DOI: https://doi.org/10.30932/1992-3252-2020-18-156-173

Features of Organisation of Transport and Logistics Cluster Prioritising Intelligent Transport Technologies Development




Elena V. BUDRINA **Anna S. LEBEDEVA** **Larisa I. ROGAVICHENE** **Katerina B. KVITKO**

Budrina, Elena V., *National Research ITMO University, St. Petersburg, Russia.*
Lebedeva, Anna S., *National Research ITMO University, St. Petersburg, Russia.*
Rogavichene, Larisa I., *National Research ITMO University, St. Petersburg, Russia,*
Kvitko, Katerina B., *Vologda Scientific Centre of the Russian Academy of Sciences, Vologda, Russia*.*

ABSTRACT

The article examines the prospects for organizing a cluster as an effective tool for ensuring connectivity of territories of the Russian Federation through the systematic and integrated implementation of intelligent transport technologies, which corresponds to strategic directions of development of transport in the Russian Federation and determines the relevance of the topic. The objective of the study is to determine the features of organisation of the transport and logistics cluster prioritising development of intelligent transport technologies by analysing the prospects for their development, studying variability of characteristics and structure of the cluster under various conditions of its formation based on the methods of formal logic, grouping, analysis of statistical data, normative-legal information, information synthesis. The study resulted in identification of prerequisites for the most rapid development and effective implementation of intelligent transport systems within the cluster. The expediency of using this approach has been substantiated, despite its labour intensity and cost. The study suggests definitions of an innovative transport and logistics cluster, as wells as characteristics of the transport and logistics cluster prioritising intelligent transport technologies. The study revealed the specifics of organisation of this cluster, which is primarily determined by the presence of dual characteristics. The peculiarities of cluster formation are reflected in the proposed structure of the cluster under study. The role of the state in organizing an innovative transport and logistics cluster is also defined.

Keywords: transport, logistics, intelligent technologies, systems, innovations, cluster, transport and logistics complex, regional development.

*Information about the authors:
Budrina, Elena V. – D.Sc. (Economics), Tenured Professor of the Faculty of Technological Management and Innovations of National Research ITMO University St. Petersburg, Russia, boudrina@mail.ru.
Lebedeva, Anna S. – Ph.D. (Economics), Tenured Associate Professor at the Faculty of Technological Management and Innovations of National Research ITMO University, St. Petersburg, Russia, hebo@rambler.ru.
Rogavichene, Larisa I. – Ph.D. (Economics), Tenured Associate Professor at the Faculty of Technological Management and Innovations of National Research ITMO University, St. Petersburg, Russia, Rogavichene@list.ru.
Kvitko, Katerina B. – Ph.D. student of Vologda Scientific Centre of the Russian Academy of Sciences, Vologda, Russia, kbkvitko@mail.ru.

Article received 16.07.2020, accepted 08.09.2020.

For the original Russian text of the article please see p. 156.

Background. In the context of globalization, which is an integral part of development of a modern economic society, it becomes urgent to increase competitiveness of individual territories, regions, industries based on innovative approaches to preserve or form the priority right to influence economic phenomena in the process of unification and integration. Thus, the main directions of technological development of the Russian Federation are formulated in the program of the national technological initiative presented to the Federal Assembly in 2014 by the President of the Russian Federation. Autonet is named as one of key markets for development of the national technology initiative, namely, as the market «for development of services, systems and modern vehicles based on intelligent platforms, networks and infrastructure in the logistics of people and things» [1], since those technologies can stimulate qualitative changes in various industries: transport, construction, trade and many others, due to integration of information and communication technologies and key components of the transportation process. The construction of efficient intelligent transport systems will make it possible to achieve a degree of scientific and technological development and quality of transport services that meets modern requirements.

