Interregional water transport cluster as a tool for economic convergence and integration

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Abstract. The aim of the study is to develop a conceptual project for creating an interregional water transport cluster along the Don River. The presented theoretical studies have been carried out using the methods of analysis and synthesis of the existing scientific developments in the field of territorial and inter-territorial transport infrastructure organization. Observation and static analysis methods were used in practice to determine the economic connectivity level of the regions along the North-South axis of the European part of Russia. According to the study results, the following results have been obtained:
- the role of inland waterway transport as a factor of convergence and integration of regional economies, territorial consolidation on the systemic cluster approach basis to the spatial organization of the economy has been proved;
- the effectiveness of the network-centric interregional cluster formation on the cooperation principles for the passenger and cargo shipping revival along the small rivers-confluents of the Don river in order to ensure maximum transport accessibility of remote areas and the corresponding multiplier effect for the development of all sectors of the economy has been substantiated;
- the idea of forming and maintaining a mega-regional ecosystem along the North-South axis along the Don River on the basis of dredging consequences’ interregional monitoring, as well as the formation of water tourism embedded cluster along the rivers of the Don basin has been proposed.

1. Introduction
The problems of the spatial development of Russia are caused by the imbalance of interests at the national, regional and municipal levels. Power decentralization in the early nineties of the twentieth century laid the foundations for increasing independence in solving the territorial development problems. However, modern structural global transformations require the managerial actions’ integration of regional and local authorities to solve common socio-economic problems. The regions’ sectoral profiles tend to converge, which is confirmed by use of such a spatial organization form as a cluster.

The research subject is the concept of the interregional water transport cluster model.

The study showed that, a resource, network-centric, systematic approach has been formed in this area of economics. At the same time, the complexity and heterogeneity of the scientific research theoretical base in relation to the research subject still remains unchanged.

The above-mentioned reasons confirm the need to test the following hypothesis: the interregional cluster creation integrator can be such a geographical form factor as a river, which simultaneously acts...
as an economic resource. Small rivers form a fairly fast and cheap transit of goods and passengers, supporting the economy in the remote areas, providing employment for the population, preventing the extinction risk of villages and settlements.

The logical project toolkit with the use of the economic ties cooperation principles will allow to ensure the formation of a qualitatively new mega-ecosystem, improve the river resources regions-users infrastructure state, stimulate industrial development, realize a synergistic effect and increase the territorial connectedness and stability by means of the interregional sectoral interaction.

2. Methods and materials
The research was carried out using the methods of analysis, synthesis, based on integration theories and concepts, scientific developments on the modern economy spatial organization problems and its interregional transport infrastructure.

Most scientists agree that consolidating processes based on the network resources’ use are decisive. Within the overall production chain, intra-industry interaction acquires new quality. The territories of Russia, occupying a huge area, are connected by a unique water network, which makes it possible to literally develop all the economy sectors on the cluster principles.

F. Perroux played an important role in the study of the regional economies’ spatial organization problems, having developed the “Growth Poles” concept in the middle of the nineteenth century. He understood Poles as the industries dominating due to their significant market share, including in the field of innovation. Such “poles ... generate a chain reaction of the emergence and growth of industrial centers” [1].

A. Marshall also enriched the regional sciences with fundamental research in this area, introducing the concept of “industrial regions” and proving the synergistic effect of nearby enterprises through free access to suppliers, knowledge exchange and innovation [2].

The most significant contribution to the development of modern science about regional clusters was made by M. Porter, defining them as “... geographically concentrated interrelated types of economic activity ...”. The scientist considered clusters as “a new progressive form of Inter-industry interaction of business”, contributing to the country’s competitiveness strengthening [3].

Let us present the most characteristic parameters of the cluster, which are noted by the majority of scientists:
- general geographic location;
- same or similar industry;
- vertical and horizontal functional communication of enterprises;
- coexistence of commercial and non-profit organizations to strengthen competitive positions;
- common technologies use;
- the cluster “core” presence.

These features of a regional cluster in total characterize the interaction effectiveness between economic entities - cluster members. Such market interaction between the members of cluster associations is based on competition and cooperation, making it possible to quickly adapt to changing external conditions.

