# Methodology for assessing the level of development of closed administrative-territorial units

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**Abstract.** The article proposes a new approach to assessing the level of development of closed administrative and territorial units (hereinafter, CATU) to form a favorable and comfortable living environment for people by implementing measures to develop scientific and production, socioeconomic and recreational potential of the territory and infrastructure of the municipality. The criteria and parameters for assessing the level of development of the territory, which ensure sustainable development of the territory of Levin town settlement (former CATU Kirov-200) of Kirov oblast is made. The article deals with the creation of the conceptual project "Biopolis" using the Ishikawa diagram. "Biopolis" is a biopharmaceutical cluster, and the principles of bionics have been applied for the development of the assessing the level of development of CATUs, which is due to the priority task under the program "Integrated development of single-industry towns".

**Keywords:** biopolis, biopharmaceutical cluster, development assessment, assessment criteria and parameters, special economic zone, sustainable development, bionics, closed administrative- territorial entity, Kirov region

## Introduction

The relevance of the article is due to the priority task of the strategic development of the Russian Federation (dated 30.11.2016) according to the programme "Integrated development of single- industry towns" [1]. To form a comfortable living environment for the people of CATU, it is necessary to develop measures to disclose the scientific and industrial, socio-economic and recreational potential of the territory and infrastructure of the municipality.

The reorganisation of formerly closed territorial entities is a promising trend in modern urban planning in Russia. A Closed Administrative-Territorial Units (CATU) is an entity within which industrial enterprises, military or other facilities are located. Period of disintegration of the USSR (the 1990s) had a negative impact on these settlements, lack of

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financing from state budget and loss of city- forming function leads to extinction of territories of former CATUs. Preservation of the availability of a leading enterprise and skilled professionals is a solid base for the development of these areas.

At present, the problems of development of the former CATUs do not lose their relevance: many cities have failed to adapt to post-Soviet conditions. Interest in the problems of single-industry towns is materializing in scientific research of both Russian and foreign scholars. The articles evaluate the historical experience of the formation of CATU, identify the economic components of the development of monocities in terms of urban formation and city specialization [2-3]. The prospects of single-industry towns' development are determined by the quality of life of a small town, which should be provided by: safety, environmental friendliness, quality of housing, availability of services, quality of education, etc. [4]. O.V. Golovina in her work determined the strategic directions of qualitative urban development transformations of single-industry towns in the functional, environmental and aesthetic components, as well as the modernization of infrastructure and information and communication systems [5]. A.A. Gundarev has considered the current state of single-industry towns in the Chelyabinsk Oblast and, based on the nature of the identified problems, proposed ways of transformation: as centres of science, various types of tourism and recreation, development of agro-industrial complex, craft and folk crafts, placement of branches of enterprises of large cities [6]. The need to improve the structure of closed territorial entities and to ensure sustainable development of the territory is determined by the high level of migration, low transport accessibility of settlements, insufficient level of residential, social and industrial infrastructure. These issues are considered in the articles on sustainable development of urban and rural settlements [7-12].

**Purpose:** to ensure the sustainable development of the urban area and the formation of a pleasant and comfortable living environment by implementing measures to maximise the productive, socio-economic and recreational potential of the municipality.

**Objectives:** 

- Study the existing urban planning situation of the urban settlement and retrospectively analyse it;
- Consider the use of the Ishikawa diagram tool to create a design concept for a Biopolis based on a former CATU;
- Define the development level assessment parameters for the redevelopment of the former CATU areas of the current and project situation;
- Develop a solution for the planning organisation and functional zoning of the territory of Levintsy.

#### Main part

#### Research part

At present, Levintsy is an area with developing economic potential. On the basis of the settlement, it is planned to implement a large-scale federal project as part of the formation of a sanitary shield of Russia - "Biopolis". This territory will be Russia's first world-class special economic zone in the field of biopharmacy and immunobiology. The representative of the project will be the plant "Nanolek", it is planned to attract more than 18 companies and enterprises focused on biotechnology, pharmaceuticals and ESG (environmental, social and corporate governance) [13, p. 126].

