

# Cluster Approach in Rural Settlement Development

E V Shcherbina<sup>1</sup>, E V Gorbenkova<sup>2</sup>

<sup>1</sup>Urban Planning Department, Moscow State University of Civil Engineering, 26, Yaroslavskoye Shosse, Moscow 129337, Russia

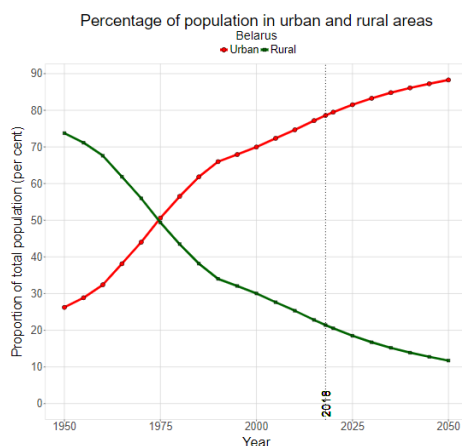
<sup>2</sup>Highways Department, Belarusian-Russian University, Mogilev 212000, Belarus

E-mail: gorbenkova@yandex.ru

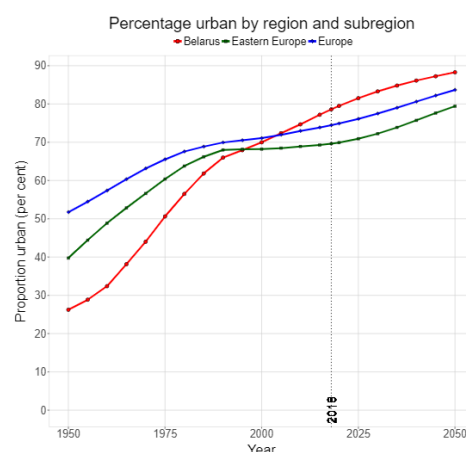
**Abstract.** The paper contains research results in modelling rural settlement cluster. Functional structure of the territorial cluster of rural region includes four resource-target subsystems: Population, Infrastructure, Manufacturing and Environment/Heritage. Main cluster development trends were identified for sustainable rural development: advances in technology; forming the comfortable living environment; housing, social, engineering and transport infrastructure and travelling support structure. The model of rural region territorial cluster is useful in making guidelines for land-use planning for sustainable development of rural settlement system.

## 1. Introduction

Today, about a half of the world population lives in cities. It is expected that mass urbanization will continue over the next 50 years (figure 1). The problem of migration from rural areas is relevant not only for post-Soviet areas, but also for numerous European countries, as shown in figure 2.



**Figure 1.** Urban and rural population in Belarus as a percentage of the total population, 1950 to 2050 (2018 United Nations. DESA.)



**Figure 2.** Proportion of urban population in the current country as compared to its sub region and region. The proportion is expressed as a percentage of the total population, 1950 to 2050.

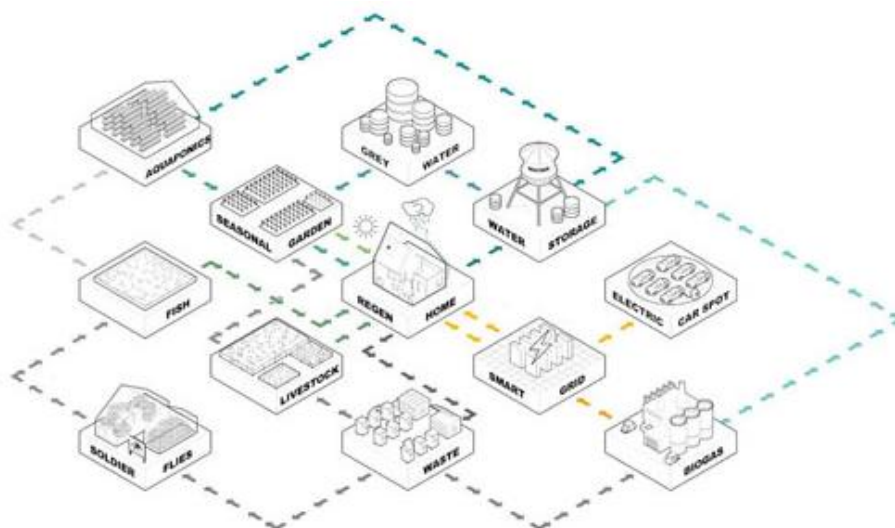


In our opinion, the main reason is the limited sectoral approach to the rural areas development. All these ultimately led to the irrational placing of manufacturing facilities, underdeveloped infrastructure and a number of other problems. The rural settlements revival, as an alternative to mass urbanization, provides opportunities for rural/peri-urban development. Thus, rural settlements become attractive economically, environmentally and socially. As a result, the rural population outflow is reduced and the urban population is attracted. Therefore, the research on the rural development conceptualization is particularly relevant.

