CLUSTER AS A DRIVER OF STABLE HISTORICAL SETTLEMENTS FORMATION

Natalia G. Blagovidova
Moscow Architectural Institute (State Academy)

Abstract: The existing doctrine of ecological balance does not offer tools to work with existing historical territories, while the aspect of cultural ecology is principal for providing ethical stability of national and local communities. The article considers an eco-sustainable approach to the design and revitalization of urbanized habitat. The hypothesis of the urban structures' balanced development is formulated based on the analysis of ecovillages and ecotowns in European and worldwide practice. The authors make up a typological classification of sustainable settlements, which are compared with small historical towns by system features. The key task is to substantiate the propensity of small urban formations towards flexible comprehensive development. The work proposes the method of compositive cluster formation to combine the ideas of sustainability, urban integrity and economic efficiency.

Keywords: cluster method, sustainability, ecovillage, revitalization, small historical cities

INTRODUCTION

Cities as urban ecosystems have largely exhausted their potential by providing physically and psychologically unhealthy living conditions. At the turn of the XXI century, the number and scale of environmental failures revealed the inability of the cities to adaptation and self-recovery. Now, the solution of environmental problems determines the future of civilization, and thus there is an acute issue of designing a sustainable habitat, which is usually referred to the doctrine of "stability". The doctrine was put forward in 1992 in the report "Our common future".

The concept of sustainable development is viewed as a controlled process of imposing restrictions on the further progressive development of civilization. The paradigm is constantly updated and supplemented, but still does not cover all the problems; it deals with waste, energy, water, and social justice issues only. Besides the regulation of large metropolises, the concept does not affect the existing small urban formations and historical settlements. Over the past 30 years, the scientific community has formulated theories and made experimental projects of ecotowns, ecovillages and ecopolices, which served as a basis for further research. Meanwhile, in Russia there is a tendency of perishing of small urban settlements, with their existing structure and way of life; the similar processes are observed in Japan and in some developing countries. The change in the economic paradigm makes the implementation of the historical function of settlements in modern conditions impossible: small towns face the problems of comprehensive development in the background of existing historical and cultural complexes. In turn, these complexes are excluded from the active development of the urban environment. It is clear the issue of complex transformation of urban landscapes together with the aspect cultural ecology, comes to the fore.

Academician D. S. Likhachev drew the attention of the scientific community to the key role of cultural factors in the sustainability of national and small social groups simultaneously with the concept of balanced development. It is impossible to limit the

environmental sciences to nature only: the death of the natural ecosystem increases the critical changes in the human body, but the destruction of the historical and cultural environment depreciated the spiritual component of the individual, the group and the nation. That is why a new formation should have a historical basis, vectors and trends in the retrospective characteristics of the environment for its further stability.

The problem of developing comprehensive methods for transforming urban settlements, especially the existing oppressed and depressed urban environment, is of critical importance. The conditions for the formation of a new technological mode seriously challenges the viability of the anthropogenic environment, and above all, its historical and traditional component. It requires versatility and flexibility from any formation. The modern structural method - cluster - meets all these parameters. Being a structure of high organization, density and autonomy, it can affect various aspects of urban environment: legislative and regulatory, economic and political, social and initiative, and architecture and planning aspects. It allows the authors to call it a driver of program transformation of urban settlements.

The aim of research is to develop a cluster approach to the formation of sustainable urbanized historical settlements. **The research tasks are the following:**

1. To classify modern types of eco-sustainable settlements
2. To consider small historic settlements as compact formations tending to stability;
3. To identify the role of communities in the formation of settlements;
4. To study foreign examples of creating clusters in the historical cities;
5. To form the concept of historical settlements development using the cluster method.

The scientific hypothesis of this work is the similarity in the structures of eco-sustainable settlements and research and production (creative) cluster. The authors offer the opportunity of efficient use of the cluster model to activate historical and cultural resource of small urbanized education. **Scientific novelty:** The cluster method as a direction of development, preservation and restoration of small historical settlements is studied for the first time. **Results:** The paper develops the principles of the cluster method in the preservation, restoration and development of small historical cities.

The theoretical basis was formed by a number of scientific works. The cities specialization and their development in modern conditions is studied in the works by Lyubovny V. Ya., Shevchenko E. A., Animitsa E. G., Vlasova N. Yu., Shubenkov M. V., Tsarev D. L., Lobodanova, Babun R., and Polyak G. B. The international experience is presented in the works by J. R. Bradfield, M. Ruano, interview with M. Appenceller, K. Paulson, and K. Kristianse. Blagovidova N. G., Bol'shakov A. G., Kurbatov J. A., Likhachev D. S., Mikulina E. M., Mullin K., Kendall G., Nawaz Rizwan N., and D. Water R. deal with environmental aspects of the problem. Aspects of cluster formations are studied by Bakumenko O. A., Alexandrova A. Yu., Girovki N. N., and Malyukh V. The works by Autukhovich O. V., Amirkhanov, L. S., Bezgodov A. V., Knor V. E., Levoshko S. S., Matveev, B. M., Monastyrskaya M. E., Tolstova A. A., Travina E. M., Tsvetkov, V. Yu., as well as archives and statistics, cover historical and modern development of the tested city and the clusterization trends of Kurortny District of St. Petersburg. One of the modern trends is frequent reference to sociological research as a method of pre-project analysis. For Example, Budlakova N. V., Kochetkov A. V., various design and development teams study urban and local communities.

ANALYSIC OF FOREIGN PRACTICES IN CREATING SUSTAINABLE SETTLEMENTS

Ecopolis continues the theories of ideal cities, representing a concept of a balanced system of interaction between biological and anthropogenic environment. In other words, it is minimization of the negative impact of human activity on ecosystems by using compensating engineering and technological systems. N. F. Reymers studied eco-sustainable urban formations. He also formulated three principles of an ecopolis[1].

The first thing to consider is the proportionality of architectural and planning forms and solutions and a man, for it affects comfortable residence in the urban environment, a sense of security and friendliness. All this forms the opposite "biopositive" attitude. It is obvious that it is about building low and medium-rise buildings, driveways and streets with little traffic[2]. The second principle concerns the structural unity of natural systems, namely the green and blue framework. It means the overall integrity of their structures - the landscape of the city. Urban architectural and planning solutions should not obstruct the natural streams of ventilation, watering, purification, and animal migration, so as not to disturb the existing ecosystem. The third principle is environmental friendliness at all levels of perception – a private house, as well as the whole city and its district, should have local areas of close communication with nature. On the one hand, it draws attention to the natural environment. On the other hand, the greening of roofs, balconies and backyards compensates for the damage caused to the system by construction and buildings in green zones. Do not forget that food farming potentially stimulates the residents' creativity and gives impetus to creating self-sustainable cell at the level of a single-family household.

One of the main organizations supporting environmental initiatives of the Global Ecovillage Network (GEN) defines ecovillage as a spiritual, traditional or urban community created by self-organized local cooperatives based on 4 aspects of "sustainability" (social, cultural, environmental and economic) in order to create, restore and develop social and natural habitats[3]. Therefore, it can be said that depending on the goals pursued by a particular eco- formation, they can be divided into: 1. eco-construction in free green areas; 2. eco-restoration of disturbed urban areas; 3. eco-provision of profile function. The following are the most striking examples of each category.

TYPE 1. ECOLOGICAL CONSTRUCTION IN FREE GREEN AREAS

The first ecovillages appeared in Northern Europe and America that experienced rapid and destructive urbanization and almost destroyed their natural landscape. They were a demonstration project of a fundamentally new approach to living environment that was more like villages than the former urban settlements. Ecovillages were based on Reymers' principles together with the latest technologies of energy, recycling and energy saving. They were established in undeveloped areas as separate entities or new districts of existing cities, outlining the drivers of the development of the entire urban settlement. Often, the creation of ecovillages was the initiative of local activists. The role of local communities is great in compact formations and would be studied separately. The following are the examples of autonomous ecopolices.

Ecolonia, Netherlands

That is the challenging project developed by experts from the Dutch Agency for Energy and Environment NOVEM. The main objective was the overall quality of the urban structure, taking into account the echnical issues. Social, urban, architectural, communal

[1] 1. - p. 218.
[2] 2. - c. 62.
[3] 3. - p. 1.

and psychological aspects of ecology are integrated in this place. Technical and economic risks are minimized through the use of reproducible solutions that correspond to the level of technology. The developed area holds 300 residential units, in which residents seek to implement the idea of optimal diversity: there are different types of houses[4]. The site plan provides for careful mixing of buildings in such a manner that companies are forced to work closely together and make joint decisions. Functionally, each company had to focus on a specific environmental field: energy, recycling ot thermal efficiency. The development plan of Ecolonia promotes the dialog between personal and public space: organic design offers a diverse opportunity for individual expression and group activities. The components of the environment became a joint language code for the urban planners of the nine architectural companies invited to implement the project. The initiators of the Ecolonia project contributed to the maximum cooperation of all participants, which ended up in the formation of a visually diverse architectural and urban environment, at the same time subordinated to the declared environmental principles.