Within the framework of this study, a hypothesis is put forward that implementation of intelligent transport systems is most effective in formation of an «ecosystem» for development and implementation of innovations, which, in turn, links together all the main participants in the transportation and logistics process. These «ecosystems» are clusters, which, as a rule, are the result of natural attraction and accumulation of elements of the transportation system interacting with each other. At the same time, receiving the status of a cluster, natural formation acquires a formalized structure, a general development strategy, state support, which significantly speeds up development and implementation of innovative technologies, increases efficiency of their use due to consistency and complexity of solutions. Within the clusters, there is an opportunity to connect technology companies, their suppliers, as well as various organisations that provide research, personnel, and administrative support to these organisations. Clustering of regional transport and logistics complexes determines not only a more rapid technological development of intelligent technologies in the Russian Federation while reducing logistics costs, but also allows to quickly influence changes in the regulatory framework. Through involvement of universities, it is possible to create training programs needed in the future to maintain and further develop the technology. Thus, there is a complex impact on various areas of activity, accelerating the process of adaptation and possible implementation of technology in the Russian market.

Thus, the high need to identify tools for effective implementation of intelligent transport management systems within the natural process of clustering regional transport and logistics complexes determines the relevance and practical significance of the research topic.

Research methodology

To achieve the *objective* of identifying the features of organisation of the transport and logistics cluster (TLC[1]) prioritising development of intelligent transport technologies, it is necessary to determine prerequisites for development of this type of innovative technologies within the framework of cluster formation, to study the possible characteristics of the cluster under various conditions of its formation, to describe its structure.

The solution of the tasks set involves the use of *methods* of formal logic, grouping, analysis of statistical data, regulatory information, information synthesis.

The current state of research on this issue

At present, a lot of scientific works are devoted to issues related to intelligent transport systems, and that once again confirms the relevance of the chosen topic. Basically, these are the works of researchers of transport universities or transport departments of universities, as well as of employees of large transport and logistics companies. The geography of research covers all developed and developing countries. In the scientific literature, the following areas of research prevail within the framework of this topic:

- advantages, objectives and goals, problems of using intelligent transport systems as a tool to improve efficiency of the economy [2–4];
- consideration of prospects for introduction of intelligent transport systems in one of the modes of transport [2; 5];
- description and assessment of one of the technologies of intelligent transport systems [6; 7];
- comparative analysis of some intelligent transport technologies [6].

[1] The Russian abridged name for transport and logistics cluster should not be confused with the same abbreviation TLC used for terminal and logistics complex. – *Ed. note.*

There is also a lot of research in the field of theoretical foundations of clustering, however, the problem of formation of transport and logistics clusters is practically not studied and is represented by rare works, which are mainly devoted to general issues of development of transport clusters [8–10] or to the prospects and conditions for formation of a cluster in a particular region [11].

Despite the significant interest of the scientific community to development and implementation of intelligent transport management systems, as well as to the study of the trends regarding formation of clusters, research works that consider these issues in close interrelation have not been found. At the same time, it seems that within the framework of the innovative TLC, the rates of development of this group of innovative technologies will be much higher.

Prerequisites for development and implementation of intelligent transport technologies within the transport and logistics cluster

Transport is a key factor in ensuring connectivity of the territory of any country, any region. For the Russian Federation, which stretches over 4000 km from north to south and over than 9000 km from west to east, territorial interaction is of particular importance. Therefore, creation of conditions for effective operation of the country's transport and logistics complex is one of the priority strategic directions of the country's development both in any historical period, and in the present and in the future.

This is possible only if the innovations are introduced that can solve the existing problems of transport sector, ensure qualitative growth of the country's transport and logistics complex, and improve conditions for interaction of various modes of transport. These innovations include intelligent transport technologies, which are a group of innovative developments aimed at creating information flows to control traffic in real time by simulating transportation systems.

