Revisiting the problem of reconditioning industrial lands in modern urban environment: case of Dalenergomash plant in the city of Khabarovsk

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Abstract. The article is devoted to the problem of renovating the territories of decommissioned industrial facilities. On the example of the territory of the Dalenergomash plant, located in the central part of the city of Khabarovsk, opportunities and prospects for the revitalization of these objects open up. A brief excursion into the history of the enterprise is given. The data of the analysis of the urban planning situation are presented. The main vector of the development of this territory is highlighted, associated with the functional re-profiling of factory premises for trade objects. Recommendations were developed for the development of this territory, ensuring flexibility, attractiveness of the urban environment and expanding the use of urban areas.

1. Introduction

The presence of "dark spots" in the structure of the city is a problem not only of Khabarovsk or post-Soviet cities. In the countries of the former USSR, indeed, the change in the economic model led to a decrease in the production capacity of factories in the industrial and military-industrial sectors, which, in turn, stopped their development. At the moment, most of the industrialization facilities of the 20th century are semi-abandoned, operating many times below their capacity limit, or completely abandoned territories. In addition to financial losses from the downtime of these facilities, such areas primarily have negative consequences for the urban environment. Currently, such facilities are abandoned areas that form gaps in the structure of the city, are inaccessible for through traffic and break the pedestrian links of the city. Also, due to the desolation of these zones, there is a danger of an increase in crime, and the nearby residential areas become less attractive for people to live in. The city of Khabarovsk is no exception, where there are currently several decommissioned and partially decommissioned industrial facilities, the largest of which is the Dalenergomash plant located in the central part of the city. The production capacity of the enterprise dropped to a minimum, and part of the production area was reconstructed for shopping mall, small industrial facilities and warehouses.

This study aims to develop proposals for renovation of the territory of Dalenergomash plant in the Khabarovsk city and to identify the perspective vector of evolution this territory, taking into account the current master plan.
2. Literature review
This research was carried out based on a number of studies by Russian and foreign scientists devoted to this problem.

The problems of renovation of industrial enterprises and modern directions of revitalization of the urban environment are considered in the works of Collaton E., Bartsch C. [1], Lorber L. [2], Louw E., Erwin van Krabben, Van H. [3], Belov V. B., Barabanova K. K., Gromyko A. A [4], Bystrova T. Yu. [5], Mylova Yu. A. [6]. The experience of modernizing industrial facilities on the example of post-Soviet cities is studied in the works of Mazaev, G.V., Verkhovykh, E.Yu. [7], Antyufeev, A.V. [8]. The problem of renovation of industrial facilities in the city of Khabarovsk is considered in publications Arkhipova D. M., Ermolenko D. I., Sadredinov S. A., Bazilevich M. E. [9, 10], Miroshnichenko A. O., Starkova, N. V. Grin, I. Yu. [11–13]. The development of transport infrastructure in the area of the Dalenergomash plant is discussed in the publication of Pugachev I. N. [14].

Thus, a fairly wide range of works has been formed, devoted to the problem of modernization and functional re-profiling industrial objects of the Soviet Union heritage. Nevertheless, a number of unsolved problems remain, including those concerning the renovation of industrial areas in the central part of the city of Khabarovsk. As a result, the problem requires more serious analysis and further study.

3. Materials and methods of research
The main method of this research was a comprehensive study of scientific literature and Internet resources devoted to the problem of renovation and functional re-profiling of industrial facilities. The empirical basis of the work was formed by the materials and results of the field survey conducted by the authors. Analysis of Russian and foreign experience in revitalizing industrial territories, as well as the existing urban planning situation, made it possible to develop specific proposals for renovating the territory of the Dalenergomash plant in the city of Khabarovsk.

4. Results
4.1. Dalenergomash plant
The Dalenergomash enterprise was founded in 1933 as a car repair plant and retained this function until the beginning of the Great Patriotic War. In 1941, the manufacture was redesigned for the production of military facilities: the enterprise was engaged in the production of ammunition and the repair of military equipment. The main direction of the plant's activity was formed already in the post-war years - power engineering, so at the beginning of the 50s the first industrial fan was produced at the enterprise. In subsequent years, the vector of the plant's development was aimed at the production of compressor and power equipment. However, by the beginning of the XXI century, the enterprise had greatly reduced its production capacity. The demand for its products fell and the maintenance of a huge territory became unprofitable. Most of the workshops and facilities of the production cycle were closed. Today, only a small part buildings of the enterprise are functioning, however, this was preceded by several decades of crisis that affected the modern look of the plant [15].

4.2. Current state. Territory and facilities
According to the map of urban planning zoning of Khabarovsk [16], this territory belongs to the business core of the city center. In accordance with the rules of land use and the urban district development "City of Khabarovsk" on this territory, the main types of permitted use include: capital construction objects, including federal, regional and local significance for the purpose of concentration of administrative, business, public, cultural, service and commercial uses in combination with residential and mixed use buildings.