Vikki, Finland

The place 8 km from the centre of Helsinki was built as a residential part of a science park near Helsinki University of Technology, laboratories and research parks, city libraries, public buildings, and commercial enterprises. The area deals with the energy efficiency; it was one of the nine pilot projects of the European community Thermie program focused on green building[5]. The concept of construction is based not only on discovering the possibilities of energy-saving technologies, but also on their interaction with social aspects: according to the creators of the project, urban planning and architecture should be based on both material and spiritual needs. The land plot sized 1 132 ha was partly given for 14 residential blocks different in their originality. Most of the houses are low-rise cottages, some are completely wooden in the best traditions of Helsinki suburbs. Each owner is provided with a plot of land sized 50-100 m^2 for his own garden, which allows feeling the natural connection with nature. One of the requirements was the feasibility and economic efficiency, because the cost of construction with all innovative energy-saving technologies should not increase on more than 5%. The design took into account local climatic features. The location, orientation, and appearance of the buildings were to ensure maximum use of natural solar radiation and lighting, increase comfort and reduce the energy load on the supply of buildings.

Regen villages, Almere, Netherlands

One of the innovative developers that combined "life in nature" and regenerative construction[6] was the development company - the owner of ReGenVillages project. It is a system of ecovillages similar to Ecolonia in the Dutch city of Almere, based on the principle of a closed cycle of resource use, autonomy of maintenance and information field. The emerging threat of isolation of the local population from the general technological progress is solved by the designers by creating their own virtual cloud for the village, through which the coordination of activities and communication within the settlement is carried out. In particular, energy consumption and production, the state of agriculture and the rural community are monitored through the common network. The data is also collected for further use of similar villages and geographical areas as a combination of their shared experiences and subsequent mutual learning.

[4] 4. – p. 128.
[5] 5. - c. 1.
[6] 6. - p. 20.

The settlement is based on a holistic approach involving a regenerative system: modern technologies, "active" houses and organic food production. A plot sized 20 ha is designed to accommodate 100 families. Residential houses are designed with local greenhouses that use heated and exhaust air. Thus, not only the costs of winter heating of the house reduce, but also the year-round cultivation of fruits and vegetables is provided[7]. The complexes of houses are connected by centers; there are public greenhouses with vertical farms, charging stations for electric vehicles and parking, ponds and recreational areas for residents in the free central part. ReGen actively uses modern technologies. The applied hydroponic cultivation of plants and animals allows minimizing the costs of a soil resource and provides compactness of the settlement. Waste is being processed into biogas and compost for consumption by insects, which serve as food for livestock and fish. The houses collect rain water for irrigation of farms, and solar panels with passive heating for electricity production, the residents sort the waste.

Poundbury, Dorchester, United Kingdom

The Dorchester expansion plan, developed by Leon Krier, contained some of the most innovative principles of the city's formation. The main principle of the program is neighborhoods, each of which is the key to the formation of the district that is autonomous in education, jobs, infrastructure, and leisure opportunities. [8] Midley farm is an experimental project of the urban environment of the future with several centers, pedestrian areas and reduced motorization. The limited traffic load is implemented by creating a winding structure of the transport network, which simultaneously contributes to the emergence of an individual nature of the area. The connectivity of the new area of the traditional type is supposed to be provided by new telecommunications, which create a kind of a tele-village.

Kirchsteigfeld, Potsdam-Drewitz, Germany

Built on 60 ha of new territory, the Kirchsteigfeld district is 3.5 km from Potsdam and has a rail link with it. Its site plan is based on the European tradition of urban planning, which at the beginning of the XX century was discredited by new thinking. It resulted in the loss of urban space, where the urban environment was viewed as an integral organism. Kirchsteigfeld consists of different areas surrounded by a green buffer zone. The focus on collective living space has been recognized as the starting point of planning[9]. Each block has its own courtyard. The buildings of different designers are literally "mixed" on the General plan, which creates a sense of live and diverse environment.

TYPE 2. ECOLOGICAL RESTORATION

Despite the positive practice of creating ecopolices, one should note the inconsistency of the stated doctrines and practices. First of all, the fact that seeking to save environmental resources, eco-town is built on a new location, reducing the most scarce land potential and transforming the original natural balanced system[10] permanently. The considered projects demonstrate a debatable form of "weak" sustainability. However, the modern practical urban planning confirms that they should not talk about free territories, but about the restoration of the existing ones: the ones that are polluted, oppressed and structurally disconnected.

[7] 7. - p. 1.
[8] 4. - p. 141.
[9] Ib. - p. 123.
[10] 8. - p. 2.

Former military garrison, Rome, Italy

A pilot project of restoring the 90 ha on the outskirts of Rome, which in the past, as a garrison alternately experienced times of consolidation and surrender[11]. Measures of the city preservation taken in the XIX century helped the area to recreate its structure and identity; now, the crisis of agriculture and the expansion of the city threaten its morphological and structural integrity. The project aims to connect the architecture of urban elements and agriculture and its historically formed and environmentally defined landscape with a new composition. It also actualizes the principle of bioclimatic, ecological and organic planning, which have been applied on the land between the river and the sea. The design of new technologies was carried out with due regard to the existing elements while maintaining the continuity of the typological development process: every city is a living organism based on the principles of history and self-regulation. For this purpose, the main points of the project were proposed: an updated approach to smart technologies, reliance on historical decisions, restoration of balance between natural and anthropogenic ecosystems, planning on complex paradigms.

Riesefeld, Freiburg, Germany

The project is building 80 hectares of land within an ecologically protected conservation area in the Rhein valley. The task is to reconstruct the estuary through a network of lakes, ponds, channels, and waterfalls. The system collects, preserves and filters rainwater and wastewater from the new built area and the surrounding city, thereby restoring the original ecological balance. The layout of the project follows the existing pattern of pits and lowlands[12]. The area becomes multifunctional, facing the water, and oriented to the pedestrian paths. The hidden potential of each public place is revealed by an individual artistic decision. Urban life takes on a quiet pace by mixing slow car, bicycle and pedestrian traffic, allowing residents to find time for social interaction. Small green areas are found in neighborhoods and near homes, forming places for recreation, socializing and neighborhood activities.

Hammarby, Stockholm, Sweden

Eco-district of Stockholm, Hammarby Sjöstaden is an example of restoration of natural biological systems in place of the former zone of small and large industrial enterprises for the production of tobacco, weaving mills and oil terminals. The area has undergone a complete and long-term remediation and decontamination of soil, which required a near-complete changing of the soil. The restored area has retained only a small share of office and industrial premises: a large share of development consists of residential areas now. All this is based on the doctrine of environmental sustainability. The waist sorting here is very careful, up to the automatic delivery to the stations of waste management. 99% of all waste is processed into energy (including biogas – eco-friendly fuel) or organic substances, such as fertilizers. Biogas is used for cooking stoves in apartments and 75% of public transport in the district[13]. Water conservation, reuse of effluents and treatment and return to the ecosystem are also rationally arranged. Rainfall, drainage, industrial sewerage and domestic waste is strictly separated and go through different cycles of purification; industrial waste water never returns to the river channel without pre-treatment. Houses and offices are equipped with solar collectors for water heating, which compensates for part of the energy consumption for heating the building.

[11] 4. - p. 174.
[12] 4. - p. 114.
[13] 9. - p. 21.

As for the appearance, in order to create a favorable environment, the buildings are no higher than 4-7 floors and have a diverse design, combining traditional and innovative techniques. Orientation and glazing area make maximum use of natural resources of insolation and illumination. The district is richly landscaped: lost forest areas have been restored, parks are getting closer to undisturbed landscapes, mowing of lawns and bushes is excluded, so new green Islands attract birds and insects, recreating biocenoses. Much attention is drawn to public spaces that contribute to the formation of local communities. The overall coordination of the district's life takes place in the information center, which is also used as a multifunctional leisure and eco-educational center for tourists and local residents.

BedZED, Hackbridge, Great Britain

BedZED (Beddington Zero Energy Development) is an energy-efficient complex located 15 km from London, in the suburb of Hackbridge, Sutton County, the former industrial zone. The adaptation of this area for a residential complex also required the reclamation of the territory, and its further preservation is in the hands of the local community. The local government of the complex chooses residents, tenants and service companies that agree with the principles of sustainable development: besides 100 townhouses, there are 1500 m^2 of office space, which are rented to companies working in architecture and construction, medical center, kindergarten, shops, organic cafes, and clubs[14]. There are lakes and river Wandley nearby.

Car traffic is completely eliminated here: the locals prefer bicycles, and in the case of long trips the community has signed a contract with the leasing company. Public transport routes are also available, and the train station is 500 meters away. The local infrastructure and jobs is the result of the fact that BedZED residents feel comfortable in their area – they use less personal transport so the environmental load is reducing[15].

Each house is equipped with a range of green technologies that reduce energy and water consumption by half, providing for the reuse of waste water and waste air, aimed at growing food, allowing residents to provide themselves with natural food. The overall planning and architectural solution of the complex, including the glazing of the southern facades, effective insulation and triple glazing evokes respect for the resources of the environment. The community of the district is also undergoing changes in the way of life: an eco-friendly lifestyle, instilled with a shared responsible attitude towards the environment, involves reuse and recycling, abandonment of consumer activity in favor of creative initiatives, energy saving rules and waste sorting.

The project is only one of the "One planet" programs aimed at applying the principles of sustainable settlement in urban planning. The municipality of Hackbridge plans to become the most sustainable municipality in England[16].

