholar] [CrossRef]

Prause, G., & Hoffmann, T. (2017). Cooperative Business Structures for Green Transport Corridors. *Baltic Journal of European Studies*, *7*(2), 3-27. [Google Scholar] [CrossRef]

Prokopenko, O. V., & Shkola, V. Yu. (2012). Controlling of the ecological and economic enterprise security on the bases of ecomarketing. *Marketing and Management of Innovations, 4,* 337-346. Retrieved from http://mmi.fem.sumdu.edu.ua/en/journals/2012/4/337-346

Prokopenko, O. V., Shkola, V. Yu, Domashenko, M. D., & Prokopenko, M. O. (2015). Conceptual grounds to form motivational constituent of the international ecological policy. *Marketing and Management of Innovations, 4,* 245-259*.* Retrieved from http://mmi.fem.sumdu.edu.ua/en/journals/2015/4/245-259

Prokopenko, O., Omelyanenko, V., & Tirto, T. (2019). Security issues of system innovation strategies. In *SHS Web of Conferences* (Vol. 65, p. 03006). EDP Sciences. [Google Scholar]

Rydzkowski, W., & Rolbiecki, R. (2005). Mozliwosci rozwoju portow srodladowych w Polsce jako centrow logistycznych. *LogForum*, *1*(2), 1-10. [Google Scholar]

Schonfelder, S., Streicher, G., Gille, J., & Trosky, F. (2015). *Employment Effects of Increased Inland Waterway Transport in the Danube Region* (No. 497). WIFO working papers. [Google Scholar]

Shkola, V. Y., & Shcherbachenko, V. A. (2011). Conceptual bases of the government regulation migratory processes on base macroeconomic forecasting. *Marketing and Management of Innovations, 4,* 237-241. Retrieved from http://mmi.fem.sumdu.edu.ua/en/journals/2011/4_2/237-241

Weijun Fe. (May, 2011*). Using More Inland Rivers in Intermodal Transport* (Final Report). APEC Transportation Working Group. Retrieved from https://www.apec.org/Publications/2011/05/Using-More-Inland-Rivers-in-Intermodal-Transport

Wiegmans, B., & Konings, R. (2015). Intermodal inland waterway transport: Modelling conditions influencing its cost competitiveness. *The Asian Journal of Shipping and Logistics*, *31*(2), 273-294. [Google Scholar] [CrossRef]

Євген Крикавський, д-р екон. наук, професор, Вища Школа Фінансів і Права, Польща
Ольга Прокопенко, д-р екон. наук, професор, Таллінннський технологічний університет, Естонія;
Інноваційний університет Collegium Mazovia, Польща
Олена Шандрівська, канд. екон. наук, доцент, Національний університет «Львівська політехніка», Україна
Надія Васильців, канд. екон. наук, кафедра маркетингу і логістики, Національний університет «Львівська політехніка», Україна
Сильвія Нич-Войтан, Університет Вістула Варшава, Польща

Інновації в управлінні комплементарним розвитком прилеглих до річкових вантажоперевезень територій
У роботі узагальнені результати наукової дискусії з питань управління комплементарним розвитком прилеглих до річкових перевезень вантажів територій. Головою метою дослідження є обґрунтування сутності та напрямків імплементації потенціалу річкових перевезень в логістичну систему країни завдяки впливу річкових перевезень на

економічний розвиток прилеглих територій на основі системного підходу. Систематизація літературних джерел і підходів до вирішення проблеми управління річковими перевезеннями вантажів в контексті управління комплементарним розвитком прилеглих до них територій свідчить про низький рівень орієнтування регіонів в своєму розвитку на реалізацію потенціалу від залучення річкового транспорту в процес перевезення вантажів, а саме в контексті: прямого впливу на економіку країни і її території завдяки підвищенню ефективності транспортних процесів, так і опосередкованого - через розвиток інфраструктури цих процесів. Актуальність дослідження полягає в тому, що в умовах доцільності переорієнтації налагодженої структури логістичної системи країни, її внутрішніх і транзитних матеріальних потоків відповідно до критеріїв економічності і екологічності, дозволяє використовувати річковий транспорт для перевезень сировинних потоків сухих і рідких вантажів, великогабаритних товарів на істотні відстані, а отже, збільшити частку річкових перевезень в загальних вантажоперевезеннях і в структурі ВВП. Зазначені фактори радикального зростання попиту на річкові перевезення з боку бізнесу і держави вимагають відповідної переорієнтації логістики для багатьох галузей економіки, в першу чергу з боку прирічкових територій. Дослідження проблематики річкових перевезень вантажів в просторово-функціональній реструктуризації економіки регіонів України із застосуванням концепції логістики проводиться в такій логічній послідовності: оцінка здатності річкового транспорту щодо формування прямого і мультиплікативного ефекту логістики, сформованого ВРП і експортними процесами в портових регіонах країни; здійснення кластеризації областей, прилеглих до річкових портів за ознаками потенціалу розвитку (валовий регіональний продукт і експорт, в т. ч. в розрахунку на душу населення); підтвердження розподілу регіонів згідно ієрархічної кластеризації прилеглих регіонів; оцінка інвестиційної привабливості портових регіонів країни; управління активізацією впливу річкового транспорту на розвиток прилеглих територій; оцінка потенціалу мультиплікативного ефекту в системі управління розвитком річкових портів. Методами дослідження стали використані в роботі евристичний підхід до структури портових регіонів (на підставі авторської методики формування кластерів на основі вкладу річкового транспорту в формування прямого і мультиплікативного ефекту логістики: сформованого ВРП і експортними процесами в портових регіонах країни) і математичний алгоритм ієрархічної кластеризації портових регіонів з використанням програмної системи SPSS. Результати оцінки вкладу річкових вантажоперевезень в економіку прилеглих територій отримані з використанням регресійного аналізу впливу річкового транспорту на динаміку розвитку регіону його розміщення, також з підтвердженням репрезентативності результатів товаротранспортної роботи річкового транспорту за період 2007-2016 років. Об'єктом дослідження стали портові регіони країни, адже саме вони є територією генерування попиту на річкові перевезення вантажів. Результати оцінки вкладу річкових вантажних перевезень в економіку прилеглих територій показали, що річковий транспорт не є ринкоутворюючим фактором розвитку прилеглих територій. Результати дослідження можуть бути корисними для Міністерства інфраструктури України, Міністерства розвитку економіки, торгівлі і сільського господарства України, адміністрації річкових портів, логістичних операторів, бізнесу в припортових регіонах, інших учасників ринку водних перевезень в умовах пріоритезації мети комбінованих перевезень вантажів.

Ключові слова: інновації, управління, річковий транспорт, логістика, комплементарний розвиток, територіальна структура.