Reorganization of industrial zones into a comfortable urban environment

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Abstract. The article is devoted to the study of the problem of reorganization of industrial zones within the existing residential development. Four redevelopment projects have been studied in the article and the main approaches in this topic have been highlighted. The study of foreign and domestic experience in the reorganization of industrial zones shows that the application of basic principles plays an important role in the formation of a comfortable urban environment. Innovativeness, sustainable development, preservation of historical heritage, consideration of the needs of society and the development of social and economic infrastructure significantly contribute to this goal. The work included a review of scientific and research papers, articles, studied the experience of cities in Russia and the world, and analyzed the methods, approaches and results of projects. As a result of the work done, the basic principles of reorganizing industrial zones into comfortable urban environments were identified.

Keywords: reorganization of industrial zones, redevelopment, sustainable development.

1 Introduction

The reorganization of industrial zones (redevelopment) is the process of transforming existing industrial zones into areas with a different functional meaning. For many cities in Russia and around the world, it is typical to locate industrial zones within existing residential areas. As the population grows, cities expand and develop, and those enterprises that were built on the outskirts of the city grow into the new development.

At the present time, in conditions of rapid urbanization process, the issue of redevelopment of industrial enterprises becomes very urgent. In large Russian cities there is a discrepancy in the development requirements of the objects of a comfortable urban environment for living [1]. Industrial enterprises are located in the city center and in residential areas, the density of urban development does not allow within the existing boundaries to form large sites for new construction. Many urban areas attractive in terms of investment are occupied by industrial enterprises that have stopped their work or use their territory inefficiently. Consequently, one of the main problems of the city's development is the problem of inconsistency between the potential economic and urban planning value of certain territories of the city with the way of functional use, density and quality of...
development. The problem of limited territorial resources becomes a general incentive to intensify the processes of reorganization of industrial areas in disrepair.

In the process of urban planning it is necessary to analyze the best practices of redevelopment of industrial zones in Russia and other countries in order to develop rational and effective design solutions.

Let's study the most successful projects for the reorganization of industrial zones:

- ZAC Seguin - Rives de Seine district of Boulogne-Billancourt, France;
- Project of Ørestad district, Copenhagen, Denmark;
- Project for the reorganization of the ZIL plant (Likhachev Plant), Moscow, Russia;
- Project for the reorganization of the Great Ivanovo Manufactory, Ivanovo, Russia.

2 Materials and methods of research

The study deals with industrial zones in central areas of cities. In the course of the work a review of scientific and research works, articles implementing the reorganization of industrial zones was carried out, the experience of various cities in Russia and around the world was studied, the methods, approaches and results of the projects were analyzed. A comparative analysis of the implementation of projects for the reorganization of industrial zones in different regions was carried out, and their approaches, strategies, solutions and results were studied.

As a result, data on industrial zones, including their geographic location, land use, and transport accessibility were collected and analyzed.

3 Results

3.1 Foreign experience

3.1.1 ZAC Seguin - Rives de Seine district of Boulogne-Billancourt, France

Renault's production workshops in the Boulogne-Billancourt district could not cope with the increased competition in the automotive industry, and in March 1992 it was decided to completely stop production. This necessitated the reorganization of the Renault factory site, which became a project of national importance for Paris. At this time, there was an acute problem of lack of land reserves for the development of the city [2].

The main requirement of the city authorities is to provide a mixed functional zoning of the area. In the development of the project it is necessary to provide a variety of housing, including 30% social housing, offices and places of employment, social and commercial service facilities [3].

The reorganization of the territory began in 1970 and included several districts: the first stage is the reorganization of the district of Pont de Sevres, the second stage the district of Trapeze and the island of Seguin [2].

The main goals of urban reconstruction:
- improving the quality of the living environment;
- creating new pedestrian connections;
- restructuring of open public spaces and increasing the attractiveness of the neighborhood;
- restructuring and unlocking the resources of the existing neighborhood development [2].