TYPE 3. PROFILE ECOVILLAGES

A special place among the ecovillages is occupied by the settlements with the main goal consisting in not just ecological restoration, but the research, scientific and technical development, as well as theoretical and practical projects to create a sustainable environment. Nowadays, sustainability has become not just a trend, but a synonym of vitality and economic efficiency while maintaining a socially healthy and creatively oriented environment. For the first creators of such innovative formations, it became obvious how much the productivity of organizations increases in comfortable

[14] 10. - p. 1.
[15] 11. - p. 1.
[16] 12. - p. 8.

environmental conditions of transport accessibility, infrastructure equipment, versatility, and overall environmental integrity.

Science parks in Great Britain

Cambridge

The founders of the Cambridge science park claim that they are changing the world for the better, combining science and nature and creating a dynamic community of like-minded people. It is a residence of 7500 people and more than 100 companies of different scale and level.17 Eco-sustainable development is one of the basic activities of the science park. This richly landscaped area with predominantly low-rise buildings are to supply the center of Trinity College, Cambridge. The core of the university and the research park create a holistic urban formation, a structured system of specialized theoretical and industrial relations.

Liverpool

Liverpool science park is creating an eco-sustainable space and encourages companies located in the park to do the same.18 Eco-sustainability is realized through technological aspects, features of architectural and urban solutions, and other ways of energy saving. Wild plants and trees are planted to preserve the local flora and fauna, and the natural landscape is protected from uncontrolled waste disposal and irrational use. The research activity positively affects the practice of related enterprises, and the centers of theoretical developments literally coordinate the development of the entire park.

Chester

Not the last factor of scientific activity is environmental initiatives for Chester University, which organizes a program of innovative changes in Cheshire and Warrington under the auspices of the European regional development aund.19 In close cooperation with young scientists and postgraduates, they work on introducing low carbon dioxide emission technologies.

Center for Alternative Technologies, Wales

It is center for environmental inspiration and education[20], as the founders of the center call their project. This is a unique research and experimental demonstration settlement, which includes a laboratory and many full-scale examples of green building solutions. The project aims at educational activities in environmental technologies: there are institutions of additional education and research programs in eco-sustainable architecture and renewable energy sources. Courses are not only for professionals, but also for the public, as well as programs for children and college students. The center has its own publishing house and holds conferences and events on the basis of eco-initiatives and volunteer programs. All educational enterprises are directly adjacent to the living embodiment of technological developments and their use, as well as commercial activities to promote environmentally responsible lifestyle.

Japanese practices

An alternative example, when the creation of an innovative function aims to restore the environment, is presented by the projects of Japanese bureaus. In recent years,

[17] 13. - p. 1.
[18] 14. – p. 1.
[19] 15. - p. 1.
[20] 16. - p. 1.

there has been an outflow of population in Japanese villages and small towns located close to megacities. The legacy of residential architecture of the XVIII-XIX centuries suffers badly. Japanese experts believe that the restoration of the settlement activity is a complex measure and requires new functions and scenarios of the environment. For example, village Takeshimaken (Takeshi prefecture) in the Western part of Tokyo has retained a vast reservoir of traditions, many Shinto and Buddhist temples and parkland. Today it is a typical suburb. Compositionally, the settlement tends to the railway station Oome, from the station square, where the main street starts. The architects identified empty houses for rent that were transformed for a network of breweries with production shops[21]. Additional sales are provided by existing market space. Such projects have state support in order to avoid overpopulation of the central large city.

The small town of Maebashi (Gumma prefecture) includes a lot of empty housing for rent. The key city formation is the technological institute, which requires appropriate infrastructure. The development program covers a number of abandoned houses and creates a complex of apartments for rent for students. The commercial efficiency of the project is ensured by the adaptation of the former warehouse to the needs of the technology company (2013), which was one of the first successful examples in Japan[22]. At the same time, the presence of a large company indicates the similarity of the research and production cluster. In addition, the project involves the organization of the main street of Maebashi as a public trade axis and the connection with it transformed buildings.

The compositional center of the city of Savara (Katori, Chiba) is the intersection of the waterway and the main street of Katori. The transformation of houses follows a program of continuous activity to create spaces of entertainment, culture and infrastructure, and to maintain the 24-7 interest of tourists and, accordingly, the overall safety of the environment[23]. Thus, one can see a variety of approaches to the sustainable development of urban settlements, involving both creating new entities and restoring the existing territories. The authors had studied more than 100 European, American and Asian ecovillages that formed a basis for the proposed classification, which mentioned only the striking examples. Nevertheless, Russian practice describes a special type of entities tending to sustainability. The work pattern with them is still unclear.

Ecovillages Russia. Small historical cities

Europe has lost its original natural landscape component and retains a huge density of development and population; for European countries, the aspirations of returning to the natural environment are very important. 90% of Russian territory is little transformed natural environment and small landscape settlements24; the country needs to preserve the existing potential and ecological connectivity of historical urban settlements. The methods of work with the urban environment for its eco-sustainable development demonstrated by the Western European practice do not fully correspond to the problems of Russia. For small settlements, the practice of incorporating green technologies is irrelevant; subsistence farming stays their principal living source. Therefore, these small towns are already a kind of eco-friendly settlements. Small towns as urbanized formations tending to sustainability can also be divided into three key types.

- **Handicraft and production**

Russia has a special type of cities. In the XVIII century, the inefficiency of the agrarian orientation of settlements in the zone of risky agriculture of Central and

[21] 17. - p. 132.
[22] 18. - p. 17.
[23] 19. - p. 53.
[24] 20. - p. 3.

Northern Russia stimulated the creation of manufactories of hired workers from the surrounding villages. They became the center of trade and exchange, including cultural communication (Fig. 1) (textile manufactories in Ozerki and Ivanovo, metal-working manufactories in Pavlovo).

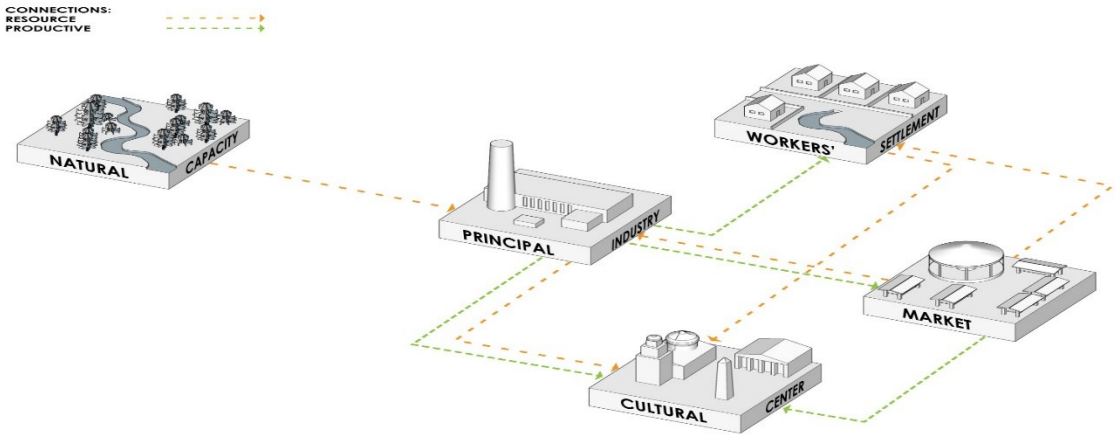

Fig.1 Model of handicraft small town

- **Cultural and tourist**

New types of cultural and tourist and recreational clusters began to appear in the middle of the XIX century. With the construction of the railway from St. Petersburg to Tsarskoe Selo and then to Pavlovsk, there appeared an issue of the efficiency of the throughway. The railway was the emperor's entertainment, and became popular only after the construction of the railway station (Voks sall (Germ.) - concert hall). The railway station was an amusement center for social gatherings and leisure of the local population (Fig. 2). At the same time, the throughway gave rise to the resort of Sestroretsk, the former industrial city, and other settlements of the northern coast of the Gulf of Finland. Their recreational natural potential formed a network of popular recreational, cultural and entertainment monotowns25.

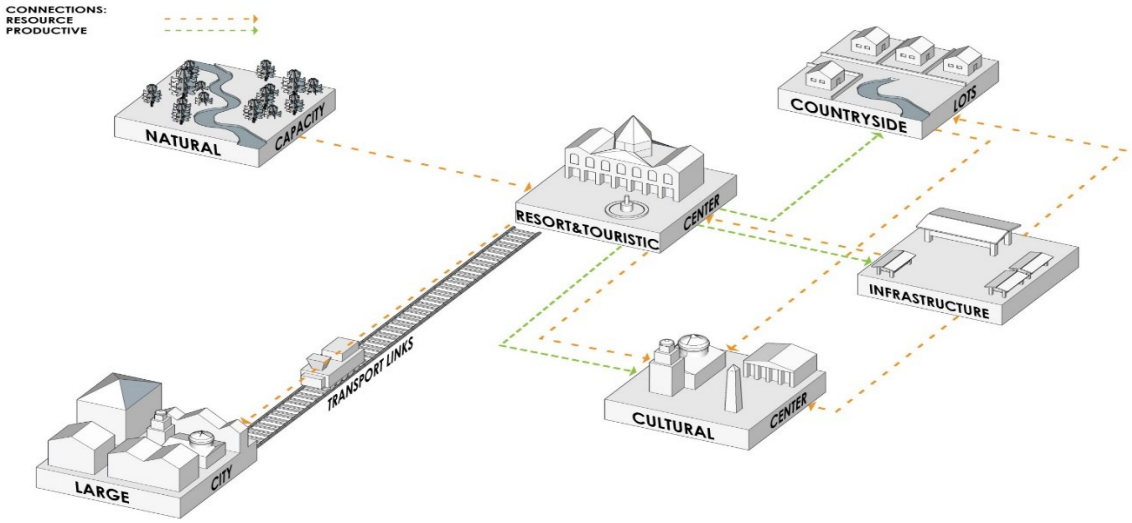

Fig. 2 Model of cultural and tourist small town

- **Scientific and innovative**

Defense and space programs of the Soviet Union formed the technology cities and closed autonomous territorial entities (CATE). There are dozens of them in modern

[25] 21. - p. 12.