For the purposes of our study, it is necessary to clarify the essence of interregional interaction. The most reasonable is the judgment of M.Yu. Makhotayeva and O. A. Bakumenko:
- it is “... a complex of resources flows’ exchanges carried out within the framework of agreements between authorities, legal entities and individuals of different regions, adopted de jure or de facto, in order to represent common interests in the national and global economic space and increase the level of sustainable development in these regions ...”;
- “business structures’ interaction of the regions in solving common problems, creating production and technological chains, clusters, associations”. [4]

To substantiate their position, the above-mentioned authors single out two most important properties of interregional interaction:
1. Economic integration, which is based on interregional production cooperation and interregional division of labor, ensuring the regional development strategic goals’ achievement.

2. Economic connectivity, reflecting the interconnection of economic growth in the regions forming economic macro space.

In our opinion, the most promising form of interaction between territories is interregional clusters. Summarizing the various interpretations of the interregional cluster essence in scientific literature, we define this phenomenon as the integration of regions interconnected by a common resource base to achieve a certain common goal of socio-economic development [5].

Despite the vastness and depth of the research in the field of clustering the economy, insufficient attention is still paid to the methodological issues of organizing interregional sectoral clusters.

3. Research results

3.1 Transport-logistical cluster as a basis for interregional interaction: system integration and network-centric approaches

Communicative interregional ties are based primarily on the transport territorial connectivity. Transport infrastructure ensures the redistribution of all factors of social reproduction and serves as an instrument of the territories’ competitive struggle for a dominant position in the economy.

Transport and logistics clusters play a special role in these processes. A.B. Volynchuk notes the following basic features of these clusters: common spatial boundaries, the presence of economic entities with developed production potential, the presence of a territory center with a high density of interaction between its participants, transport lines with several transport modes [6].

Let us prove the validity of this statement using a systematic approach. So, the sign of the space unity means the possibility of the cluster’s exclusive existence within the territory. With regard to the interregional quality of transport clusters, this means the length of water and land transport routes, useful storage areas, interaction intensity between the economic agents, taking into account regional specifics.

An important feature of the transport and logistics cluster is also a high level of concentration of the enterprises with developed production potential. This circumstance is associated with a decrease in the cost of moving raw materials and finished products. This feature correlates with the formation of the cluster core as a space-forming factor: effective economic contacts determine the real boundaries of the cluster.

Let us pay special attention to the types of transport in the transport and logistics cluster. As a system, the latter can have one basic type of transport, which should be dynamic, accessible and have a simple infrastructure. To ensure interregional connections and sufficient carrying capacity, water transport, road and rail are suitable. To form a cluster, at least two types of transport are needed: the first creates internal cohesion and unity of the system, the other - communication with other clusters and economic systems.

We believe that it is the inland water transport that is the strategic sector of interregional interaction with a multiplier effect. The river system of Russia acts as a natural network of transport and communications for most regions. We also emphasize the solution to the problem of greening transport by increasing the goods and passengers’ transportation by water transport.

The essence of the network approach in the area under study is well explained by V.V. Tsyganov through the concept of supported development based on self-organization: “...this is harmonious ... development ... in which the use of natural resources, the investments direction, the orientation of scientific and technological development, personal development and institutional changes are coordinated with each other and strengthen the current and future potential for human satisfaction, needs and aspirations, ensuring the quality of people’s life …”. The author develops the idea of a network approach to network centrality, the essence of which is to support the self-organization and development of capital centers, including those with the use of public-private partnership mechanisms [7].

Thus, the existing scientific developments confirm the validity of the proposed idea to consider inland waterways and water transport as the aforementioned strategic centers, taking into account the multiplicative effects of increasing investments in projects for the inland waterways’ reconstruction and
development. The ultimate goal is to increase the regions’ integration level, develop the economic potential of the territories, increase the welfare of the population.

3.2 The river waterways and inland waterway transport state analysis

The territory of Russia is characterized by the world’s longest exploited network of inland waterways - 101.7 thousand km, including the unified deep-water system of the European part of Russia is 6.5 thousand km and is part of the most important inland waterways of global importance.

In the Russian regions with operated inland waterways, 80% of the country’s population is concentrated and about 90% of the gross domestic product is produced.