## 2. Materials and methods

The cluster approach is considered to be one of the effective tools for ensuring the sustainable innovative development in the world practices of land-use planning. According to M. Porter, the concept author, «a business cluster is a geographic concentration of interconnected businesses, suppliers, and associated institutions in a particular field» [1]. The main cluster features are agglomeration of industries and infrastructure, common connections and export orientation.

The survey of world experience shown, that the cluster approach is used in various fields. It should be noted that insufficient attention has been paid to clusters in rural areas until recently. The importance of studying clusters as tools for sustainable innovative development of rural areas is shown in studies on the development of recommendations for rural settlement cluster zoning [2], modeling rural areas clusters [3], the development problems of neo-rural settlements in the context of counter-urbanization [4]. In addition, recent European studies show the need of creating the hyperlocal and independent settlements, while the «RegenVillages» initiative is a reference model [5]. The basis of RegenVillage conceptual model are 6 key propriety areas: energy-positive, component homes from the built environment research; readily available and regionally appropriate renewable energy sources; high-yield organic food production via aquaponics systems; water management and waste-to-resource system development; incorporating Stanford and local university curriculum; socio-economic community enterprises fostered through incubation (Figure 3).



**Figure 3.** RegenVillage conceptual model [Ошибка! Источник ссылки не найден.].

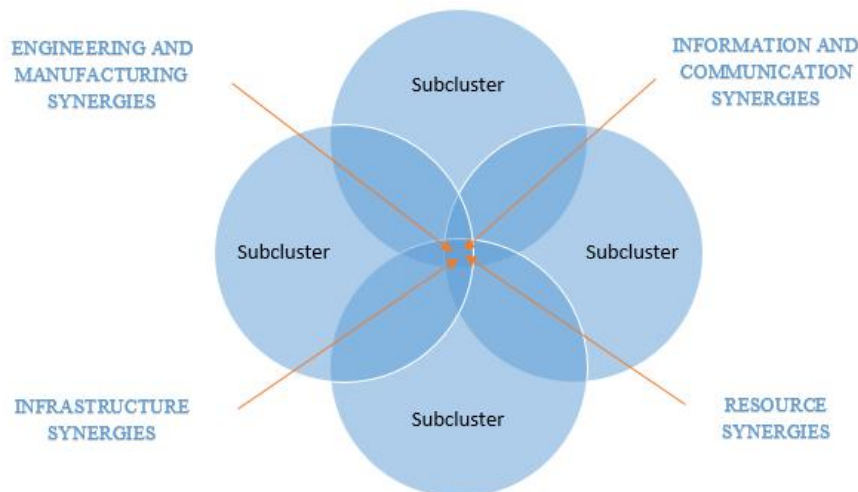
The most of modern domestic research present clusters as economic models. Multi-criteria models are the framework of studies on land use planning [7-9]. Meanwhile, innovative methods of areas sustainable development are provided by creating various types of territorial/regional clusters: manufacturing and educational, scientific and innovative, agro-industrial, etc. For example, the research of E. V. Shcherbina and K. D. Tretyakova identified the model of territorial cluster for urban identity. The resulting model is necessary for an integrated assessment and orientation of long-term

city development [10]. The research [11] examines urban aspects of tourism and recreation cluster development.

It is quite evident that insufficient attention is paid to the clusters modeling for rural areas. The development need for creating the fundamental model of rural settlement territorial cluster defines at the state level in some countries. For example, in Belarus, the concept of «The future village» is based on an integrated approach for ensuring all the components of sustainable development: social, environmental and economic. The effective use of resources, which were created within the implementation of the state programs for the village revival and development, is expected. The concept provides a new level of social standards in rural areas within the development of all rural settlements, not just future-oriented ones, such as agro-towns. At the same time the social and economic importance for ensuring the sustainable agro-industrial sector development are considered. It should be pointed out that the interest in creating a basic cluster model for rural areas conditioned by the need of solving the typical for various regions and countries problems, such as depopulation, unemployment rising, limited access to basic services/infrastructure, etc.