Russia. Their aim was to create a research cluster. However, their work was highly specialized and did not involve direct interaction with the subsequent production, as well as with other activities (Fig. 3).

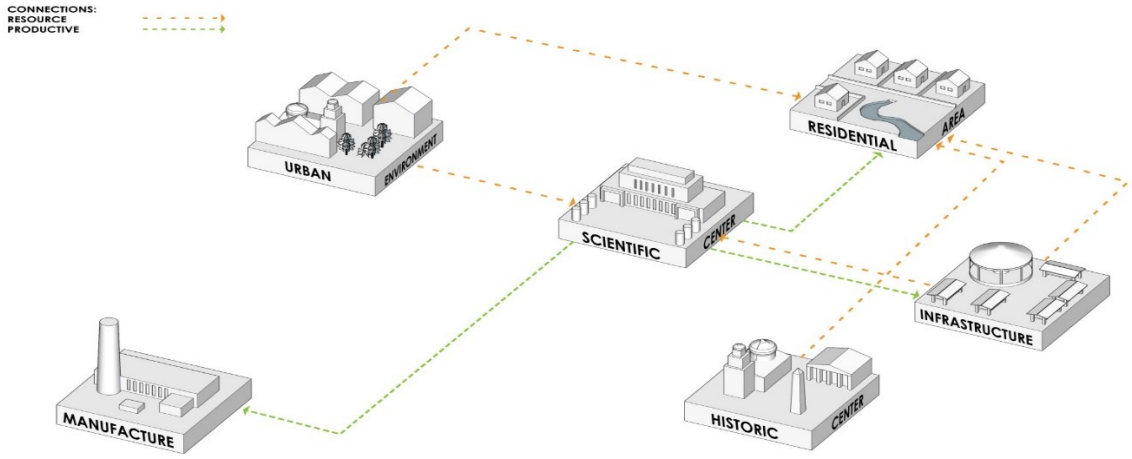

Fig. 3 Model of cultural and tourist small town

Unfortunately, the survival of single-industry entities is doubtful. Russian practice demonstrates the limited approaches to historical settlements, as they use the methods of isolating the heritage objects only, emphasizing their material value, but completely ignoring the context, environment and image. Natural forms and elements during the formation of the settlement became the basis for the long-term development of the urban structure of the towns. Therefore, the environment of a small historical city can not be isolated from the environment. For example, the uniqueness of the building is lost in the museum complexes located on a separate territory outside the natural environment, but is preserved if it is a site of the historical settlement. However, there are several stakeholders determining the development of regional territories in historical cities besides the state (Fig.4). Each of them has an impact on urban education at different levels. They determine the methods and means of work with the urban environment, among which the most frequent is agglomeration in disctricts of production, tourism and innovation. This trend leads one to think about the possibility of preserving the identity of a particular historical settlement.

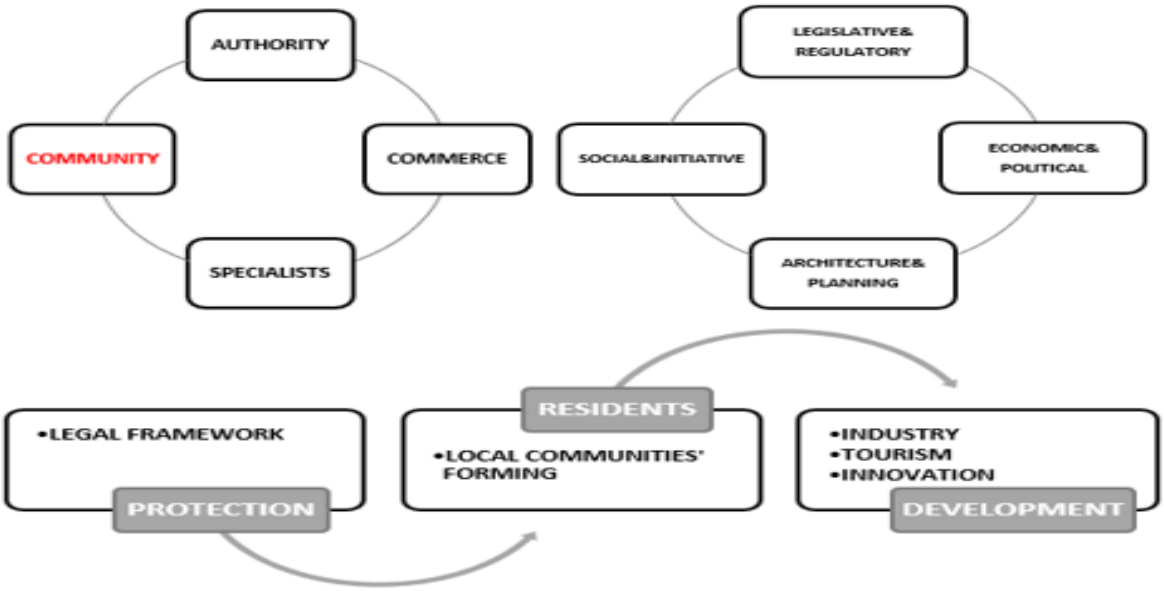

Fig. 4 Diagrams of the main aspects of the historic city: a) participants in urban relations; b) methods of work with the environment; C) development program

THE ROLE OF COMMUNITY IN CREATING AN ECO-SUSTAINABLE ENVIRONMENT

In an urban anthropogenic environment, it is difficult to exaggerate the role of the local community. Social relations are the most valuable capital of human communities and one of its varieties that determines the conditions of existence of mankind as a whole[26]. For many centuries, the urban structure has been built on the existing landscape and social connections. In the traditional process of town development, urban biotopes were formed to meet the immediate needs and desires of the inhabitants. As a result, inattention to creating a comfortable environment for human relations lead to systemic design errors - making non-functional, functionally "dead" space.

Over the last century, as Ruano notes in his work, car-oriented planning, inappropriate proportions for human needs, limited social interaction, low density of housing and the emphasis on individual housing units, individualism and security, as well as too pronounced functional division have damaged the quality of urban space. In contrast to such critical transformations of the environment at the end of the XX century, projects of a new type of environment were created.[27] In 1993, the creators of the Village Homes project in California founded a public organization that gave rise to New Urbanism movement. The doctrine was based on the principle of diversity of the environment, the formation of neighborly relations, and the preservation of natural spaces and historical heritage. Designers noticed that in areas with a strong local community it was much easier to achieve these aspects of human comfort. The awareness of local residents prevents negative changes in urban environment: loss of green and yard spaces, desolation and destruction of housing stock, loss of identity of the environment – citizens' pride.

The used paradigm was called New Urbanism. It is for the rehabilitation of existing urban densely populated centers, as well as settlements in the suburbs around agglomerations and the restructuring of over-developed suburbs. The proponents of the theory aspire to localities with the real nature of the neighborhood and internal diversity, return to the natural environment and preservation of architectural heritage.[28] Socially-oriented planning initiatives can often be found today in many developed countries: in

[26] 4. - p. 20.
[27] 4. - p. 18.
[28] Ib. - p. 21.

Hammarby, BedZED and other ecovillages discussed above, the community plays a key organizational and coordinating role, which ensures the sustainability of the structures.

A small town should be viewd as an ecosystem, in which modern society and the environment interact as a balanced ecological unit.[29] Local residents play a crucial role in forming of the tourist zone. The presence of a formed community is the key to implementing the most competent program of urban development, while the cultural and historical significance is created based on a combination of inner pride and love of all citizens to their small homeland. In Russia, the social movement "Tom Sawyer fest" has become very popular. The festival was organized to restore the historical environment of the cities by volunteers sponsored in 2015 in Samara. The efforts of the participants guided by the experts in restoration have given new life to 200 houses of the late XIX – early XX centuries and created art objects. The extra-budgetary investments attraction and cooperation with suppliers on gratuitous terms were vigorous. For two years, the organizers have attracted more than 2 million rubles of extra-budgetary funds to carry out these works. The festival took place in 27 cities of Russia and continues to grow. In particular, it was held in small towns like Kimrah (44 743 people), Khvalynsk (12 556 people), and Borovsk (10 966 people)[30].

In this regard, the authors highlight the Republic of Tatarstan, which is currently at the forefront of socially-oriented design. Over the past 5 years, a lot of work has been done to stimulate the creation and development of local communities. In the framework of the same "Tom Sawyer fest", [68] wooden houses were restored in the historical center of Kazan and regional cities. At the International Park Forum (28.06.2018), the assistant of the President of Tatarstan Natalia Fishman presented the results of wirking over the small towns and settlements (the bank of Lake Kaban), and formulated 3 aspects to a good environment, according to local residents: "beauty", "culture", "like in the city center". Urban improvement works are carried out only together with the local community: the projects undergo long coordination of the architectural concept.