These technologies can facilitate the achievement of the following results:

- to provide end users with the information they need;
- to improve safety of road users;
- to qualitatively increase the level of interaction between traffic participants;
- to redistribute load and reduce traffic density, reducing the likelihood of congestion;
- to reduce fuel consumption, which will have a positive effect on environmental safety of the country;
- to reduce the level of negative influence on the psychoemotional state of road users [12].

Thus, intelligent transport technologies act as an element connecting the stakeholders, which makes it possible to bridge the current gap in terms of sustainability between transportation systems, which is caused by an increase in the volume of transport work and the number of vehicles, by higher requirements for quality and speed of transport services, high traffic routes congestion, a significant share of the transport component in the cost of the final product and other social, technological and environmental factors.

The versatility and relevance of this group of innovations have determined the emergence of many different technologies in this area, which are developed both by organisations subordinate to the state and by private companies specializing in intelligent transport technologies.

Intelligent transport technologies can represent both simple navigation systems, traffic control systems, warning signs, devices for recognizing and reading speed and vehicle data, as well as more complex video surveillance systems that allow collecting and processing significant amounts of data from various sources, such as meteorological services, systems for controlling bridges, parking (e.g., Parking guidance and information (PGI) systems) and others.

However, the variety of products offered on the market does not ensure the transition of the country's transport and logistics complex to a fundamentally new evolutionary level. Moreover, this approach inhibits its development and increases the gap with more innovatively developed countries by reducing the level of integration and interaction of participants in the transport services market.

This is due to the fact that implementation of existing developments occurs pointwise, haphazardly. There is no fundamental understanding of exactly which innovations need to be introduced, on what scale, in which regions, what effects will be obtained. The scope of the applied technologies is limited to individual cities, districts to solve individual municipal problems, without a tendency towards further globalization. As a rule, the intelligent technologies used have different developers, and, accordingly, are not connected into a single network, often do not have the technical ability to integrate with each other. In other words, there are no expected globalization processes and synergistic effects for the regions and the country as a whole.

At the same time, the experience of foreign countries indicates the presence of significant positive effects resulting from introduction of intelligent transport systems. For example, in Stockholm, these technologies made it possible to reduce the likelihood of congestion by 20 %, improve the environmental safety of megalopolis transport by reducing harmful emissions by 12 %, and actively stimulate the population to use public transport. In Seoul, a city with a high rate of motorization of the population, due to introduction of intelligent systems, the average speed of movement has increased by 20 %. At the same time, the emerging social effect also determines the economic effect in the form of a reduction in various items of expenditure in the budgets of cities and countries. The total savings after introduction of intelligent transport systems in South Korea, for example, amounted to about $1,5 billion per year, and in one of the states in the United States, the cost of road maintenance in winter was reduced by 62 % [13]. Data shown is based on actual results. In domestic practices, only forecasts of the results from introduction of intelligent technologies for the transport system are presented, based mainly on expert estimates without considering specific innovative technologies and factors of their implementation in individual regions, where they will differ significantly.

At present, practical experience of foreign countries has been accumulated in design and implementation of intelligent systems, including within the framework of existing transport and logistics complexes. For example, in the United States, to justify a project for implementation of intelligent transport systems, a multi-level assessment procedure is performed by experts in various fields using specially developed methods (scenario method) and software products for making a managerial decision on implementation of a technical solution at the state level (MICA, PRUEVIIN, IDAS, SCRITS, CAL-B/C, etc.). The design of these systems in Europe seems to be based on a more rigorous scientific approach than in other regions. Process of development of projects in Japan is organised similarly to European countries: the internal specifics and a plan of subsequent impact, a plan for degradation of the system and its subsequent modernization are calculated. Due to capital intensity and complexity of procedures in domestic practices, the stages of assessing implementation of intelligent transport systems are simplified, which leads to the fact that the implemented control systems are described and created, in essence, as a set of equipment (for example, «Start» system in Moscow) [14].