At the same time, the share of Russia’s internal river transport in the total cargo turnover is less than one and a half percent. For comparison, in the European countries this index was: in Germany - 11%, the Netherlands - 34%, France - 10% of the freight turnover. Inland waterway transport in the European countries is complementary to rail and road transport, forms more than 35% of cargo deliveries to the largest seaports of Europe, is an environmentally friendly and safe mode of transport.

Passenger traffic by inland waterway transport has also steadily decreased since the early 90-s of the XX century, although in the regions of Siberia and the Far East, this type of transport remains highly important for the population. At the same time, in large cities the potential of water transport is practically not used to transport passengers in conditions of congested roads. Only 300-400 thousand people are transported per year on the tourist routes on small and large rivers.

The qualitative characteristics of inland waterways should be recalled here:

- with guaranteed dimensions of navigable passages and with conditions - 48.3% of the total tracks length, or 49 thousand km, of which with illuminated conditions - 25%, with reflective conditions - 11.3%, with unlit conditions - 11.9%.

Inland waterways with guaranteed dimensions of the passages make up slightly more than 26 thousand km or 53.5%:

- without guaranteed dimensions of navigable passages and with the situation, inland waterways make up about 3 thousand km or 3.1%, of which only 0.4% with illuminated conditions; with unlit conditions - 2.7%;

- without navigation barriers and guaranteed dimensions, the waterways length is almost 49.5 thousand km or 48.7% [8].

A significant problem is the infrastructural restrictions on navigation on the main waterways in the European part of Russia, where the sections length with a depth of less than 4 meters today is almost 1.8 thousand, or about 25% of the length of the deep-water system waterways.

Experts state that, the length of navigable routes with guaranteed depths has decreased by almost one and a half times over the past three decades, there is a dilapidation of navigable hydraulic structures, the turnover of inland waterway transport has decreased by 4 times, and the passenger turnover - by 6 times. Approximately 95% of self-propelled river vessels are over 20 years old and over 40 years old - 40% of ships.

We present the comparative characteristics of inland waterway transport with other modes of transport according to the following efficiency parameters:

- in the total volume of fuel consumption, inland waterway transport accounts for 2.9%, at the same time, railway transport has a share of 8.3%, road transport - 32.4%. In terms of energy efficiency, inland waterway transport is the second only to railroad transport: 113.6 against 158.7 thousand ton-km / t conv. fuel and much more efficient than road transport, for which this indicator is only 4.7 thousand ton-km / t conv. fuel.

- total costs for the maintenance and development of public highways of federal and regional significance per 10 ton-km of road transport freight turnover are 14 times higher than inland water transport.

- the transport modes share in terms of their contribution to environmental pollution are distributed as follows: road transport - 94%, railway - 1.5, river transport - 0.6%.
- the cost of transporting dry cargo by inland waterway transport is reduced compared to the road transport at a distance of more than 200 - 300 km, and for oil products - at a distance of more than 600 km. Compared to the railway transport, the highest efficiency is achieved when transporting metal and metal products by water transport over a distance of more than 200 km, agricultural products - more than 250 km, oil products - more than 700 km [8].

The analysis made it possible to identify and generalize the following systemic problems of the Russian inland waterway transport:
- negative stable dynamics of a decrease in the share in the country’s transport system;
- deterioration of the inland waterways’ quality parameters, technical condition of hydraulic structures, high physical and moral deterioration of self-propelled vessels;
- decrease in the availability level of water transport services and their quality for remote rural areas, both in terms of cargo supply and passenger traffic;
- poor use of the small rivers’ transit potential.

3.3 The water transport complex of the Rostov region state analysis
The Don River flows from the North to the South of the European part of Russia and has a length of 1870 km, the area of the river basin ranks 8th among the rivers in the country and is 421.7 thousand sq. km, of which 368.6 thousand sq. km are within Russia. The river, along with its confluents, adjoins 16 regions, including 390 thousand settlements. Only in the Rostov region there are 1960 settlements and directly in the river delta there are about 2.5 million water users.

The river basin is represented by a developed hydrographic network with 13 thousand streams and 8 thousand lakes, 10 thousand ponds and small reservoirs. There are 43 integrated reservoirs with a volume of 10 million cubic meters for seasonal flow regulation.