It can be concluded that the community is the main component of the urban environment that regulates its development. In Western European practice, local initiatives have huge and comprehensive support, and in the organization of new living spaces, attention is primarily drawn to the formation of communities. In Russia, the formation of communities is mostly spontaneous and limited, and the actions of the authorities and specialists are often uncoordinated with local impulses and needs. The community plays a huge role in the formation of the urban structure, it is a key aspect of its sustainability, and it becomes even more important in creating such complex systems as clusters.

RESULTS. THEORY OF CLUSTERS

The change of technological mode to scientific-production one leads to significant transformations, including the urban planning. Focus on the innovative technologies and high-tech production suggests new approaches to the formation of the city as a system, including the cluster model. Similarly structured models were mentioned as profile ecovillages, where program refunctionalization provides ample opportunities for innovative development of urban formations based on existing potential. The cluster in urban planning has not yet a definition as a term. There are comcepts with similar meanings like technology park, industrial park and cluster, as well as the concept of regional innovation systems and special economic zones (SEZ). All this proves the need for the introduction of proper terminology. Technology park is an object of innovative

[29] 2. - p. 92.
[30] 22. - p. 3.

infrastructure. As a rule, it functions in a separate building or land[31]. It is a place of generating ideas in research developments. The result of technology park activity is not a material product, but methods, schemes, principles, and technologies. Industrial park is a site for locating production facilities, usually the capital construction projects, and necessary infrastructure within the existing administrative and legal restrictions[32].

The cluster is a flexible and free association of enterprises on the territorial and spatial principle[33] in order to strengthen the competitive advantages of companies and the region. It is a self-sufficient and mostly autonomous system. It implies concentration of specialized companies, suppliers, specialized labor force, universities, and research institutes in a certain location. However, clusters have heterogeneous, multi-functional composition and very conditional territorial boundaries, since it involves creating the environment for joint projects between cluster members, which can be carried out even virtually. Unlike industrial parks, clusters do not aim at creating production facilities, which is an aspect of its flexibility. In Russian legislation, cluster creation is related to special economic zones (SEZ). They are parts of the RF territory with a special legal status, providing preferential conditions for domestic and foreign entrepreneurs in order to attract investment, advanced production technologies, highly skilled labor, minimize transport and customs costs, and proximity of the finished product to the consumer. The regional innovation system is considered to be an alternative method[34] that implies the implementation of a certain concept within the framework of territorial education; it does result in close cooperation of related research and production enterprises. This system may include multiple regional clusters.

In 2012, Rune Dahl Fitjar and Andres Rodríguez-Posé studied the example of 1604 companies operating in Norwegian cities, and concluded that the cluster is economically inefficient in the setting of globalization, as it operates on the basis of local relations only[35]. However, this criticism highlights another fundamental aspect for this work – the local orientation of the cluster. Here the cluster is an approach to creating a self-sufficient spatial component, structured by the system of internal relations of specialized manufacturing enterprises, research and experimental organizations, commercial companies and public institutions, based on the existing urban formation and with due regard to its historical potential. It can be assumed that the formation of small historical cities and settlements and the creation of clusters have a similar effect: They are based on historical potential; They provide comprehensive transformation; They form the local community; They stimulate sustainable development. Cluster structures are divided according to the key function or type of production. They can be industrial, tourist and recreational, and scientific and innovative[36].

Industrial

This is the most common type of cluster aimed at coordinating several production enterprises into a single system. As a rule, enterprise-related profile is the basic principle of concentration. The purpose of the industrial cluster is the implementation of a certain chain of making the finished product. Research and development, production and marketing becomes the core of the cluster. The impulse of the industrial cluster foundation is the industrial potential of the territory, the availability of all the cooperation

[31] 23. – p. 4.
[32] Ib. - p. 6.
[33] 24. - p. 1.
[34] 23. - p. 17.
[35] 25. - p. 35.
[36] 26 - p. 2.

participants in the territorial accessibility, the necessary resources and support (Fig. 5). The trend of production clustering is now particularly noticeable in Russia. For example, Boris Titov, the business Ombudsman and the Chairman of the Party of Growth mentions such possible clusters as "Kalmytskoe myaso" (Kalmyk meat), "Tambovskoe rastenievodstvo" (Tambov plant production), "Russky lyon" (Russian flax - cultivation of flax and making clothing in Ivanovo and Tver regions and Moscow), the furniture cluster in Ulyanovsk region, motor industry cluster "Innokam" in Tatarstan, pharmaceutical cluster in Kaluga region, "Vinnaya doroga Kubani" (Kuban Wine Road, Krasnodar Krai)[37]. It should be noted that in contrast to the innovation clusters, which will be discussed below, the role of intellectual potential is secondary in industrial clusters.

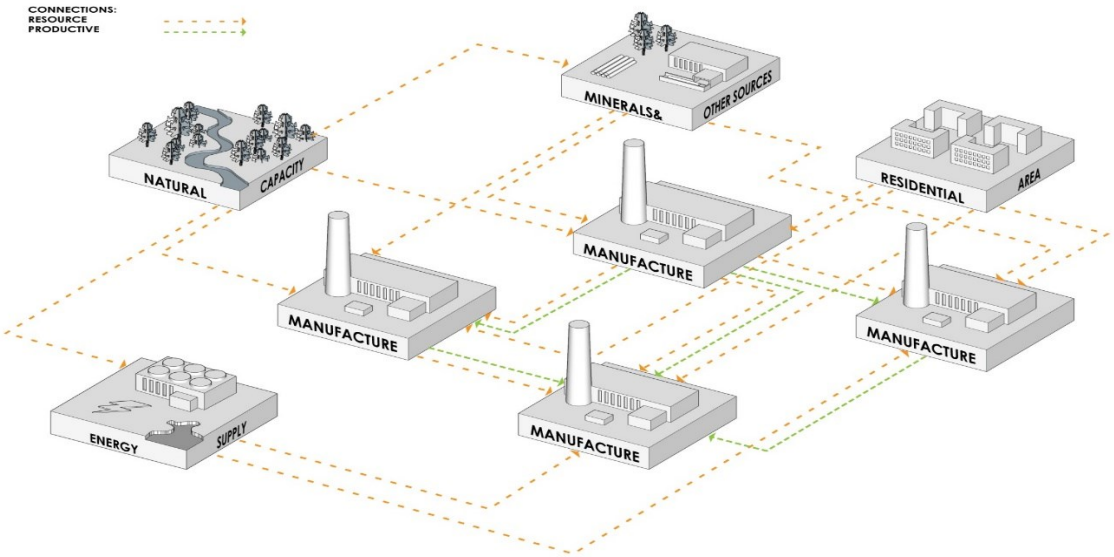

Fig.5 Model of industrial cluster

Tourist and recreational

"In the context of Russia's transition to an innovative type of economic development focused on the maximum use of intellectual resources, historical and cultural heritage is an important component of a favorable living environment"[38]. With the general trend of increasing interest in historical and cultural heritage and the declared political priority of the development of regions and increase patriotic consciousness, historical cities and settlements often trandfer to the realization of tourist and recreational potential. This is how the cities of the Golden Ring of Russia work (Myshkin, Suzdal, Uglich, etc.). However, when reorienting small urban entities, they work as an integrated system, and at the initial stage such model requires serious investments. Primary income is not enough to activate recreational and historical and cultural resources, maintain natural landscape complexes and tourist infrastructure.

The realization of the potential of cultural heritage objects (CHO) requires special measures of their protection, implying primarily the preservation of appearance, because the subject of identity here is tradition. Therefore, in such tourist areas, CHO usually stick to the "passive model". This is very different from the European practice, including the rules of "soft" restoration, when the CHO is restored using technologies and materials close to the original, seek to reproduce the historical appearance, and adapt the complex to a new function. In Russia, a separate building is removed from use and acquires a representative function. Often the result is excessive decoration during restoration

[37] 27. - p. 1.
[38] 1. - p. 600.

reaching kitsch. This trend is a consequence of the imperfect legislation, where the CHO falls out of the environmental context, which indirectly threatens the identity of the terriroty[39].

In the conditions of troublesome management of huge Russian territories, independence of municipalities and activity of local government is the only impulse of harmonious development of urban areas. In small towns with a very close and orderly structure of relations, the initiative of social groups is able to start the process of the overall renewal and improvement of the environment. Here, CHO and the surrounding territories are the object of attention of the owner, which is the most effective method of protection on the one hand, and a threat in the case of owner's ignorance of the value of the complex and methods of treating it. In such circumstances, the work of expert groups to educate about the significance, technologies and measures for the care of the monument is crucial. Finland has enough experience in organizing such commission: its activities protect CHO from intentional and accidental damage from the owner, since it is the residents who ensure the included development of the historical complex. However, the conservation status in Russia is a burden for the owner: it excludes any possibility of full-scale use and development, which again reveals the imperfections of the legislation.
The value of landscapes in the nearest urban environment is generally recognized, especially in the conditions of accelerating degradation of the developed lands. Tourist and recreational activity is a serious anthropogenic load for natural complexes, because the latter require close attention and work on the basis of long-term and responsible transformations-predictive design of the urban environment[40].

The second key aspect is infrastructure: the system of external and internal relations of the urban settlement area. It is obvious that well-built internal routes and the frame of points of attraction of tourists increase the economic efficiency of the system. It is also very clear that in the setting of the lack of interaction with governmental bodies and transport links with regional and agglomeration centers, the use of recreational and tourist potential is impossible. In this case, the participation of private investors, local entrepreneurs and manufacturers, whose initiative and financial support contribute to the implementation of major interregional cooperation projects and develop a system of links between historical cities and districts, is extremely important (Fig. 6).