The tool for solving this problem is formation of clusters, in particular, innovation clusters, the main task of which is to activate innovation processes in a certain area and to increase innovation activity and efficiency of innovation activities not only of individual market entities, but also of the country as a whole. At the same time, this group of innovative technologies, first, refers to the transport complex, and, therefore, is implemented within the framework of the country's regional transport and logistics complexes, which are currently subject to the general clustering process [15]. It should be noted that, despite the adoption, within the framework of the long-term strategy of socio-economic development of the Russian Federation until 2030, of the decision to create a network of innovative and territorial-production clusters [16] and the trend of clustering in the field of transport, not a single TLC has been created with assignment of an official status. This determines not only the lack of a single development strategy and the lack of state support in the form of financing and legal regulation of interaction of participants tending to clustering the country's transport complexes, but also shows the low level of efficiency of their innovative component.

The identified prerequisites determine expediency of determining the specific conditions for formation of TLC with highly developed innovative technologies in the field of intelligent transport management in the country.

Study of the characteristics and structure of the transport and logistics cluster prioritising development of intelligent transport technologies

To identify the specifics of TLC organisation prioritising development of intelligent transport technologies, it is necessary to determine its type and main characteristics.

Since there is no officially assigned TLC or innovation cluster focused on development of intelligent transport technologies in the Russian Federation, a potential type of cluster is being considered. There are two options for formation of this cluster: self-organisation within the existing conditions without a formal status, or organisation of a formal cluster assigned with an official status. Subject to assignment of official status, it will become secondary one, and a number of its characteristics will change, for example, the degree of control by the state. Therefore, Table 1 shows the characteristics of this cluster both under existing conditions and

Table 1

Characteristics of the transport and logistics cluster (TLC) prioritising intelligent transport technologies development

Feature	Characteristics of a cluster under conditions of self-organisation	Characteristics of a cluster subject to assignment of an official status
Legal status, status	Primary (undetected)	Secondary (explicit)
Depending on the nature of the cluster-forming industry	Innovative Transport-logistics	Innovative Transport-logistics
Result of activity	Transport and logistics services Creation of intelligent transport technologies	Transport and logistics services Creation of intelligent transport technologies
Development orientation	Sectoral Regional	Sectoral Regional
Degree of government involvement	Passive (support for the innovation component)	Active (legal regulation, financial support, etc.)
Degree of connectedness of cluster members	Weak ties, latent	Strong, stable
Role expectations of participants	Multiple roles for each participant Fuzzy role functions	Role specification of participants Clear role functions
Management	Decentralized	Centralized
Goal setting	Targeted	Targeted
Geographic concentration	City Region	City Region
Nature of origin	Spontaneousness	Awareness
Key motives for forming	Product-oriented	Product-oriented
Expected efficiency	Low or average	High

Source: compiled by the authors.

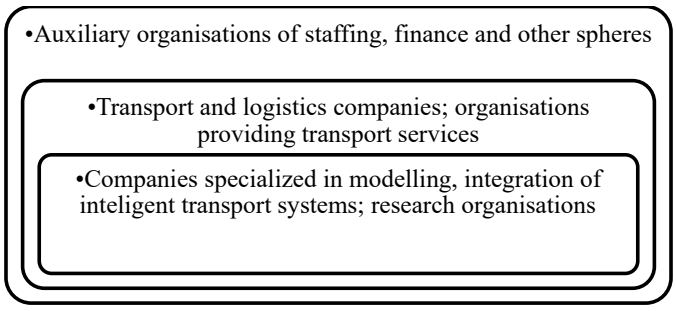
subject to assignment of the official status of the cluster.

Attention should be paid to the presence of dual characteristics. So, on the one hand, TLC is focused on provision of services, on the other hand, development and implementation of innovations require availability of production facilities. This cluster develops both a close relationship with a specific industry and regional development. This is due to the fact that this type of cluster combines characteristics of two types of clusters: transport and logistics and innovative ones.