Previously, on the territory of the plant of 49 hectares, there were 25 workshops [15], currently some of them have been converted into shopping malls, the other has been completely destroyed, only 5 manufacture buildings of the plant, and also the administrative block continues to function today.
The territory of the enterprise itself borders on a zone of low-rise individual residential buildings, as well as within this territory there are warehouse facilities and garage cooperatives. In the north-west, the site is bordered by an abandoned construction site of the third stage of the Novy Kvartal business center. On the western side, there are low-rise private residential buildings, as well as individual administrative buildings and an apartment building. On the southwestern side of the site is the still operating production workshop of Dalenergomash factory.

The transport and pedestrian ways is in an unsatisfactory condition. Despite the fact that the object is located in the central part of the city and borders on Karl Marx Street, which is the main central axis, the territory of the enterprise creates a gap in the planning structure of the city, cutting off the opportunity for building pedestrian and car routes have an unpaved surface and do not meet the requirements of convenience and safety, for the organization of car traffic and unhindered access to this area. Also, the issue of renovation is complicated by the complex relief and the presence of scour erosion.

4.3. Development program for the territory of the former Dalenergomash plant

The analysis showed that at present there is a tendency of gradual revitalization of this territory. Its main vector is aimed at functional re-profiling of former factory workshops for commercial objects. As objects of renovation, the developers have chosen buildings adjacent to the transport arteries – Leningradskaya and Rabochiy Gorodok streets. At the same time, part of the plant's territory still remains in a deplorable state, in particular, there is a poor transport accessibility of objects, part of the territory is occupied by technical structures, warehouses, garages and abandoned or destroyed production cycle facilities.

Based on the analysis, a program for the development of this territory is proposed, which includes five main stages:

1) The first stage involves the dismantling of structures not participating in the renovation program. Such a selective path in the reconstruction of structures will make it possible to free up a large area and save only those objects that can be reconstructed and are suitable for further use. For example, garage cooperatives, as well as small technical structures, are planned to be demolished, since they do not have aesthetic value, and their reconstruction is simply impractical, since these are highly specialized objects. Production buildings can be reconstructed, but not all of them, because from many of the workshops of the plant only supporting structures remained - columns, trusses, sometimes walls are partially present – such fragments of structures are not suitable for further use, and their reconstruction is economically unprofitable. First of all, industrial facilities are offered for renovation, which can be re-profiled for other functions and the architectural envelope of which has not undergone serious negative impacts.

2) The second stage involves the implementation of measures to eliminate the technogenic impact on the soil of this territory, as well as the preparation of soils and work to strengthen them. Provides for the organization of water-retaining and drainage shafts, the construction of retaining walls and reclamation measures. First of all, the soil is filled up and strengthened, intended for new construction in this area: buildings, highways and other objects and structures. Backfilling of ravines in the recreational zone of this area may not be advisable; instead, it is proposed to strengthen the soil, arrange terraced paths and observation points, and in the depressions of the relief – to create a number of artificial reservoirs.

3) The third stage includes work on the formation of a transport frame by creating internal passages and organizing direct connections with highways of city significance, the arrangement of exits from Karl Marx, Rabochiy Gorodok and Sechenov streets. In order to reduce the density of traffic flows, the project provides for open parking lots and parking pockets for cars. On the territory of the projected public and business center, there are pedestrian paths with intersections of motorways at unregulated pedestrian crossings. The crossings are made above the level of the roadbed, on the same level with the sidewalks. This makes it possible to create an artificial obstacle for road transport, to provide better accessibility to pedestrian paths, and also to increase safety.
These measures will allow not only to organize the movement of road transport on the projected territory, but also to reduce the load on the existing road network in this area of the city.

4) The fourth stage involves the creation of an open public and business zone in the north-western part of the site through the construction of a multifunctional center, which will become the main point of attraction for this territory and will engage the attention of the city administration and private investors. The construction of the business complex forms the "core" of this area and will become a place of attraction for various groups of the population with different social and consumer needs: residents of nearby districts, representatives of small and large businesses, as well as city guests.

An analysis of the surrounding buildings and the peculiarities of the visual perception of this fragment of the territory, mainly from the traffic intersection at the intersection of the main streets of Karl Marx and Prospect 60th Anniversary of October, suggests the need to build a multi-storey public building. The projected object consists of four volumes-towers of different heights, united by a common stylobate at the level of the first floor. Its roof serves as an open landscaped terrace. The main volumes have different number of storeys and floor heights, due to their functional purpose. Since the building is located below the level of the central axis of the city – Karl Marx st., the complex will not rise much above the surrounding buildings. But thanks to the free location on the site, it will be clearly visible from various points.

5) The fifth, final stage involves a comprehensive improvement of the territory. The planting of arrays of green spaces is envisaged for the organization of noise protection and strengthening of soils and prevention of gully erosion. In the central part of the site, it is proposed to create a recreational and walking area, which includes exhibition halls obtained through the reconstruction of industrial structures, extensive park zones, and the creation of decorative artificial reservoirs.

Thus, the formation of a modern and flexible urban environment will help to increase the aesthetic and economic attractiveness of the area, and will create a platform for the implementation of various investment projects, holding public and exhibition events, and will also provide an opportunity for the sale of products of private entrepreneurs.