Using the model of Kazan Innopolis in the settlement of Levintsy, it is planned to create a Biopolis city project, including full provision of social and educational infrastructure: clinics, kindergartens, schools, university campuses, sports facilities and cultural and leisure centres, as well as housing of various types and layouts for enterprise professionals. The project is expected to attract funding from private investors, federal and regional budgets.

The number of residents is projected to increase due to employees attracted to work in the biopharmaceutical cluster from other regions and settlements of the Kirov region. Due to the developing economic potential of the territory, the settlement of Levintsy needs to develop residential and public buildings.



Fig. 1. Layout of the location of Levintsy township in the settlement system [author's figure].

The municipality of the Levin township is located in the eastern part of the Orichevsky District.

The administrative centre of the Levin township is the township of Levintsy.

Transport accessibility indicators: the distance from the settlement of Levintsy to the regional centre - Kirov - 36 km, to the district centre - Oritchi - 12 km. The nearest railway station is in Strizhi village 6 km away. Pobedilovo Airport is 13 km away. The area has an advantageous position in relation to important transport routes [14].

The retrospective analysis is to look at the urban system at different points in time and in different aspects of existence (Fig. 2). The territory of Biopolis is not chosen by chance, earlier Levin township was a closed territorial entity, the plant of the Research Institute of Microbiology of the Ministry of Defence of the Russian Federation was located here [14].

In 2004, Russia's only inter-university research centre for micro-biology and biotechnology, based at Vyatka State University, was established on the premises of the former plant of the Research Institute of Microbiology of the Ministry of Defence, which became the basis for opening a pharmaceutical production facility under the Federal Target Programme "Development of Pharmaceutical and Medical Industry in the Russian Federation until 2020 and beyond".



The village of Levintsy was founded in 1795 (1816).



1983 - disappearance of the village of Levintsy



From the late 1970s to 2004, the Kirov-200 was a closed ad A ministerial-territorial entity.



Fig. 2. Retrospective analysis of the area [author's figure].

Creation of "Biopolis" concept on the base of closed territorial entity in Kirov region will increase competitiveness of the region in the sphere of biotechnology and micro-biology, will attract investments and will create a technopark, which will increase the number of working places. The Ishikawa diagram is one of the tools which enable the identification of the necessary factors for the creation of the "Biopolis" concept. With this tool it is possible to identify the missing factors for the realization of the biopharmaceutical cluster idea. The following were selected as the main functions for the development of the area: scientific and educational, industrial, residential, recreational, social, public and business, transport and engineering [15-16]. (fig. 3)



Fig. 3. Ishikawa diagram [author's figure]

*The research and education function* includes the establishment of a campus at Vyatka State University.

*Production function* - existing city-forming enterprises (LLC Nanolek, LLC Agrovet, LLC Farmzaschita reserve territories for new production capacities.

**Residential function** - planned residential development in the south-west and west in the form of individual and low-rise residential development with public spaces; redevelopment of existing residential development, currently represented by prefabricated panel construction, to create a welcoming urban environment.

**Recreational function** - existing landscaped parkland; planned public realm landscaping network. The existing landscaped park area is currently located in the northern part of the settlement, bordering the educational institutions. There is a need for a shared landscaping network linking the planned area with the existing development and businesses, including a new city park, boulevards and green corridors.

*The social function* - existing social infrastructure, which is represented by the objects of educational institutions, outpatient clinics, boarding house, library, as well as the creation of additional educational institutions in connection with the planned expansion of the territory and the increasing need for an increase in the number of residents.

*Community and business* - there is a need for a multifunctional community centre, sports facilities and new public spaces for communication and community interaction "Biopolis".

*Engineering and transport functions* - the settlement's vacant building areas are not provided with engineering and transport infrastructure, which hampers housing construction.

The aim of the experiment is to assess the existing design area and bring it into an ideal model of sustainable development.

The assessment of the level of development for the reorganisation of the CATU areas will be determined by the set of parameters described in Table 1. The maximum value is taken as 7 c.u. [17].