The transport and logistics cluster (TLC) is a complex system of infrastructure and companies specializing in storage, following, monitoring and delivery of goods and passengers, that is, performing various transportation and logistics operations [17]. The main goal of this cluster is to create effective management of technological chains of movement of cargo flows from suppliers of raw materials, production structures to consumers [18]. On the one hand, it involves development of the transport industry, on the other hand, it is aimed at increasing the logistics potential of the territory. In addition, transport is a connecting link for other sectors of the economy, which determines the intersectoral nature of the cluster. Also, a feature of TLC is the need not only for availability of major enterprises providing transportation and logistics services, but also for a developed transport infrastructure. Therefore, as a rule, this type of clusters is formed within territories with significant transit potential, for example, in port cities, at large transport and logistics hubs, in the area of international transport corridors.

An innovation cluster is «an informal unification of efforts of various organisations (industrial companies, research centres, universities, public scientific institutions, etc.) capable of transferring new knowledge, scientific discoveries and inventions, transforming them into innovations demanded by the market» [17]. This type of cluster is a supersystem, since it can be associated with various industries and clusters of other types. The main goal of the innovation cluster is naturally innovation, both industrial and social, managerial and other. The development of infrastructure of intellectual and financial capital is important for an innovation cluster. It is the innovation cluster that can speed up the process of creating and commercializing innovations, which is necessary for harmonious development and implementation of intelligent transport technologies.

In the Russian Federation, there are many transport and logistics complexes with significant potential for development of the industry and organisation of a cluster. At the same time, it should



Pic. 1. Structure of the transport and logistics cluster (TLC) prioritising intelligent transport systems development. Source: compiled by the authors.

be noted their low innovative activity in general, despite the presence of some innovative achievements in the field of railway and air transport. A systemic, integrated approach to development and implementation of radical innovations not borrowed from world practices can be carried out by large domestic companies with state support and a significant amount of financial and material and technical resources. The current situation requires a different approach to formation of TLC with an emphasis on the innovative component. Therefore, it is advisable to define the type of cluster corresponding to the purpose of the study as innovative transport and logistics cluster.

An innovative transport and logistics cluster (ITLC) is a group of interconnected subjects of the transportation services market with its inherent features of cluster formation, the core of which is range of key organisations specializing in development and implementation of innovative transport technologies.

The presence of dual characteristics of a cluster determines the specifics of its structure. The required type of cluster to ensure development of intelligent transport technologies must have the resources of production (information technology), transport and logistics and innovation clusters.

Any cluster assumes a three-tier structure: the base of the cluster («key companies»); organisations providing services to «key» companies; auxiliary organisations providing participants with various resources. As a result of the analysis of the structures of the production, transport, logistics and innovation clusters [15], we have determined the structure of the required type of cluster, as shown in Pic. 1.

The core of the cluster is represented by companies whose main task is to develop and integrate components of intelligent transport systems, interconnecting and uniting subjects of the transport and logistics component of the cluster. This function can be performed by individual companies (SCOUT Group of Companies, LLC A+C Transproject, LLC IntelTech, LLC Intelligent Transport Systems, etc.), subsidiaries of large transport and logistics organisations. Also, the first level includes structures that carry out research work in the field of intelligent transport technologies that are not related to the technical field of development and implementation: marketing companies, subdivisions of large research structures (universities, laboratories), subdivisions of subordinate state enterprises (GKU Organizer of Transportation, Committee on Transport, etc.).

Close interaction of the subjects of the first level while maintaining the required level of competition is the main factor of the cluster's efficiency. It is precisely on ensuring the required level of confidence and trust between cluster members that the degree of realization of its innovative potential and the efficiency of resource use depend, thus affecting its competitiveness.

The second level of the cluster includes transport and logistics enterprises: consumers of intelligent transport technologies (carriers, logistics operators, port companies, forwarding organisations, etc.). This level is also the basis for approbation of intelligent transport control developments. In addition, at this level, organisations providing services to transport sector are needed, such as service stations, car washes, etc.