Let us highlight the most important problems of the water transport complex in the Rostov region, reflecting the general condition of the country’s inland waterways:
- shallow waterways, caused by shallowing, drift and overgrowth. Low water leads to a decrease in the throughput and safety of vessels’ navigation; therefore, the depths also decrease in the waters of the international seaports of Azov and Rostov-on-Don, the carrying capacity of incoming ships is limited to 3-3.5 thousand tons.
- a significant part of the “river-sea” fleet and marine serves under a foreign flag and have the right to work only in the waters of the Azov Sea, not going up the river. In this regard, the river ports operate as storage tanks and double transshipment of goods is required, which leads to an increase in logistics costs and a decrease in the competitiveness of products;
- the equipment of river ports and quay walls does not allow to properly service promising oil and chemical cargo;
- shallow depths do not allow passenger shipping development, and the infrastructure for it has fallen into disrepair. A significant number of vessels are 30-40 years old, the depreciation of the production assets of water transport exceeds 70%. All these factors hinder the development of water tourism in the region along the Don River and the Taganrog Bay of the Azov Sea, to Moscow, St. Petersburg, Volga cities;
- there is an increase in the processes of coastal destruction, silting, sewage pollution, the growth of blue-green algae.

The Azov-Don basin is an integral part of the European water transport ring and ensures the movement of goods to the southern European countries. A special role is assigned to the Volga-Don shipping canal, which passes through the regions that form half of the industrial potential and 65% of the country’s agricultural potential. The importance of inland waterway transport in the region is increasing in connection with the international transport corridor Danube-Don-Volga development. The transport complex of the Rostov region integrates all types of mainline transport, warehouse and information logistics infrastructure.

3.4 Development of a project concept for an interregional water transport cluster along the Don River
The proposed project meets the requirements of the innovative scenario for the transport strategy of Russia for the period up to 2030. The project purpose is to prevent the internal water transport infrastructure degradation threat in the European part of the country, to increase the efficiency of transport enterprises and systems, and to bring population mobility closer to the developed countries’ indicators.

The Don River flows directly through the territory of five regions: Tula, Lipetsk, Voronezh, Volgograd and Rostov regions.

3.4.1. Organizational and economic mechanism of interaction between the regions along the North-South axis along the Don River
- public authorities and local self-government of the territories participating in the water cluster ensure the solution of common problems for the infrastructure development along the entire river bank on the basis of agreements and cooperation programs;
- business structures’ interaction in the adjacent regions to create production and technological chains for servicing transport facilities and structures of the water complex;
- public-private and municipal-private partnerships to attract investment resources in the interregional water cluster mechanism development.

The studies have shown that the interregional interaction implementation in practice is possible only if it is positioned as the goal of strategic management for the regional development. Very few regions set tasks for mutual partnership and integration.

3.4.2. The regions participating interaction tasks in the cluster being formed
- the territorial management process simplification - it is necessary to develop a regulatory legal act at the federal level to regulate the basic elements of interregional interaction; at the regional and local levels - the creation of interregional associations and foundations is required;
- reducing costs in the structure of regional gross products based on integrated transport and logistics infrastructure and information and telecommunications infrastructure;
- implementation of marketing projects of the territories - creation of an integrated water tourism interregional cluster on the water transport cluster basis.

3.4.3 Economic indicators of the main regions participating in the cluster being formed
Let us analyze the economic potential of the regions under study (see Table 1). The information sources were the data of the Ministry of Economic Development of the Russian Federation, the Rating Agency “RIA Rating”, the Federal State Statistics Service.

| Indicators and regions | Tula region | Voronezh region | Lipetsk region | Volgograd region | Rostov region | Russian Federation |
|------------------------|-------------|-----------------|---------------|-----------------|---------------|-------------------|
| Industrial production index in January-May 2020, % to January-May 2019 | 124.1 (2nd place in the rating) | 109.3 (10th place in the rating) | 103.6 (29th place in the rating) | 101.9 (36th place in the rating) | 97.8 (59th place in the rating) | 97.6 |
| The volume of shipped goods of own production, work performed and services per resident, in January - May 2020. | 300.9 | 200.8 | 344.5 | 201.2 | 156.5 | 281.2 |
The territories of the Don River basin are quite different in terms of the industrial production development level. So, the Tula and Voronezh regions are among the top ten leaders in the country. Although in terms of the absolute value of the shipped products volume per inhabitant, the Lipetsk region has the first position among the considered regions - 344.5 thousand rubles, the Rostov region - only 156.5 thousand rubles. At the same time, in terms of investment in fixed assets, the Rostov region is ahead of all the cluster regions. Also, a significant dissonance is observed in the budgetary sphere of the regions - two out of five regions have deficit budgets.

