

## Article

# Potential and Opportunities of Use of Postindustrial Buildings and Territories for Urban Development: Case Studies of the Historical Area in Lviv (Ukraine)

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**Abstract:** Industrial objects constructed between the XIX century and the first half of the XX century were scattered outside the historical city center. However, they are currently located within the boundaries of the historical area of a big city. Postindustrial objects that have lost their initial function create opportunities for city development. An urgent problem of urban planning in Lviv is to determine the prospects for the development and reconstruction of industrial areas, complexes, and buildings. The purpose of the work is to identify the modern urban trends in the development process of postindustrial areas located in the historic area of Lviv, as well as its compliance with the city development strategy. The article investigates the connection of new objects with the main functions of the district, provides a historical excursion of their development, on-site studies, and a comparative analysis of objects with the goals of the master plan of Lviv and of the integrated concept of development of the central part of the city. The studied objects of the urban revitalization of postindustrial buildings and areas are grouped according to new dominant function: 1—Development of the creative industry; 2—Revalued multifunctional areas; 3—Implementation of the concept of city center expansion; 4—Reconstruction of historical localities, and 5—Creation of new residential complexes. The authors consider the process of re-urbanization in some particular postindustrial areas and objects as a search for ideas to generalize their use for the whole city. The intensive industrial development of the city during the Soviet period led to strict regulation of other areas. After obtaining independence, there is an opportunity to fix the imbalance. This process occurs in different ways. In particular, the “in situ” review provides an opportunity to understand the development of the territory—whether it follows the master plan (or contradicts it), whether it meets the new development strategy of the city, whether it meets the needs of the local community, or meets the interests of developers only.

**Keywords:** city center expansion; development of the creative industry; historical area; Lviv; model of urban development; multifunctional areas; new residential complexes; postindustrial buildings and territories; revalued multifunctional areas; revitalization; urban planning; urban renewal

## 1. Introduction

The general scheme of the planning framework in Ukraine is based on (i) the development of regional and local settlement systems and (ii) the prospects of the development of settlements of various types. For the largest cities of Ukraine, such as Kyiv, Kharkiv, Dnipro, Donetsk [under Russian occupation since 2014], Odesa, and Lviv, development involves considering the effective use of their social and economic potential and advantages of geographical locations with their development as centers of economic activity, innovations and highly specialized public services [1].

The spatial organization of the economy and the distribution of population in the country should optimally contribute to its effective and innovative development on a democratic basis. Achieving this goal in modern conditions is possible only on the basis of decentralization, the leveling of territorial disparities, and the development of a network society [2].

The polycentric model of the city structure was laid down in the general plans of Lviv in the 1970s and is gradually being implemented by various means. The compact city model, embedded in the concept of the Integrated Development of Lviv in 2021, ensures the development of the polycentric model and introduces the “compact city (city of short distances)” model, which helps to overcome critical problems created by modernist doctrines of functional zoning of the city [3]. The development of postindustrial buildings and territories helps to implement the abovementioned models faster. However, there are no universal approaches to postindustrial re-urbanization. The approach depends on the political will of the local authorities, economic reasons, and investment opportunities.

According to Koshelyuk and Toman, in order to determine which method of development of new territories is promising from this point of view, it is necessary to understand what is becoming “city-forming elements” for cities today, in the postindustrial era. Examples of successful urban modernization projects that have been implemented over the past decades give us the answer: almost all of them revolve around the creation of new “centers of activity”. These are new business centers, technology parks, incubators, centers for the development of new technologies and knowledge, creative industries, logistics hubs, etc. It is not about an updated, modern analog of monofunctional “industrial zones” but rather about multifunctional areas where opportunities for starting new businesses, various types of employment, and new quality of housing and leisure are realized [4].

Processes of the revitalization of post-industrial territories revealed the problem of inconsistency of city master plans with modern directions of urban development. The master plans were created on the basis of the Soviet methodology and were subject to adjustment, which for some time has been the main document for the development of cities for decades. As an alternative, from 2009 to 2011, an interdisciplinary working group of the city council worked on the development of the first in Ukraine “Integrated Concept of Action” for the historic center of Lviv, which in 2011 was approved by the Lviv City Council [5]. As an extension of this concept, the “Integrated Development Concept: Lviv 2030” was developed and approved on 9 July 2021. It considers the city as a whole and organizes all dynamic urban processes. After all, urban planning and housing, mobility and technical infrastructure, culture and cultural heritage, education and social spheres, tourism, public landscaping, economy, the labor market, and management can be considered as a complex of components with close connections and interaction. The use of the synergetic effect of which will allow the city to respond in advance to changes in conditions and those challenges that stand in the way of successful and sustainable development, during which all the potential and resources of the city will be used [6].