The third level includes organisations that provide resource support for the cluster. First, this is staffing, since development of intelligent transport systems requires involvement of highly qualified IT architects, systems technicians, analysts, engineers, transportation specialists, innovation specialists, programmers, IT administrators. It is necessary to develop educational programs on the basis of universities in conjunction with companies of the first level of the cluster.

The financial support of the cluster at the first stage of development is expected to be provided at

the expense of state investments, at the subsequent stage – at the expense of own resources and investments of business incubators, venture capital enterprises, and individual investors.

In addition, it is advisable to include in the third level structures that perform a number of administrative functions related to regulatory issues in implementation of intelligent transport technologies, lobby projects for modernization and development of transport infrastructure.

It should be noted once again that organisation of a cluster of this type involves government participation. Even though clustering in its essence should take place on the initiative and meet the needs of enterprises for unification and interaction, it is rather difficult to imagine this process without state support. The state is the developer of cluster policy aimed at creating conditions for development and provision of infrastructure for clusters and implementation of measures to support them.

State cluster policy can be implemented based on one of two approaches. The first approach assumes that identification of clusters, identification of priority areas of activity of cluster-forming enterprises, implementation of activities supporting the clusters are carried out at the state level. The second approach implies a deep understanding of functioning of each cluster and formation of an individual program for their support and problem solving.

Depending on the degree of intervention and control by the state of the clusters, four types of cluster policy are distinguished: catalytic, supportive, directive, interventionist. With each subsequent type, the responsibility expands, but at the same time the degree of state control over the activities of the subjects of the cluster also extends [19]. At the same time, the most widespread is supportive policy, it is carried out in relation to 40 % of regional clusters, catalytic policy refers to 20 %, directive policy is relevant for 5 %, interventionist policy addresses 2–3 % of clusters [20, p. 16].

Since strategic management and rationalization of the composition of the cluster should be centralized, at the first stage of development of the cluster under study, it will be necessary to conduct a directive cluster policy in terms of formation of a common goal setting and organisation of interaction between the participants in the first and second levels of the cluster. At subsequent stages, the state can only perform supporting functions, gradually reducing the volume of investments and the degree of interference in cluster functioning.

The high labour intensity of TLC organisation prioritising development of intelligent transport technologies and involvement of public and private companies in this process determine the need for large-scale research in order to analyse the problems and capabilities of the existing cluster-forming regional transport and logistics complexes of the country and identify the most promising of them.

Thus, the specifics of organisation of TLC focusing on the priority of intelligent transport technologies development is as follows:

- need to consider the characteristics of the cluster, which vary depending on the conditions of its organisation;
- presence of dual characteristics of the cluster due to its belonging both to the transport and logistics sphere and to the innovation field;
- special structure design that provides access to the necessary resources;
- importance of development of transport infrastructure and infrastructure of intellectual and financial capital;
- high demand for staffing;
- need to ensure interaction of participants in the production process and implementation of intelligent transport technologies while maintaining the required level of competition;
- need for government intervention and support in the field of transport and overall goal-setting of the cluster to attain high expected efficiency;
- high labour intensity of the organisation process;
- need for large-scale research at the planning stage of the cluster organisation.

Conclusion. The objective prerequisites for development of intelligent transport technologies highlighted in the study within the framework of TLC necessitate organisation of a cluster with specific characteristics and potential to achieve set goals, despite high labour intensity and cost of this process.

The most effective and least costly is organisation of a formal cluster based on a cluster-forming regional transport and logistics complex of the Russian Federation selected based on the research results with the phased introduction of an innovative component aimed at development and implementation of intelligent transport technologies. As a result of the cluster's activities, it is expected to create a single intelligent system for managing the transport and logistics system of a particular region with subsequent dissemination of the implemented and tested innovative transport technologies to other

regions to form a stable connectivity of the country's territory and to achieve increased transport competitiveness.