### 3. Results

The most significant effects of creating clusters are engineering and manufacturing synergies, information and communication synergies, infrastructure synergies and resource synergies as shown in figure 4.



**Figure 4.** The synergy effect of cluster.

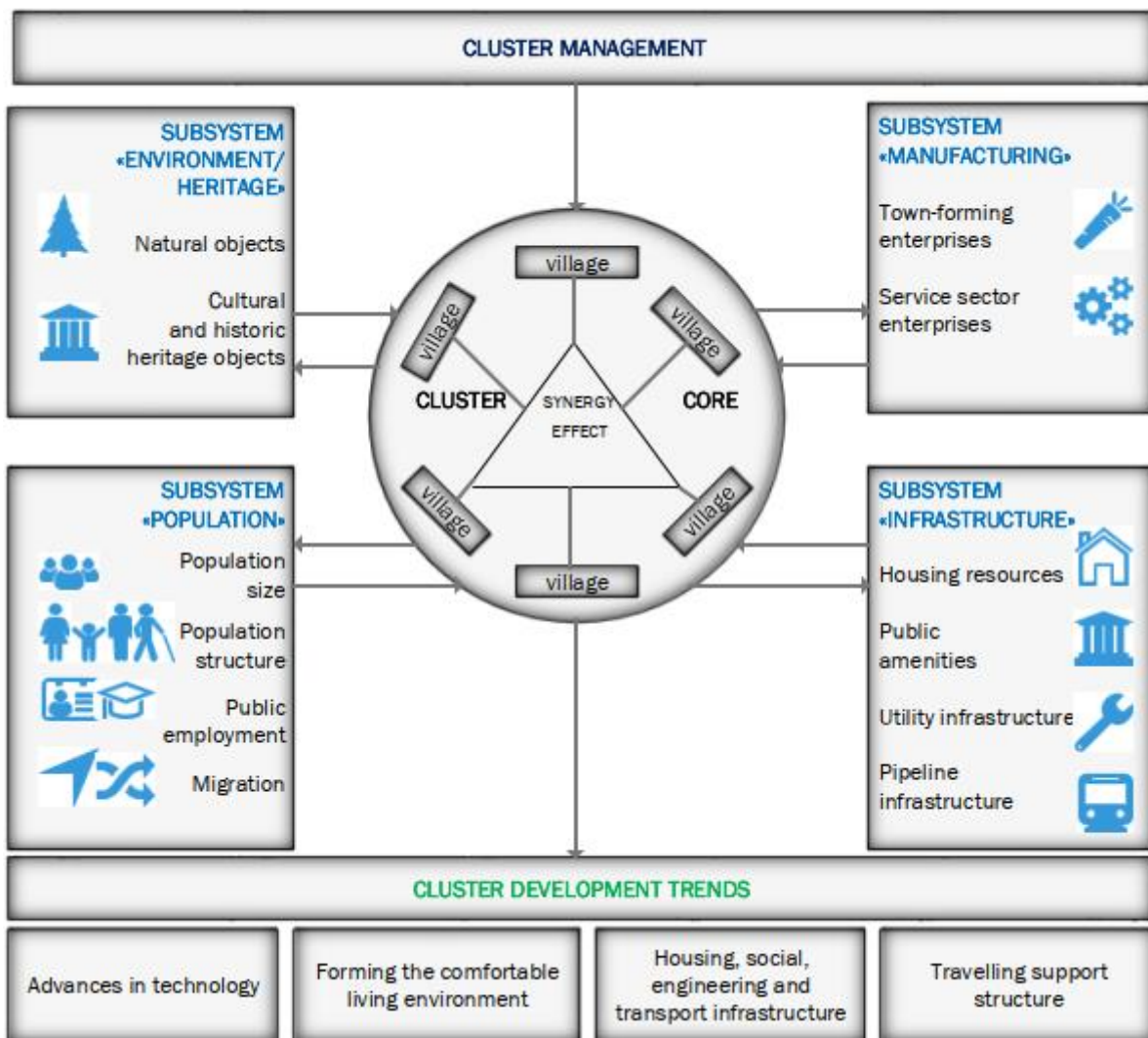
In land use planning, a cluster is a territorial entity within a metropolis, which is an autonomous unit, which provides a full set of urban functions for residents, such as housing, administrative and business, trading-entertaining, recreational etc.