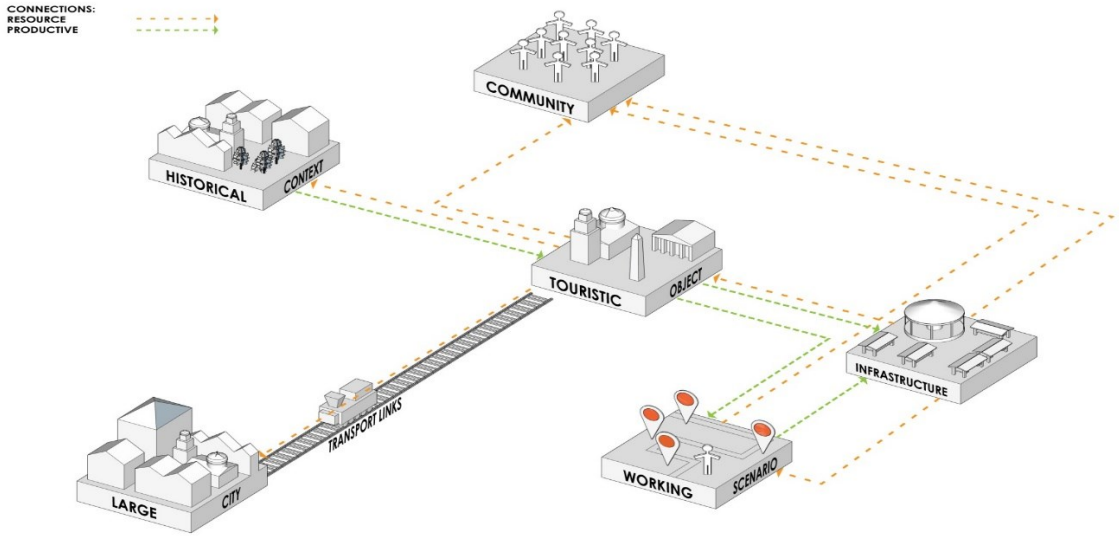

Fig. 6 Model of tourist cluster

[39] 28. - p. 189.
[40] 2. - p. 71.

An example of high-quality tourist development is the city of Tikhvin: its development program was elaborated in 2012[41]. The rail car-building plant opened in this city has become a financial guarantor of transformations based on the historical potential and the center of attraction of young professionals. The city center was divided into two zones: The recreational route for citizens and the tourist route, which covered the Tikhvin monastery and other areas of the city. Based on archive materials, the hydraulic structures of the Tikhvin water system were restored, the territory along the Vyazitsky stream was improved based on the archive materials, thus connecting the old and new parts of the city. Three foot bridge and observation platforms were arranged for a view of the city panoramas. The formed tourist and recreational framework attracts new initiatives and investments. The project was launched in 2015 to create a library of social and cultural center "Teffi", aimed at the younger generation. It should be noted that in this model, the implementation of local identity is based on the principle of possible development vectors, not directly based on the tourism paradigm. But tourism is one-sided, it does not give a truly new life to the heritage and hinders the development of the city on the basis of other resources. A different, integrated approach is represented by scientific and innovative, or so-called creative clusters.

Scientific-innovative

Such clusters, which have become popular in the last 30 years, are the most promising from the viewpoint of the latest intellectual developments. Abroad, the organization of the Silicon Valley and the Israeli cluster has become a mass practice. It was planned to create such clusters in Taiwan, and in Japan such formations are concentrated in prefectures, involving medium and small cities. The same can be said about Russia, where the scientific clusters (CATE) were formed on the basis of small towns with high innovative potential in the last century.[42] Research cluster aims first and foremost the search for promising sectors and initiatives.[43] This requires the factors of the second order, which include people (communities), nature (quality environment), and intellectual human resource (advanced technologies corresponding to the 6th technological pattern, according to the theory of N.D. Condratiev). All this leads to the creation of new mechanisms, a new culture and a new identity. Therefore, the task of ensuring the viability of the state economy is unimpeded scientific communication and cooperation. An efficient impulse of such transformations is an innovative creative cluster (Fig. 7).

In Russia, Boris Titov, business Ombudsman and Chairman of the Party of Growth, supports the creation of such clusters. At the present time, when "the main goal of city management is to promote the implementation of reproduction aimed at the reconstruction of a single urban "organism" and increase its stability in accordance with the new requirements and conditions of socio-economic development"[44], Russia needs to develop a way of efficient development of the non-resource sector. The basic projects of such program should be clusters that would concentrate the centers of development of new technologies and high-tech production. In historical, especially single-industry cities, the cluster system is efficient provided its construction on the basis of small and medium-sized businesses. Their structures, as well as the clusters themselves, are flexible and able to adapt to any changes in external conditions. "An integrated approach only can provide

[41] 29. - p.127.
[42] 26. - p. 4.
[43] 30. - p. 30.
[44] 20. - p. 607.

small and medium-sized businesses with investment security and stable profits"[45]. The local producers focus on the basic urban identity, they easier contact with the citizens, strengthening the integrity of the local community.

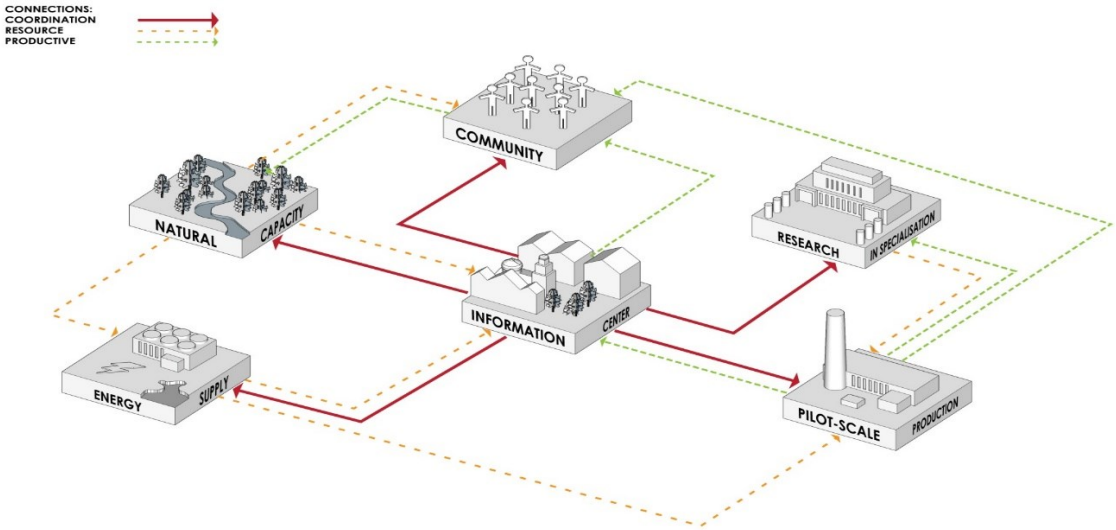

Fig. 7 Model of research and innovation cluster

It would seem that innovative cluster models do not imply the preservation of historical heritage, and CHO are extremely time-consuming to adapt to modern production technologies. Indeed, the cluster is an autonomous entity that is built in free, undeveloped territories, same as ecovillages. In case of the present historical component can not be ignored in the creation of a holistic urban model, although in the innovation cluster, its preservation as a basic factor does not imply capacity development. Being an example of an innovation cluster, Cambridge is one of the oldest universities in England and the city-forming center of the region. Back in the 1970s, the latest trends in production and the planned transition to the 6th technological mode became apparent to the administrative structures of Cambridge. The beginning of innovative transformations was the area of Cambridge Science Park. It was based on the principles of a vertical technology cluster[46]:

1. the association of production companies and research institutes;
2. functional limitations of the contribution of an individual enterprise to the overall cycle;
3. interrelation with existing centers of attraction of the city: university departments, research laboratories and firms;
4. environmental sustainability (low density development with integrated landscape development of the territory).

The principles concerned only the plot area sized 1 ha. However, after 15 years, the cluster became known as the entire North-Eastern region of Cambridge - research and production center that efficiently worked on modern computer technology, the production of components (fiber, chips, processors, laser devices), software development, and geographic information systems. The fact that all factory processes were minimal, ensuring the preservation of the environment, and set the task only to create an experimental sample for further launch into mass production, is very significant. Now Cambridge cluster (Silicon Fen) is a leader in computer technology and attracts increasing

[45] 31. – p. 1.
[46] 32. - p. 13.

investment. This example shows how the program approach can be used to create innovative research clusters on the historical territory. In this case, urban formation receives continuous development without contradiction with the current trends of urban formation.

Compositive cluster

Special conditions of the Russian small historical settlements do not allow to be assigned to any category of the presented classification, so the authors introduce another type of cluster - compositive. Its goal is supportive development, which is to take into account local environmental factors and potentials (human, natural and cultural-historical resources) and their combination with advanced science-intensive production. The synthetic cluster provides for the variability of the original and potential functions, and thus, an individual approach to each historical settlement. To create a cluster in a small historical settlement, the authors propose the following principles:

1. Historical and cultural identity: The use of existing areas of development and attraction of the city as a social and focal points and a comprehensive adaptation of objects of historical heritage for urban activity.
2. Community: The use of local communities of residents to regulate the emerging schemes of intra-cluster interaction.
3. Advanced development: According to the main potential of the territory, the areas of innovation are allocated.
4. Organization of experimental science-intensive production: Theoretical studies are closely related with manufacturing the product and technology in the form of experimental samples and techniques.
5. Supporting development: Testing of the developed methods is carried out directly on the territory of the organization of the synthetic cluster to support its development.