REFERENCES

1. National Technology Initiative. A program of measures to form fundamentally new markets and create conditions for the global technological leadership of Russia by 2035. [*Natsionalnaya tekhnologichesaya initsiativa. Programma mer po formirovaniyu printsipialno novykh rynkov i sozdaniya uslovii dlya globalnogo tekhnologicheskogo liderstva Rossii k 2035*]. [Electronic resource]: https://old.asi.ru/nti/. Last accessed 30.04.2020.

2. Suleiman, Gh. M. Decreasing of Traffic Delay with Intelligent Transportation System ITS. The Seventh International Conference on Advances in Civil and Structural Engineering, CSE, 2017. [Electronic resource]: https://www.researchgate.net/profile/Ghassan_Suleiman/publication/320695746_Decreasing_of_Traffic_Delay_With_Intellegent_Transportation_System_ITS/links/5c37213292851c22a3691f8b/Decreasing-of-Traffic-Delay-With-Intellegent-Transportation-System-ITS.pdf. Last accessed 30.04.2020.

3. Popovic, Z., Miucic, R. Connected vehicles. Intelligent Transportation Systems. Springer International Publishing, Switzerland, 2019, 271 p. DOI: 10.1007/978-3-319-9.4785-3.

4. Fayaz, D. Intelligent Transport System-A Review, 2018. [Electronic resource]: https://www.researchgate.net/publication/329864030_Intelligent_Transport_System-A_Review. Last accessed 30.04.2020.

5. Ureche, C. Intelligent Transport Systems Architecture. *Journal of Scientific Conference Proceedings*, 2018, Vol. 7 (Future Traffic Management), p. 805. [Electronic resource]: https://www.researchgate.net/publication/330118340_Intelligent_Transport_Systems_Architecture. Last accessed 30.04.2020.

6. Popova, I. M., Abramov, N. V., Popova, E. A. Assessment of the economic effect of introduction of intelligent systems for traffic management [*Otsenka ekonomicheskgo effekta ot vnedreniya intellektualnykh system upravleniya transportnymi potokami*]. Scientific and methodological electronic journal «*Concept*», 2015, Vol. 35, pp. 116–120. [Electronic resource]: http://e-koncept.ru/2015/95577.html. Last accessed 30.04.2020.

7. Jiadong, Liang; Jianqun, Wang; Jingxuan, Chen. A Short-Term Forecast Method for Highway Traffic Conditions Based on CHMM. 17th COTA International Conference of Transportation Professionals, 2018, pp. 633–644. DOI: https://doi.org/10.1061/9780784480915.065.

8. Balalaev, A. S., Korol, R. G., Serenko, A. F. Transportation logistics clusters: shaping and development. Scholarly Notes of KNASTU «Humanities, Social and Cultural Sciences», 2014, Vol. III-2 (19), pp. 90–95. [Electronic resource]: https://www.uzknastu.ru/en/archnum/45-2014/99-ii-119-2014-l-r.html. Last accessed 30.04.2020.

9. Postan, M. Ya., Stolyarov, G. P. Research on sources of efficiency of transport and logistics clusters and ways of their implementation [*Issledovanie istochnikov effektivnosti transportno-logisticheskikh klasterov i putei ikh realizatsii*]. *Eastern European Journal of Advanced Tech*nologies, 2015, Iss. 3 (3), pp. 43–51. [Electronic resource]: http://nbuv.gov.ua/UJRN/Vejpte_2015_3(3)__9. Last accessed 30.04.2020.

10. Scott, S. A., Hughes, M., Kraus, S. Developing relationships in innovation clusters. *Entrepreneurship and Regional Development*, 2019, Vol. 31 (1–2), pp. 22–45. DOI: 10.1080/08985626.2018.1537145.