The system approach defines a territorial cluster as a large developing system of various interacting subsystems, which are interrelated, interdependent, and complementary and united by territorial integrity. Therefore, when designing the most comfortable living environment, it is necessary to take into account numerous different requirements and factors (environmental, social, architectural, economic, etc.) [12-18].

Besides, according to authors' earlier researches [19-22], sustainable development of rural settlement provides the improvement of economic, environmental and social spheres, engineering and transport infrastructure. Akgun et. al. implemented Pentagon approach for sustainable rural development [23-25]. Forleo et al. highlighted such significant drivers for rural settlements development as demographic, economic, natural, socio-cultural and agriculture, livestock and tourism [26].

On the other hand the territorial cluster of rural region provides for the formation of a rural settlements system. At the same time, one of the cluster settlements is a multifunctional center.

Taking all these points together, we identified 4 resource-target subsystems within the territorial cluster of rural region (Fig. 3). The subsystem «Population» is one of the leading subsystems that determines parameters and organization of another subsystems. The subsystem «Infrastructure» includes such components as housing, social, engineering and transport. The subsystem «Manufacturing» includes city-forming and city-servicing enterprises. Subsystem «Environment/Heritage» is the basis that forms the identity of rural region structure, defines the city-forming potential and is necessary in forming the spatial planning structure of rural region.



**Figure 5.** Functional structure of the territorial cluster of rural region.

#### 4. Conclusions

Consequently the model of rural region territorial cluster is useful in making guidelines for land-use planning for sustainable development of rural settlement system. Directions for future research are in making recommendations for integrated rural development, taking into account local resources and characteristics.