All this leads to a balanced, "sustainable" development of the historical settlement. Cluster creation is carried out in 4 stages, which reveal the essence of the model: 1. Engagement – resource activation; 2. Aggregation - formation of complexes; 3. Synthesis - creation of a single structure; 4. Maintaining - continuous development based on scientific and cultural potential.

DISCUSSION

It is clear that the cluster is not just a formation, but a special, locally-hued approach to the refunctionalization and restoration of the environment, stimulating its recovery and development. The cluster, like the ecovillage, is autonomous and has a close and interconnected structure. Industrial clusters create a new spatially connected system, the tourist ones provide the connectivity of the existing environment. The introduced compositive cluster is the most versatile and multi-tasking; it is close to the environment and at the same time develops the potential in various fields, including the formation of new, progressive research communities. However, it is clear that the potential of the cluster in the activation of settlements that have lost their structural connectivity is not fully realized, both in foreign and domestic practices. The cluster has great opportunities for the restoration of the historical environment, namely the cultural and historical potential, which, being a factor of the second order, still plays the key role in the development of small urban formations, for example, for the natural allocation of a new defining and coordinating functions.

To confirm its capabilities, the synthetic cluster model is tested on the example of Sestroretsk, Kurortny District of the Leningrad region. The city has passed several

development stages: from the landscape, based on natural economy, to the formation of production-mining systems of the Arms Plant, then the resort region with its therapeutic institutions. Now this suburb is under the threat of mass housing development and transformation into a residential area of St. Petersburg[47]. This is particularly critical in view of a significant layer of architectural and urban heritage of the late XIX-early XX centuries preserved as complexes of wooden manor houses and country houses and a unique landscape – urban organic layout area. Historical research and analysis of scientific literature proves the great natural, recreational, socio-economic, cultural, and historical potentials of Sestroretsk[48]. However, the resort, residential and tourist infrastructures and natural complexes are in dire need of modern research and revitalization. Therefore, the increase in economic activity and resort attractiveness of the region would be aided by the formation of a research and experimental cluster of medicine and recreationdevelop the recreational resources of Kurortny District (Fig. 8).

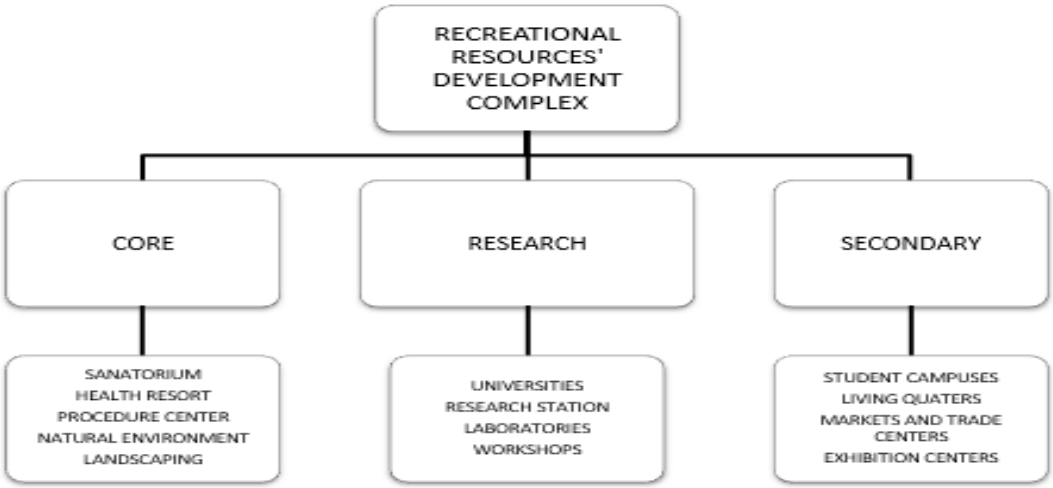

Fig. 8 Diagram of the cluster components of Sestroretsk

Authors define a key aspect of Sestroretsk development: the resort potential[49]. They also indicate three fields of research that contribute to maintaining the quality of the environment, health care and recreational resources. They are: 1. Medical; 2. Biological-ecological; 3. Architectural and restoration. Manufacturing enterprises that develop medical techniques and drugs, eco-technology and restoration methods are formed at the intersection of differently specialized research institutes. Energy supply is carried out not only using traditional hydropower, but also by innovative methods of biogas and electricity production during waste recycling. The coordinating center is the former Tool Plant. Using heritage sites, on the territory of the suburbs and other urban centers, the branches of large universities, laboratories and workshops can be opened. Their research activities would be tested as experimental techniques in sanatoriums in order to form a comprehensive improvement program with the study of biological and architectural and urban features of the area. Auxiliary infrastructure of student campuses, fairs, and exhibition centers would increase the socio-economic activity of the territory. This approach creates a holistic structure of the urban environment focused on innovative transformation in the field of sanatorium and health treatment, maintenance and rehabilitation of natural complexes of Sestroretsk (Fig. 9).

[47] 33. - p. 20.
[48] 34. - p. 114.
[49] 35. - p. 5.

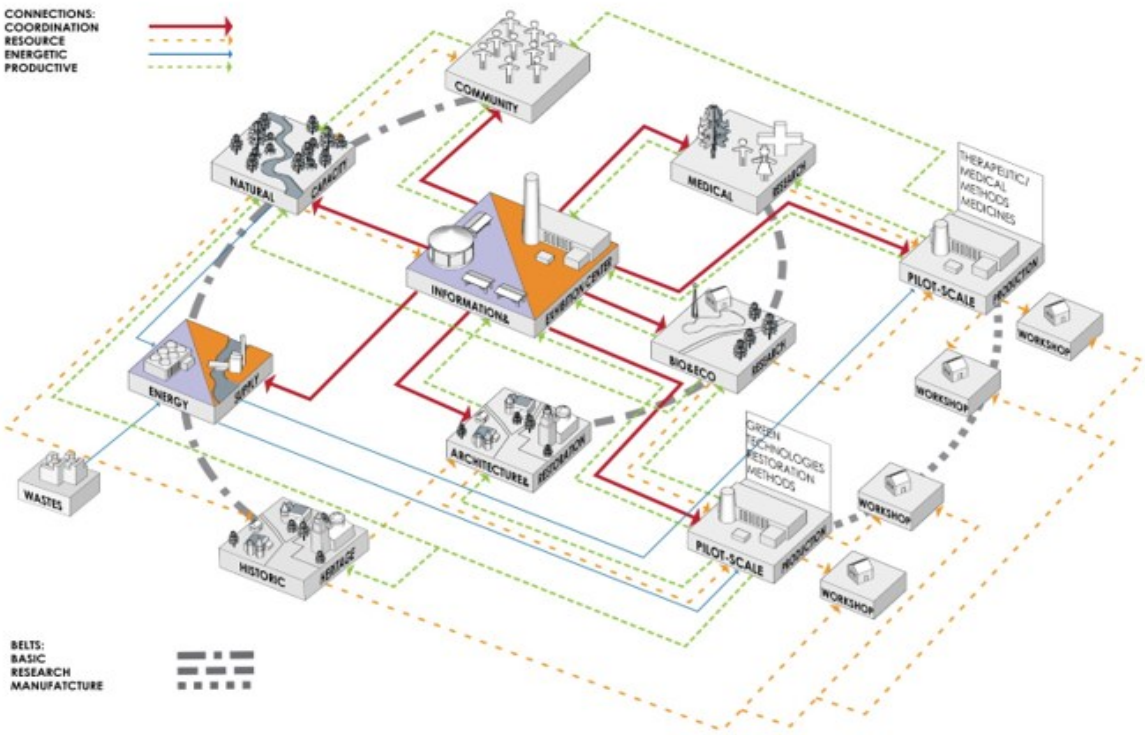

Fig. 9 Model of the synthetic cluster of Sestroretsk

CONCLUSIONS

The paper proposes a classification of eco-sustainable settlements on their goals, which are set by their creators. They are: new green construction, restoration of disturbed territories, profile settlements. Of the three categories, the most widely represented are the last - profile ecovillages. They need green technologies as a necessary tool for setting a comfortable creative environment. Russia has a lot of urbanized formations that tend to sustainability; in particular, small historical cities are represented by a domestic type of ecovillages with an already established system of subsistence farming and a collaborative local community. The paper presents the classification of small historical cities and models of each type. The key role is played by the local community as a development factor of a comfortable environment regarding the human needs and trends of the transformations of the urban environment in all sustainable entities.

The paper describes in detail the cluster as a method that combines the instruments to ensure eco-sustainability, innovative forecasting and city-wide integrity. The authors formulated the term of urban cluster, developed the classification of cluster formations and models of their work, as well as revealed the main components and their connections. A new type of synthetic cluster, combining the principles of all categories with the flexible main function, is proposed. This type takes into account the factors that determine the balanced development of ecovillages and small historical cities, like intellectual resources, initiatives of local and scientific communities, natural, historical, and cultural environments. The restoration principles for the structure of a small historical city using the cluster method are developed. They are:

- Principle of historical and cultural identity
- Community principle implies creating th local initiative groups to coordinate urban development
- Principle of advanced development involves research activity based on the potential of the territory

- Principle of organizing experimental high-tech production based on theoretical research
- Supporting development principle is to apply the developed methods to the intracluster environment.