The share of profitable enterprises fluctuates between 63-65%, only the Voronezh region stands out from the total number with an index of 68.9%. But in terms of employment, the Tula and Lipetsk regions

### Table: Various Economic Indicators

| Category                                                                 | 2019 | 2020 |
|--------------------------------------------------------------------------|------|------|
| The volume of investments in fixed assets in the first half of 2020      |      |      |
| mln ru per % to the similar period 2019                                  | 44368.3 /60.5 | 75548.8 /86.3 | 60452.2 /122.8 | 70222.1 /116.2 | 127853.9 /136.7 | 6916.6 /96.0 |
| Surplus (deficit) of the consolidated budgets of the constituent entities of the Russian Federation, thousand rubles | - 3091134 | 8252365 | -220072 | 248248 | 1709576 | - |
| Profitable enterprises' share, %                                        | 63.1 | 68.9 | 65.6 | 63.5 | 64.7 | 64.7 |
| Dynamics of real money income of the population, in the first half of 2020 at % to the similar period 2019 | 100.1 | 95.1 | 96.1 | 90.9 | 92.0 | 96.9 |
| Employment rate, at %                                                   | 59.6 | 56.4 | 59.4 | 54.0 | 56.7 | 58.0 |
| Unemployment rate, at %                                                 | 4.8  | 4.5  | 4.4  | 8.7  | 5.1  | 6.2  |
| Transport Infrastructure Development Index                               | 3.00 | 2.96 | 3.28 | 3.08 | 3.06 | 3.24 |
| The development level of the public-private partnership sphere, points   | 55.9 | 39.2 | 32.6 | 49.2 | 40.5 | -    |
| Tourism development level, points                                       | 77.6 (24th place) | 73.7 (28th place) | 70.5 (31st place) | 75.5 (27th place) | 89 (15th place) | -    |
are in the lead, approaching 60%. The same two regions managed to practically keep the dynamics of real money income at the level of 2019.

Interestingly, only the Lipetsk region exceeds the value of the industry average index of transport infrastructure development, the lowest indicator is in the Voronezh region. At the same time, in terms of the public-private partnership mechanism use level, the Lipetsk region has the weakest positions in comparison with the rest of the regions participating in the sample.

This unevenness of territorial development confirms the need for integration and convergence on the cluster interaction basis in an interregional format based on the joint use of water resources, expansion of sales markets, ensuring economic connectivity and transport accessibility for the population.

3.4.4. Explanations of the concept individual elements
The current economic model of a federal state determines the competition of regions for federal funds and foreign investment. At the same time, the resource, systemic and network-centric approaches to the organization of interregional interaction are not used to level the living standards and develop the regions’ economic potential [9].

The transport water cluster along the Don River will optimize the placement of the economic infrastructure of the studied regions on the cooperation basis, eliminate ineffective budgetary expenditures, unite the economic potential of the territories to solve large-scale investment projects based on the public-private partnership mechanism.

Particular attention should be paid to the creation of a monitoring and dredging system along the entire length of the Don River. Some regions carry out such work in case of emergency, when the depth goes beyond the maximum minimum and navigation becomes impossible. In connection with the high cost of equipment and work, we propose to create an interregional fund on terms of cooperation, purchase self-dredging dredgers, barges with opening hull, rope excavators, multi-bucket shells, anchor carriers for joint use on the basis of an interregional year-round schedule. The teams will be local, and in the absence of the necessary specialists in one region, it will be possible to use the principles of personnel leasing. At the same time, we propose to create an interregional service for monitoring the impact of dredging operations on the environment, since such works negatively affect fish resources.