11. Groznik, A., Kovačič, A., Zoric, B., Vicic, D. E-logistics: Informatization of Slovenian transport logistics cluster. 26th International Conference on Information Technology Interfaces, 2004. DOI: 10.1109/ITI.2004.242952.

12. Intelligent transport systems. Official website of the group of companies LLC A+S Transproject. [Electronic resource]: http://apluss.ru/activities/its_konsalting. Last accessed 30.04.2020.

13. Strauss, O. When the car and the road get wiser [*Kogda avto i doroga poumneyut*]. *Economy of the North-West*, No. 266 (7729). [Electronic resource]: https://rg.ru/2018/11/27/reg-szfo/uchenye-nashli-sposob-izbavit-peterburg-ot-probok.html. Last accessed 30.04.2020.

14. Zhankaziev, S. V. Development of projects of intelligent transport systems: Study guide [*Razrabotka proektov intellektualnykh transportnykh system: Ucheb. posobie*]. Moscow, MADI publ., 2016, 104 p.

15. Lebedeva, A. S., Rogavichene, L. I. The Innovative Development of the Transport Services Market: A Cluster Approach. *Studies on Russian Economic Development*, 2018, Vol. 29, No. 4, pp. 399–405. [Electronic resource]: https://ideas.repec.org/a/spr/sorede/v29y2018i4d10.1134_s1075700718040123.html#download. Last accessed 30.04.2020. DOI: 10.1134/S1075700718040123.

16. Forecast of long-term socio-economic development of the Russian Federation for the period up to 2030 [*Prognoz dolgosrochnogo sotsialno-ekonomicheskogo razvitiya RF na period do 2030*]. Ministry of Economic Development of the Russian Federation, Moscow, March 2013. [Electronic resource]: http://static.government.ru/media/files/41d457592e04b76338b7.pdf. Last accessed 30.04.2020.

17. Akhtarieva, L. G. Cluster mechanism for increasing the competitiveness of the region [*Klasterniy mekhanizm povysheniya konkurentosposobnosti regiona*]. *Ekonomika i upravlenie*, 2009, Iss. 34 (127), pp. 54–61. [Electronic resource]: https://cyberleninka.ru/article/n/klasternyy-mehanizm-povysheniya-konkurentosposobnosti-regiona/pdf. Last accessed 30.04.2020.

18. Fedotenkov, D. G., Padalko, A. A. Transport and logistics clusters as a challenge of time in the socio-economic development of the region [*Transportno-logisticheskie klastery kak vyzov vremeni v sotsialno-ekonomicheskom razvitii regiona*]. *Problems and prospects of economics and management: Proceedings of III international scientific conference*. St. Petersburg, 2014, pp. 270–273. [Electronic resource]: https://moluch.ru/conf/econ/archive/131/6894/. Last accessed 02.05.2020.

19. Pilipenko, I. V. Implementation of cluster policy in Russia. Appendix 6 to the Annual Economic Report of the All-Russian Public Organisation «Business Russia» «Strategy 2020»: from the economy of «directives» to the economy of «incentives» [*Provedenie klasternoi politiki v Rossii. Prilozhenie 6 k ezhegodnomu ekonomicheskomu dokladu Obshcherossiiskoi obshchestvennoi organizatsii «Delovaya Rossiya» «Strategiya 2020»: ot ekonomiki «direktiv» v ekonomike «stimulov»*]. *Delovaya Rossiya,* Moscow, 2008, pp. 1–34. [Electronic resource]: http://www.biblio-globus.ru/docs/Annex_6.pdf. Last accessed 02.05.2020.

20. Enright, M. J. Survey on the Characterization of Regional Clusters: Initial Results. Working Paper, Institute of Economic Policy and Business Strategy: Competitions Program, University of Hong Kong, 2000, 25 p. [Electronic resource]: https://www.researchgate.net/publication/ 228599616_Survey_on_the_characterization_of_regional_clusters_initial_results. Last accessed 02.05.2020.