5. Conclusion
There are many examples in the world of reconstruction and arrangement of industrial facilities. This problem is not new and is quite relevant, because a modern city implies openness, accessibility and safety. Enterprises within the city are becoming less and less in demand today. Proposals for the renovation of these territories are individual and directly depend on the existing facility, the needs of residents of the city and nearby areas. This work proposes the development of the territory of the Dalenergomash plant in the city of Khabarovsk by creating a flexible modern urban environment, involving reconstructed production facilities in it and building a public and business center, which will become a place of attraction for many city residents. Such changes will expand the usable area of the city by changing the unused territories.

References
[1] Collaton E, Bartsch C 1996 Industrial Site Reuse and Urban Redevelopment – An Overview. *Cityscape: A Journal of Policy Development and Research* (September 1996, Vol. 2) (Washington: U.S. Department of Housing and Urban Development. Office of Policy Development and Research) 3 pp 17–61
[2] Lorber L 2014 Holistic Approach to Revitalised Old Industrial Areas *Materials of the 3rd International Geography Symposium. Procedia – Social and Behavioral Sciences* (Amsterdam: Elsevier) 120 (2014) pp 326–334
[3] Louw E, Erwin van Krabben, Van H 2007 Amsterdam Spatial efficiency of industrial land *Materials of 47th Congress of the European Regional Science Association in Paris* (Paris: Urban and Mobility Studies) 25 p
[4] Belov V B, Barabanova K K, Gromyko A A 2004 Experience of reorganization of industrial territories in large industrial cities of Europe (on the example of Paris, London, Berlin)
(Moscow: Lights of Moscow) 84 p

[5] Bystrova T Yu 2014 Park Emsher: principles and methods of rehabilitation of industrial territories *Academic Bulletin UralNIIProekt RAACS* (Yekaterinburg: Branch of the FSBI “TsNIIP of the Ministry of Construction of Russia” of the Order of the Badge of Honor Ural Research and Design Institute) 2 pp 9–14

[6] Mylova Yu A 2018 Renovation of landscape infrastructure of an industrial city (on the example of Komsomolsk-on-Amur) *Architecton: Proceedings of Higher Education* 2 (62), available at: http://archvuz.ru/2018_2/8

[7] Mazaev G V, Verkhovykh E Yu 2017 The influence of post-industrialism ideas on the development of industrial cities of the Urals *Academic Bulletin UralNIIProekt RAACS* (Yekaterinburg: Branch of the FSBI “TsNIIP of the Ministry of Construction of Russia” of the Order of the Badge of Honor Ural Research and Design Institute) 4 pp 11–6

[8] Antyufeev A V 2015 Urban planning renovation of depressed industrial areas in large industrial cities (on the example of Volgograd) *Biosphere compatibility: Materials of the general meeting of the RAASN in Kursk* (Kursk: Southwestern State University, Bryansk State Engineering and Technological University, Research Institute of Building Physics RAACS) 9 pp 100–105

[9] Arkhipova D M, Ermolenko D I, Bazilevich M E 2018 On the problem of re-use of industrial objects. The experience of Khabarovsk *Architecton: Proceedings of Higher Education* 3 (63), available at: http://archvuz.ru/en/2018_3/15

[10] Sadredinov S A and Bazilevich M E 2020 Perspective directions of development of waste processing enterprises in Khabarovsk *IOP Conf. Ser.: Mater. Sci. Eng.* 775 012033 https://doi.org/10.1088/1757-899X/775/1/012033

[11] Miroshnichenko A O, Grin I Yu 2015 Modernization of green spaces in industrial areas in Europe *The new Ideas of New Century – 2015 : The Fifteenth International Scientific Conference Proceedings* (Khabarovsk: Pacific National University) Vol 2 pp 161–7

[12] Miroshnichenko A O, Grin I Yu 2016 Reconstruction of the industrial area of the Dal dizel plant in Khabarovsk *The new Ideas of New Century – 2016 : The Sixteenth International Scientific Conference Proceedings* (Khabarovsk: Pacific National University) Vol 2 pp 198–204

[13] Starkova N V, Grin I Yu 2016 Modernization of the territory of the Dalenergomash plant based on a flexible urban structure in the city of Khabarovsk *The new Ideas of New Century – 2016 : The Sixteenth International Scientific Conference Proceedings* Vol 2 (Khabarovsk: Pacific National University) pp 297–303

[14] Pugachev I N 2015 Development of transport infrastructure in the area of the Dalenergomash plant in Khabarovsk *The Far East: Problems of Development of the Architecture, Construction and Road Transport Complex: Materials of the International Scientific and Practical Conference* (Khabarovsk: Pacific National University) pp 76–82

[15] The Dalenergomash plant in Khabarovsk has lost its former greatness, available at: https://amurmedia.ru/news/258002/

[16] The current master plan of the city of Khabarovsk Portal of the administration of the city of Khabarovsk, available at: https://dasiz.khabarovskadm.ru/town-planning/gen_plan/