High scores in the national tourism rating of the studied regions prove the feasibility of integrating into the interregional transport cluster and the water tourism cluster. Gravitation to the coastline will ensure the concentration of tourism industry objects evenly across all participating regions and, accordingly, increase employment in the social and technical infrastructure of the industry. In addition, all of these regions have significant cultural heritage. Thus, Tula is the third museum center after Moscow and St. Petersburg; Volgograd is the center of military-patriotic and historical and educational tourism, the cities of the Rostov region are included in the tourist route “The Golden Ring of the Bosporus Kingdom”, the Voronezh region specializes in folk and event tourism, the Lipetsk region develops pilgrimage and archaeological tourism programs [10].

Thus, the results of the study confirm the need to move from a strategy of competition for resources to a strategy of interregional cluster interaction.

4. Discussion
The concept of integrating internal resources of territories based on the formation of cluster structures is of great scientific interest, since it determines the possibility of achieving competitive advantages and economic growth of the regions.

To study the role of resources in the activities of various clusters, it is necessary to discuss the provisions of the resource theory and the resource-oriented approach to managing the regional economy in conditions of limited resources. E. Penrose, J. Barney, B. Wernerfelt, C.K. Prahalad made a significant contribution to the development of this scientific field: G. Hamel, K. Ketels and others.

Synthesizing scientific developments on this issue, we can conclude that the territories’ interaction is possible through the clusters for the purpose of their further development based on the joint use of
available resources. For example, K. Ketels’s idea of inter-cluster cooperation based on specialized platforms is interesting. In general, the scientists agree on the following positions:

- the cluster-network principle allows organizing effective integration interaction of regions, ensuring the alignment of their spatial development and economic cohesion;

- the use of natural resources, for example, inland water resources, forms a direct link between competitive advantages and effective management of strategic resources of territories.

According to the research results of the Harvard Business School, labor productivity at enterprises participating in the cluster is 20-40% higher than the industry average and, accordingly, the level of wages is one third higher than the national average. The clusters form up to 60% of GDP and more than 30% of employment in the US [11].

The European Union is pursuing a network transport policy aimed at stimulating the development of information, financial and social networks that contribute to the development of transport complex. Currently, such a policy is gradually transforming into a network-centric one, when network centers are selected and maintained as points of the transport system growth. In turn, a synergistic effect is created from directing the efforts of participants to a specific object or project.

So, there are more than 80 transport and logistics clusters, including 42 thousand km of inland waterways, 73 thousand km of roads, 215 thousand km of railways, 366 airports on the territory of the EU. The most prominent example of interregional transport clusters in Europe is the Frankfurt am Main cluster located in the five largest cities in the state of Hesse. This cluster, in addition to highly developed road and rail networks and the third airport in the world in terms of passenger traffic, includes a river port with access to the North and Black Seas [11].

Within the framework of the cluster policy, the state provides direct support in the format of financing programs: over the past decade, more than half a billion euros were allocated in Germany for the development of 32 clusters; in France, three billion euros were spent on the needs of 71 clusters [11]. Also, within the framework of the state cluster policy, specialized organizations with supporting functions (marketing, information, consulting, educational) are created.

5. Summary

The analysis showed that for the transit potential implementation in the region, the creation of an interregional water cluster is expedient. Inter-territorial interaction on the basis of cooperation will permit:

- to increase guaranteed navigable depths up to 4-4.5 meters through systematic dredging and cleaning works throughout the river by all the user regions on the basis of a joint coordinated schedule;

- to increase the share of the ports in the Rostov region in cargo processing, including container and chemical, among the ports of the Azov basin;

- to form a unified system of freight forwarding services on water transport with a logistics center in Rostov-on-Don;

- to create a favorable investment climate on the public-private partnership basis for the development and technical re-equipment of the river fleet and hydraulic structures on the Don River and its confluents;

- to improve interaction with other transport modes, to develop port rail and road approaches to river ports;

Restoration of inland navigation will reduce the transport costs share in the cost of intra-regional cargo flows of agricultural products, construction materials, fertilizers, and, accordingly, increase the transshipment of goods, according to experts, to 26-27 million tons per year. Full-fledged passenger river navigation and the construction of passenger port points, piers will ensure the development of water tourism, excursion and recreational services, cruise transportation to the Black Sea, and resorts including the Crimean.

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