The authors also declared the main stages of a compositive cluster formation: involvement - activation of resources, aggregation-formation of complexes, synthesis - creation of a common structure, maintenance – continuous development. A cluster model with the formation of three types of specialized research is built on the example of Sestroretsk, Kurortny District of the Leningrad region (medical, bio-ecological, architectural and restoration)and the creation of science-intensive industries (medicines and medical technologies, eco-technologies and restoration methods). The formation of the coordinating center takes place in the historical territories of the former Tool Plant; the ensembles of architectural and urban heritage are used to the maximum possible extent. Thus, it is revealed that the cluster is relevant in the setting of valuable historical ensembles in the environment of small historical settlements both in Russia and in other countries due to the restoration and maintenance of structural integrity, natural and historical value, and active involvement of the local community.

REFERENCES

[1] *Reymers, N.F.* (1994). Ecology (theories, laws, rules, principles, and hypotheses) [Ekologiya (teorii, zakony, pravila printsipy i gipotezy)]. Moscow: Zhurnal «Rossiya Molodaya», 367p.
[2] *Mikulina, E.M. & Blagovidova, N.G.* (2013). Architectural ecology [Arkhitekturnaya ekologiya]. Moscow: Izdatel'skiy tsentr «Akademiya».
[3] GEN.(n.d.)Russian Ecovillages & Initiatives Union. URL: http://gen-russia.ru/o-gen/.
[4] *Ruano, M.* (1999). Ökologischer Stadtebau. Karl Kramer Verlag Stuttgart Zürich.
[5] *Bozhuk, V.* (n.d.). Viikki eco-district [Ekologicheskiy rayon Viikki]. URL: https://archi.place/modern-architecture/ekologicheskij-rajon-eko-viikki/.
[6] *Lyle, J.T* (1996). Regenerative design for sustainable development. John Wiley & Sons, USA.
[7] *Frearson, A.* (n.d.). EFFEKT designs ReGen Villages that could produce all their own food and energy. Dezeen Architecture and design magazine URL: https://www.dezeen.com/2016105/20/effekt-designs-regen-villages-produceown-food-energy-danish -pavilion -venice-archi tecture-biennale-2 016/.
[8] *Blagovidova, N.G., Perkova, M. V. & Tribuntseva, K.M. (2015). Features* of Design of Ecovillages in Depressed Areas in the City. Research Journal of applied Sciences 10(10): 608-619, 2015. ISSN: 1815-932X, Medwell Journals, 12p.
[9] Alekseeva, T. (Ed.). (n.d.). Stockholm eco-district - Hammarby Sjöstad. Hammarby Lake City [Ekorayon Stokgol'ma Hammarby Sjöstad. Ozornyy gorod Khammarbyu]. URL: http://www.ecolife.ru/gorod/12451/.
[10] *Duving, S.* (n.r.). English construction is being ECOistic [U angliyskogo stroitel'stva bol'shoe EKO]. PROF2. Tsentr mikroklimata i avtomatizatsii zdaniy. URL: http://www.prof2.rf/stroitelstvo/biblioteka_stroitelstvo/ehko/.
[11] BedZED seven years on (July, 2014), 21–22. URL: https: bioregional.com.
[12] RIBA Journal Sustainability Award BedZED, Wallington, Surrey. Architects' Journal (27 November 2003). URL: https://www.architectsjournal.co.uk/home/riba-journal-sustainability-award-bedzed-wallington-surrey/147503.article.
[13] *Malyukh, V.* (30.01.2012). Silicon Fen or All roads lead to Cambridge [Silikonovoe boloto ili vse dorogi vedut v Kembridzh]. ISICAD. URL: http://isicad.ru/ru/articles.php?article_num=14986.

[14] Liverpool Science Park houses two Grade-A multi-tenanted buildings in the heart of the city's Knowledge Quarter (n.d.). URL: https://www.liverpoolsciencepark.co.uk/about/sustainability/.
[15] Eco-Innovation Cheshire and Warrington (n.d.). URL: https://www1.chester.ac.uk/departments/eco-innovation-cheshire-and-warrington.
[16] What do we do. Center of Alternative Technologies. (n.d.). URL: https://content.cat.org.uk/index.php/about-cat-what-do-we-do.
[17] Beer & public house Ome-Bakushu (2018). Shinckenshiku, 9, 130-135.
[18] Toshiaki. I. (2016). Toward the city grow with young people. Beginning of the town. The Japan Architect, 103, 014-021.
[19] Yumi, K. & Toshiya, E. (2016). Inspired by the traditional townscape, reviving the townscape through historical renovation. Beginning of the town. The Japan Architec, 103, 052-059.
[20] *Lyubovny, V.Ya.* (2018). Monotowns of Russia: origins, evolution of development and regulation [Monoprofil'nye goroda Rossii: istoki, evolyutsiya razvitiya i regulirovaniya]. Moscow: Izd-vo «Ekon-Inform».
[21] *Matveev, B.M.* (2013). Historical-theoretical and scientific-practical development of urban planning regulation of the historical urban environment of Sestroretsky architectural and landscape complex [Istoriko-teoreticheskie i nauchno-prakticheskie razrabotki gradostroitel'noy reglamentatsii istoricheskoy gorodskoy sredy Sestroretskogo arkhitekturno-landshaftnogo kompleksa]. Extended abstract of candidate dissertation, 27p.
[22] *Kochetkov, A.V.* (2017). Srudy guide to "Tom Sawyer fest" [Metodicheskoe posobie «Tom Soyyer Fest»]. Samara.
[23] *Kutsenko, E.S.* (n.d.). Cluster policies and cluster initiatives [Klasternye politiki i klasternye initsiativy]. Proceedings of the seminar. URL: https://www.hse.ru/mirror/pubs/share/216157502.
[24] *Khavina, S.A.* (n.d.). Cluster [Klaster]. Bol'shaya rossiyskaya entsiklopediya. URL: https://bigenc.ru/economics/text/2623087.
[25] *Khvan, V. & Khorsvitt, G.* (2012). Tropical forest. The secret to creating the next Silicon Valley [Tropicheskiy les. Sekret sozdaniya sleduyushchey Silikonovoy doliny].
[26] *Zvyagina, E.M.* (2014). Typology of clusters and clustering features of the regional economy of Russia [Tipologiya klasterov i osobennosti klasterizatsii ekonomiki regionov Rossii]. Sovremennye problemy nauki i obrazovaniya, 2. URL: http://science-education.ru/ru/article/view?id=12696.
[27] Theme of the week [Tema nedeli] (25.10.2010). Rossiyskaya Biznes-gazeta. 751(18). URL: https://rg.ru/2010/05/25/innovacii.html.
[28] *Shevchenko, E.A.* (2018). On the problems of preserving historical settlements and more [O problemakh sokhraneniya istoricheskikh poseleniy i ne tol'ko]. Saint Petersburg: Izd-vo «ZODCHIY».
[29] Belozertseva, N., Shishalova, Yu. & Oynas, D. (2017). Environment: Russia [Sreda: Rossiya]. Speech. Regiony, 18, 122-160.
[30] The law of the required diversity. Interview with Corresponding Member of the RAACS, specialist of the Genplan Institute of Moscow, G.S. Yusin [Zakon neobkhodimogo raznoobraziya. Interv'yu s chlenom-korrespondentom RAASN, spetsialistom GUP «NIiPI Genplana Moskvy» G.S. Yusinym] (2015). URBAN magazine, 2, 24-33.
[31] Nikolaeva, D. (01.10.2018). Not a national project, so let's try a cluster. Boris Titov continues his search for growth strategies in the interdepartmental government working group [Ne natsproektom, tak klasterom. Boris Titov prodolzhayet poisk strategii rosta v mezhvedomstvennoy rabochey gruppe pravitel'stva]. Gazeta "Kommersant",178, 2.

[32] *Bradfield, J.R.G.* (1980). Cambridge Science Park. Directory. URL: https://wellcomelibrary.org/item/b20190682.
[33] Amirkhanov, L. (2014). Sestroretsk. 300 years of history [Sestroretsk. 300 let istorii]. Sankt-Peterburg: I.A. Minakov.
[34] Gryaz'kin, A.V., Monastyrskaya, M.E., Shtiglits, M.S. & Shkanova, E.G. (2008). Historical and urban planning substantiation of the concept of creatinf and developing artificial areas for social, business and residential purposes in Sestroretsk [Istoriko-gradostroitel'noe obosnovanie kontseptsii sozdaniya i razvitiya iskusstvennykh territoriy obshchestvenno-delovogo i zhilogo naznacheniya v Sestroretske].. V. 2, v.3. Saint Petersburg.
[35] *Nikitina, O.A.* (2016). Opportunities for the resource potential of Kurortny District of St. Petersburg for the development of medical tourism [Vozmozhnosti resursnogo potentsiala kurortnogo rayona Sankt-Peterburga dlya razvitiya meditsinskogo turizma]. Uspekhi sovremennoy nauki i obrazovaniya, v. 2, 6, 104-109.