The main urban features of the construction project:
The ZAC Seguin - Rive-de-Seine development area forms a smooth transition from high-density development to less dense development in the peripheral area near the River Seine. The number of storeys varies from 2 to 9 storeys in the main areas and from 8 to 12 storeys in the periphery, reflecting the morphological diversity [2].

The main objects of development are macrolots. Macrolots are 200 to 400 meters in length and 150 to 200 meters in width. Each macrolot includes areas for offices and residential developments with public and commercial facilities on the first floor of the buildings, as well as a courtyard area and public space on the outer perimeter of the development. The area of each macrolot is from 3 to 5 hectares. The openness of the interior macro spaces to pedestrians is a key feature that contributes to convenient pedestrian traffic in the area [2].

The proximity of the projected area ZAC Seguin to the water body (river Seine), had a significant impact in the planning structure of the area. First, the presence in the Seine River was the most important factor in the morphology of development. The design of the area took into account the landscape features of the river valley and built a smooth transition from high-density neighborhoods in the center to less dense development on the periphery near the bank of the river. In order to open the view of the water space [4].

Secondly, the presence of the water body has influenced the functional zoning of the area. Along the Seine River, public space and recreational areas are created for residents and visitors to relax and meet. Here you can take advantage of water entertainment (walks on the river) or just enjoy the beautiful places [4].

Thus, the close proximity to the water body - the river Seine - is reflected in the planning area of ZAC Seguin, contributing to the formation of a harmonious and functional development, as well as a comfortable environment for living and recreation.

When analyzing the experience of reorganizing an industrial area in the ZAC Seguin - Rives de Seine, located near the city of Paris, it is possible to identify the basic principles, urban planning techniques and working tools used in the reorganization of the industrial area.
One aspect of shaping a quality urban environment during redevelopment is the development of a structured system of open and pedestrian connections. It is important to create a landscape-ecological framework using environmentally friendly technologies. Diversity in architecture, functionality, and typology of the built-up area is also significant. It is important to create a comfortable living environment and successfully integrate new planning solutions into the existing structure of the city. Consideration of these aspects in urban planning in Russia greatly affects the formation of the attractiveness of the urban environment.

3.1.2 Construction project for the Ørestad district in Copenhagen, Denmark

Ørestad is a project with a diverse use of space that combines residential, commercial and public functions. The goal of the project is to create a picturesque urban environment where people can live, work, relax and enjoy their surroundings.

Under the area was allocated ideally oriented to the sides of the world, a piece of land, the size of 600 meters from west to east, and 5000 - from north to south. This rectangular area is surrounded to the north by developed, established areas of Copenhagen, to the east by private houses, and to the south and west by a natural park on the site of an old artillery range. The area is divided into four sectors with their own character and predominant functions [5].

The neighborhood consists of:

- 60% research and development, business and financial services, and headquarters of multinational companies, providing 50,000 jobs (ODC estimates).
- 20% housing: 8,000 units are planned with an estimated population of 25,000.
- 20% are public and private research institutions, cultural facilities, official institutions, and commercial activities. These institutions will serve approximately 22,000 students [6].

The main urban planning justifications for the Ørestad construction project in Copenhagen include:

- *Mixed use of space:* The project provides a mix of residential and public functions to create a vibrant and dynamic urban neighborhood.
- **Environmental sustainability:** The project uses environmental technology, energy-efficient solutions and loss-reduction measures. The concept includes the use of ecological energy sources, the creation of green areas and the promotion of ecological mobility. Particular attention is paid to green spaces, parking lots, and squares. It is planned to use natural elements such as vegetation, water features, and natural materials to create an attractive and sustainable environment for neighborhood residents.