Table 1. Development Assessment parameters for the reorganisation of the former CATU areas

	0	0,5	1
Scientific and educational function	Lack of scientific and educational production facilities (VU-Zov branches, campuses, laboratories)	Availability of closed science facilities	Providing facilities for the science and education function in connection with enterprises
Production function	No city-forming enterprise	Existence of a city-forming enterprise	Extension or presumption of The following are some of the reasons for the increase in production capacity
Residential function	Acute shortages or severe deterioration of housing Foundation	Housing is represented by one type of development	The need for a comfortable and varied In the case of new housing
Recreational function	Lack of recreational facilities	Inadequate recreational facilities	Availability of landscaped parks, boulevards and landscaping
Public and political function	Lack of facilities for public and business functions	Insufficient number of public and business centres	Provision of sports, commercial, administrative and multifunctional facilities
The function of the social infrastructure tours	Lack of social infrastructure	The number of social infrastructure facilities is insufficient structures	The full provision of education, health care and recreational facilities of conservation and culture
Transport and infrastructure function	Lack of road network (no pavement) Lack of engineering infrastructure	The street and road network corresponds to the structure of the settlement and the location of the functional areas Public transport stops are not provided with a radius of accessibility Engineering infrastructure: Poor technical condition Structural unsuitability	Provision of safe and comfortable traffic of different modes of transport Developed pedestrian and bicycle network Existence of a network of public transport stops Engineering infrastructure: A well-developed engineering network, to which residential, social and industrial infrastructure is connected structures

 Table 2. Development Assessment parameters for the redevelopment of the former CATU areas.

 Existing situation

	0	0,5	1
Scientific and educational function	Lack of scientific and educational production facilities (VU-Zov branches, campuses, laboratories)	Availability of closed science facilities	Providing facilities for the science and education function in connection with enterprises
Production function	No city-forming enterprise	Existence of a city-forming enterprise	Extension or presumption of The following are some of the reasons for the increase in production capacity
Residential function	An acute shortage or high depreciation of the housing stock	Housing is represented by one type of development	Ensuring the need for comfortable and diverse housing
Recreational function	Lack of recreational facilities	Inadequate recreational facilities	Availability of landscaped parks, boulevards and landscaping
Public and political function	Lack of facilities for public and business functions	Insufficient number of public and business centres	The provision of sporting, commercial, administrative and multifunctional facilities For more information see
Social infrastructure function	Lack of social infrastructure	Insufficient social infrastructure facilities	Full provision of education, health and culture facilities
Transport and infrastructure function	Lack of road network (no pavement) Lack of engineering infrastructure	The street and road network corresponds to the structure of the settlement and the location of the functional areas Public transport stops are not provided with a radius of accessibility Engineering infrastructure: Poor technical condition Structural unsuitability	Provision of safe and comfortable traffic of different modes of transport Developed pedestrian and bicycle network Existence of a network of public transport stops Engineering infrastructure: A well-developed engineering network, to which residential, social and industrial infrastructure is connected structures

Based on this assessment, the existing level of development for redevelopment is taken as 2.5 c.u. out of 7 c.u. Further, it is possible to highlight the necessary measures for integrated and sustainable development of the areas.

#### Project proposals

One of the directions for the planning organization of urban areas in Russia and abroad is the application of bionics methods [18-21]. The planning scheme of the gene plan is based

on the image of the Immunoglobulin M molecule (IgM) and the molecular grid (fig.4). Nanolek LLC specialises in the production of import-substituting and innovative pharmaceuticals.

The key area is modern vaccines and HIV therapy. The key focus area is modern vaccines and HIV therapy. The immunoglobulin molecule is related to the specifics of the company's operations.







**Fig. 5.** Schematic diagram of the existing cadastral division [author's figure].

**Fig. 6.** Project cadastral division diagram [author's figure].



**Fig. 7.** Existing transport scheme [author's figure].

**Fig. 8.** Schematic diagram of the project's transport and pedestrian infrastructure [author's figure].



**Fig. 9.** Schematic diagram of the state of green spaces [author's figure].



**Fig. 10.** Schematic diagram of the project landscaping [author's drawing].







**Fig. 13.** Schematic of accessibility radiuses for preschools [author's figure].





Fig. 12. Layout of green corridors

[author's drawing].