## References

- [1] Porter Michael E, Christian H M Ketels, Kaia Miller and Richard T Bryden 2004 Competitiveness in rural US regions: Learning and research agenda Institute for Strategy and Competitiveness Harvard Business School [http://www.eda.gov/PDF/EDA\\_Rural\\_Regions\\_Final.pdf](http://www.eda.gov/PDF/EDA_Rural_Regions_Final.pdf)
- [2] Pivo, Gary, Robert Small and Charles R Wolfe 1990 Rural Cluster Zoning: Survey and Guidelines *Land Use Law and Zoning Digest* vol 42 10.1080/00947598.1990.10395727
- [3] Zheliazkov, Georgi, Darina Zaimova, Evgeni Genchev and Krasimira Toneva 2015 Cluster development in rural areas *Economics of agriculture* vol 1 73-94 10.5937/ekoPolj1501073Z
- [4] [https://fenix.tecnico.ulisboa.pt/downloadFile/395146462980/ExtAbstract\\_DSL48455.pdf](https://fenix.tecnico.ulisboa.pt/downloadFile/395146462980/ExtAbstract_DSL48455.pdf)
- [5] [https://sustainabledevelopment.un.org/content/documents/622766\\_Ehrlich\\_Integrated%20village%20designs%20for%20thriving%20regenerative%20communities.pdf](https://sustainabledevelopment.un.org/content/documents/622766_Ehrlich_Integrated%20village%20designs%20for%20thriving%20regenerative%20communities.pdf)
- [6] [https://iut.univ-amu.fr/sites/iut.univ-amu.fr/files/marine\\_robert\\_-sonia\\_zarzah\\_2017.pdf](https://iut.univ-amu.fr/sites/iut.univ-amu.fr/files/marine_robert_-sonia_zarzah_2017.pdf)
- [7] Danilina N and Vlasov D 2017 Development of «Park-and-Ride» system as a tool for sustainable access control managing *IOP Conf. Ser.: Earth Environ. Sci.* vol 90 p 012214 DOI: <https://doi.org/10.1088/1755-1315/90/1/012214>
- [8] Gorbenkova E V and Shcherbina E V 2017 Methodological Approaches for Modeling the Rural Settlement Development *Vestnik MGSU Proceedings of Moscow State University of Civil Engineering* vol 12 issue 10 (109) pp 1107–1114 DOI: 10.22227/1997-0935.2017.10.1107-1114
- [9] Petković-Groždanović N, Stoiljković B and Shubenkov M 2016 Location Criteria Relevant for Sustainability of Social Housing Model *MATEC Web of Conferences* vol 73 P 06001 DOI: 10.1051/mateconf/20167306001
- [10] Tret'jakova K D and Shcherbina E V 2018 Model territorial'nogo klastera gorodskoj identichnosti istoricheskogo goroda Velikij Novgorod V *sbornike: Ustojchivoe razvitie territorij sbornik dokladov mezhdunarodnoj nauchno-prakticheskoy konferencii* pp 231-235
- [11] Shcherbina E V and Egorova S P 2019 Town-planning aspects of development of tourism industry *Bulletin of BSTU named after V.G. Shukhov* **4** pp 88–93 DOI: 10.34031/article\_5cb1e65ee16de2.46800338
- [12] Telichenko V I and Shcherbina E V 2019 Social-natural-technogenic system of sustainable environment of vital activity *Industrial and Civil Engineering* vol 6 pp 5-12 DOI: 10.33622/0869-7019.2019.06.5-12
- [13] Shubenkov M V and Khomyakov D A 2016 Space of the regional agglomerations and re-industrialization *Journal of Applied Engineering Science* vol 14 **1** pp 154-162 doi:10.5937/jaes14-10217
- [14] Shcherbina E, Gorbenkova E and Slepnev M 2017 Urban-planning sustainability problems in a city natural framework *MATEC Web Conf.* vol 106 p 01032 DOI: <https://doi.org/10.1051/mateconf/201710601032>
- [15] Gorbenkova E, Shcherbina E and Belal A 2018 *IFAC PapersOnLine* 51-30 786–790 <https://doi.org/10.1016/j.ifacol.2018.11.195>
- [16] Shcherbina E and Gorbenkova E 2018 Smart City Technologies for Sustainable Rural Development *IOP Conf. Ser.: Mater. Sci. Eng.* 365 022039 DOI:10.1088/1757-899X/365/2/022039
- [17] Shcherbina E V, Marshalkovich A S and Zotova E A 2018 Sustainable development of rural settlements: the importance of environmental factors *Ecology of urban areas* vol 2 pp 78-83 DOI: 10.24411/1816-1863-2018-12078
- [18] Shcherbina E V and Belal A A 2019 The value of historical and cultural heritage in the reconstruction and restoration of cities *Proceedings of Moscow State University of Civil Engineering* vol 14 issue 4 pp 418-427 DOI: 10.22227/1997-0935.2019.4.418-427
- [19] Gorbenkova E V 2019 Factors shaping the development of rural settlement *Vestnik MGSU Proceedings of Moscow State University of Civil Engineering* 14:7:805-818 DOI: 10.22227/1997-0935.2019.7.805-818

- [20] Shcherbina E V and Gorbenkova E V 2018 Modelling the Rural Settlement Development *Materials Science Forum* 931 877-882 <https://doi.org/10.4028/www.scientific.net/MSF.931.877>
- [21] Davidenko P, Menshikova E and Gorbenkova E 2018 «Smart settlements»: the development concept in a new socio-economic and informatiologic conditions *IOP Conf. Ser.: Mater. Sci. Eng.* vol 365 p 022050 doi:10.1088/1757-899X/365/2/022050
- [22] Davidenko P N and Gorbenkova E V 2018 Modeling the rural-urban settlement system in Russia *The Eurasian Scientific Journal* vol 5(10) <https://esj.today/PDF/52SAVN518.pdf> (Russian)
- [23] Akgun A A, Baycan Levent T and Nijkamp P 2011 Repositioning rural areas as promising future hot spots *Research Memorandum* 2011-13 FEWEB VU University (Amsterdam)
- [24] Akgun A A, van Leeuwen E S and Nijkamp P 2011 A systemic perspective on multi-stakeholder sustainable development strategies *Research Memorandum* 2011-9 FEWEB VU University (Amsterdam)
- [25] Akgun A A, Baycan Levent T and Nijkamp P 2011 Creative capacity for sustainable development: A comparative analysis of European and Turkish rural regions *Research Memorandum* 2011-20 FEWEB VU University (Amsterdam)
- [26] Forleo M B et al 2017 Socio-Economic Drivers, Land Cover Changes and the Dynamics of Rural Settlements: Mt. Matese Area (Italy) *European Countryside* **9(3)** 435-457 DOI 10.1515/euco-2017-0026 <https://doaj.org/article/fcf600d1a6bb4afbae2bfef237d6a898/>