- **Relationship to infrastructure:** The Bellakvarter project is connected to the city's existing infrastructure, including systems and communications. This creates a convenient connection to other areas of the city and ensures accessibility for residents and visitors. Much attention has also been paid to pedestrian accessibility. In planning, special attention has been given to safe and attractive pedestrian areas. Wide sidewalks, cozy alleys, and pedestrian-friendly streets encourage active pedestrian movement.

- **Urban environment and public space:** The project focuses on creating a high-quality urban environment. It provides for the improvement of parks, squares and walking areas. The goal is to create a comfortable and attractive environment that promotes social activity.

- **Architectural and aesthetic quality:** The Bellakvarter project aims to create architecturally attractive and harmonious spaces. It selects quality architectural firms and designers to develop the area.

The Ørestad district in Copenhagen, Denmark, has achieved impressive results in urban planning. It has become a modern, sustainable and innovative urban district, successfully implementing goals and contributing greatly to the development of Copenhagen.

Erestad attracts attention with its modern architectural and high-level infrastructure, looking at opportunities for living, working and recreation. An important feature of the area is its environmental orientation, where the principles of environmental sustainability, energy efficiency are applied.

Erestad has become a destination that creates a dynamic living environment. It is home to modern apartment complexes, office buildings, stores, restaurants, sports venues and cultural centers, offering a variety of opportunities for diverse leisure activities.

Overall, the Ørestad project in Copenhagen has achieved results, creating a modern and sustainable urban area that is a symbol of modern urban planning and offers a high quality of life and environmental attractiveness.

### 3.2 Domestic experience

#### 3.2.1 Project for the reorganization of the plant ZIL (Likhachev Plant), Moscow

Located on about 300 hectares in the western part of Moscow, the former Likhachev Plant stretches along the Moskva River and borders the Third Ring Road. Its history goes back more than 100 years, from its prosperity in the 1930s and 1940s to its decline in the 1990s. However, in 2011 it was decided to transform the area into a modern district [8].

The projected area is planned divided into two parts - north and south, the boundary of the sites is a district highway, passing from the Third Ring Road to the Andropov Avenue. Along the highway is formed a community center with objects of administrative and business, commercial and residential purpose. [9].

In the northern part of the formed public and communal areas: offices, retail, entertainment and cultural facilities, a fire station at 4 posts, the building of the Department of Internal Affairs and the site of the entertainment facility. Part of the territory is occupied.
by the preserved and reconstructed objects of predominantly communal and industrial purposes. The southern part is dominated by the residential function [9].

When planning the territory of the ZIL plant in Moscow, the following principles were taken into account:

- **Multifunctionality**: The zoning division of the area provides space for a variety of activities, including residential development, commercial facilities, offices, shopping centers, as well as cultural and sports facilities.

- **Sustainability**: Planning is based on environmentally efficient solutions, such as the use of renewable energy sources, energy efficient systems and resource balancing, to ensure the sustainable development of the area.

- **Openness and accessibility**: Great attention is paid to creating an open and accessible environment. Pedestrian zones, bicycle paths, public spaces, parks, and squares are provided for the comfortable movement and recreation of residents and visitors.

- **Restoration and preservation of historical heritage**: The layout takes into account the historical value of the territory of the ZIL plant. Special attention is paid to the restoration and preservation of historic buildings and elements of industrial heritage.

- **Social infrastructure**: The organization of the territory includes the creation of necessary social infrastructure such as schools, kindergartens, medical facilities and other facilities to ensure comfortable living and maintenance of residents.

- **Transport accessibility**: The layout takes into account transport accessibility, including the development of public transport, the creation of convenient transport routes and parking areas.

All these principles played an important role in shaping the plan for organizing the territory of the ZIL plant, creating a balanced and comfortable space.

Fig. 3. Key ideas of territory development [9].
3.2.2 Project for the reorganization of the Great Ivanovo Manufactory, Ivanovo, Russia

The Great Ivanovo Manufactory, located in the city of Ivanovo, Russia, is a prominent textile industry enterprise with a rich history. Founded in the early 18th century, it quickly became one of the leading textile manufacturers in the Russian Empire. During its existence, the manufactory went through many changes and developments. In the 19th century it successfully changed from manual production to machine production, introducing advanced technology and equipment. This greatly increased its productivity and diversity of textile products [10].