**Fig. 14.** Public transport stop accessibility radius scheme [author's figure].



**Fig. 16.** Schematic diagram of the construction phases [author's drawing].

#### Rationale for project proposals

- 1. An area of residential development with individual and low-rise apartment buildings with landscaped courtyard areas and green corridors linking the project area with the center;
- 2. Pre-school education facilities to provide a new residential area;
- 3. A multifunctional center with the creation of walking alleys, quiet rest areas and playgrounds;
- 4. An academic and educational cluster, combining a training center and a hotel in a single area with a sports facility, which will create a new point of attraction in the long term;
- 5. Pedestrian axes and cycle routes linking the science and education cluster and the multifunctional leisure center, the residential project area and the existing construction site;
- 6. A new park on the existing axis of 70th Anniversary of October Street, the completion of which is the projected church as a vertical dominant.
- 7. Renovation of the façades of existing panel buildings to provide a comfortable urban environment.



Fig. 17. Example of reconstruction of the facades of panel houses [https://www.behance.net]



Fig. 18. Site planning project [author's figure].

The result of the project solutions implementation will achieve a high level of complex and sustainable development of the territory of the former CATU Levintsy. When evaluated according to the derived parameters it will be calculated by 7 c.u. out of 7 c.u., with the initial value of 2.5 c.u. (Table 3.).

 Table 3. Development Assessment Parameters for the redevelopment of the former CATU areas.

 Project proposal.

	0	0,5	1
Scientific and educational function	Lack of scientific and educational production facilities (branches of HEI- Call, campuses, laboratories)	Availability of closed science facilities	Providing facilities for the science and education function in conjunction with companies
Production function	No city-forming enterprise	Existence of a city-forming enterprise	Expansion or incentives to increase production capacity
Residential function	An acute shortage of, or a dis- the deterioration of the housing stock	Housing is represented by one type of development	Ensuring the need for comfortable and diverse housing
Recreational function	Lack of recreational facilities	Inadequate recreational facilities	Availability of landscaped parks, boulevards and landscaping
Public and political function	Lack of facilities for public and business functions	Insufficient number of public and business centres	The provision of sporting, commercial, administrative and multi-use facilities of functional relevance
Social infrastructure function	Lack of social infrastructure	Insufficient social infrastructure facilities	Full provision of education, health and culture facilities
Transport and infrastructure function	Lack of road network (no pavement) Lack of engineering infrastructure	The street and road network corresponds to the structure of the settlement and the location of the functional areas Public transport stops are not provided with a radius of accessibility Engineering infrastructure: Poor technical condition Structural unsuitability	Provision of safe and comfortable traffic of different modes of transport Developed pedestrian and bicycle network Existence of a network of public transport stops Engineering infrastructure: Developed engineering network, to which residential, social and industrial infrastructure is connected

Visualisation of the sustainable development model [16]



Fig. 19. Model for the sustainable development of the existing and project area [author's figure].

# Conclusions

As a result, a universal model for the reorganisation and development of formerly closed territorial entities has been proposed, which is formed by using the tool Ishikawa diagram, as well as defining criteria for assessing the existing situation of the settlement and the project proposal. The method is an open system and offers the possibility of changing the number of parameters and refining their grading scale as necessary and as further research progresses. The approach in the study includes those criteria that are promising for development in the territory of the former CATU, the basic criteria being: science, production, housing, recreation, public and business infrastructure, social, transport and engineering infrastructure.

The Ishikawa diagram enables a systematic consideration of the main functions of the settlement for the formation of the Biopolis concept in the Kirov region, and also identifies the necessary tasks, which are subsequently reflected in the project proposal.

A possible way forward could be to analyse closed communities that have lost their status, identify their development prospects, attract the population through the reorganisation of the area and ensure sustainable development.

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