The Great Ivanovo Manufactory earned recognition for its high-quality textile products, including cotton and silk fabrics. Its products were known not only in Russia, but were also exported to various countries.

In 2008, the work of the manufactory was stopped, and in 2016 the building was given the status of a cultural heritage site of regional significance [11].

The main task of the project is to create an environment that is not only a new symbol of the city, but also in harmony with its historical heritage. The approach is based on a comprehensive analysis and the use of modern architectural and planning techniques, as well as the desire to preserve the unique image of the building, developed in the history of Ivanovo.

![Fig. 4. Redevelopment project of Bolshaya Ivanovskaya manufactory [12].](image)

When planning the territory of the Great Ivanovo Manufactory in the city of Ivanovo, the following principles are taken into account:

- **Preservation of Historical Heritage**: Emphasis is placed on historic preservation, including the restoration and preservation of historic buildings and elements to preserve the authenticity, and uniqueness of the manufactory.
- **Functional diversity**: The layout provides for a variety of functional areas such as production halls, offices, retail spaces, exhibition and cultural spaces, as well as recreational and leisure areas.
- **Sustainable development**: Includes the use of eco-efficient solutions, renewable energy sources, energy-efficient systems and balanced management of resources to minimize the negative impact on the environment.
- **Creating an open and accessible environment**: The emphasis is on the comfort and convenience of visitors and residents, as well as social activity and interaction through the creation of open spaces, pedestrian zones, parks and squares.
- **Integration with urban infrastructure**: Includes the development of transport accessibility, convenient transportation routes and parking areas for the convenience of visitors and employees.
- **Development of social infrastructure**: provides for the creation of schools, kindergartens, medical facilities and sports fields to ensure a comfortable stay and work for employees and residents of the manufactory.
- **Innovativeness and technological progress**: Modern technologies are used to improve production efficiency and reduce the negative impact on the environment, stimulating the development of research and development.
- **Consideration of community needs and preferences**: Includes public consultation and dialogue with residents and stakeholders to determine the most appropriate solutions and create an environment that meets their expectations.

**Stimulating economic development**: Creating a favorable environment for business and investment contributes to the growth of production, job creation and improved living standards in the city of Ivanovo.

These principles play an important role in the formation of the planning organization of the Greater Ivanovo Manufactory, ensuring sustainable development, preserving historical heritage and creating a comfortable and balanced environment for life, work and leisure.

### 4 Discussion

The study of foreign and domestic experience in the reorganization of industrial zones shows that the application of basic principles plays an important role in the formation of a comfortable urban environment. Innovativeness, sustainable development, preservation of historical heritage, consideration of the needs of society and the development of social and economic infrastructure significantly contribute to the achievement of this goal.

The development of social and economic infrastructure is an integral part of creating a comfortable urban environment. The construction of schools, kindergartens, medical facilities, and sports grounds provides amenities for residents and employees, as well as helping to attract investment and create new jobs.

These approaches not only improve the quality of life for local residents, but also help attract tourists and develop businesses. The preservation and restoration of historic buildings and elements, combined with the use of innovative technologies and environmentally efficient solutions, create a unique and attractive environment for living and working.

### 5 Conclusion

Consideration of community needs and preferences plays a fundamental role in the successful redevelopment of industrial zones. Involving local residents and stakeholders in the decision-making process helps create an environment that meets their expectations and needs. This leads to better interaction within the community and strengthens social ties.

Based on the analysis of this experience, it is recommended that these principles be considered in the development and implementation of plans to transform industrial zones into comfortable urban environments. This approach not only improves the quality of life, but can also create a sustainable and prosperous urban environment as a whole.


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