After World War Two and until the 1990s, Lviv developed according to the Soviet ideological paradigm. The city was being industrialized, which was accompanied by an influx of new population and the construction of large residential areas, which caused the expansive development of the city. At the same time, the central part of the city was not properly estimated. However, it had not undergone radical intervention [7]. In the postwar decade, the principles of radical modernist planning began to be criticized, such

as the construction of highways through urban neighborhoods or the policy of cleaning (=destroying) city slums. During the 1960s, alternative views about city life were developed, which, de facto, led to the disappearance of planned urban renewal by the 1970s, and the ideas of modernism lost their assertiveness. The set of ideas and institutions supported and mutually reinforced the so-called “order of urban renewal”. “The order of urban renewal” was presented as a set of aesthetic preferences, expertise, state policy, and local government [8–10]. Recent discoveries and inventions such as new construction materials, artificial intelligence [11–13], concepts of the internet of things, and smart cities [11,14–16] are rapidly changing the architecture and operating principles of cities [17]. That is why relevant and effective strategies for preserving their historical heritage are needed. Many countries have successfully harmonized urban renewal and its alternatives [18]. The goal of all reconstructions of cities, in the long run, is to ensure the comfort of residents in the long term [19].

City renewal programs are manifested through the creation of economic value of a certain area and activities of revitalization [20,21], and wider urban renewal and urban redevelopment. These processes usually are (if they receive a different assessment among experts and citizens) an important measure against the uncontrolled urban spread and improve urban environment [22]. This refers to large-scale activities (e.g., in a city district or part of a city) and in relation to many areas of urban functioning (e.g., architectural, social, economic, or cultural areas) [21,23]. The concept of revitalization is defined as a process of spatial, social, and economic change in degraded urban areas. Degradation refers to the deterioration of urban infrastructure, as well as negative phenomena occurring in the social sphere. Revitalization should contribute to improving the quality of life of residents, restoring spatial order, economic revival, and restoring social ties at different levels of urban planning [18,24,25].

Revitalization is a long-term and purposeful process of overcoming degraded areas from the crisis state, which is carried out comprehensively, through complex measures for the benefit of the local community, through complex projects (it integrates interventions with the local community, space, and local economy), territorially oriented and conducted in cooperation with the local community. Revitalization measures ultimately represent a project, group of projects, or other measures, including social, economic, urban, construction, environmental, ecological nature protection, educational, scientific, medical, or cultural, which are included or are the result of a revitalization program and are logically related with the content and objectives of the city (regional) revitalization program. The studies of revitalization cases are numerous [26–28] because they are very relevant in the modern world. The problem of revitalization is very relevant in former socialist countries because of specific conditions of their development after World War Two [29–31].

The process of re-urbanization of postindustrial areas in cities with a long history and a significant cultural heritage is particularly difficult due to numerous limitations. More than 70% of cultural heritage properties inscribed on the World Heritage List are either located in urban areas or have urban areas within their nominated areas. The 1092 properties on the World Heritage List today include more than 2700 cities/towns in 624 cultural and mixed heritage properties [32–37].

Postindustrial heritage became an integral part of the identity of cities, which requires special approaches to the preservation of these objects in the fabric of the city. The cultural response to conservation actions and the greater idea of preserving heritage do not contradict each other philosophically or morally. In other words, the recasting of conservation plans based on the social, cultural, and economic dimensions of society urges the need for a national charter that conforms to the needs and essence of the society [38].

It is important to preserve the originality of postindustrial buildings, and intervention methods should have the minimum effect on the body and structure of the building when applying the adaptive measures [39].

To develop strategies of adaptive reuse of industrial buildings, the program approach is applied. It constitutes the search for a new appropriate function, principles of intervention

design (principles related to the physical problems of the building), and the technical aspect of the reuse. The ownership status of the buildings is another important factor during their restoration. That is why the re-adaptation of industrial buildings in the world is always challenging. Thus, industrial buildings are usually converted into multifunctional buildings and/or museums [40].

In addition to the zone under the protection of UNESCO, the historical area of Lviv covers a much larger area, which was actually built before 1939 [41], where a buffer zone regime is established with clear architectural and environmental limitations. However, the valuable historical build fabric suffered numerous losses in World War II and was supplemented by new construction, according to the Soviet directions of industrialization and mass housing. Also, the old industrial enterprises were drastically renovated and expanded. After the severe economic crisis in Ukraine of the 1990s, they went bankrupt and were restructured or entered the land market as plots for new investments [42].

The results of original research present built heritage in the process of revitalization [43–46]. The practice of transforming industrial areas in large cities into new multifunctional buildings is of great interest as well [47–55]. The problem of renewal of urban industrial areas in the context of architecture, construction, and reconstruction was studied, too [56–63]. Foreign scholars [64–74] have widely studied the concept of renewal theoretically and on the basis of examples from certain cities. In recent years, the problem of “redevelopment of industrial zones” has been studied thoroughly [71,72]. The studies conducted in Crakow [73] are of particular interest because history, urban processes, and problems are similar to that of Lviv.

Today the theory of Professor Paul Syms [74] can be considered one of the most rational ones. According to this theory, the following aspects of the development of post-industrial territories are allocated: reserve, ecological, aesthetic, political, and social [75].

The land clearing of contamination by the products of industrial enterprises, their reclamation and revitalization, and, consequently, the further thoughtful use for the actual needs of the city perhaps best demonstrate the approaches to the concept of sustainable development in practice. The impact of human life on natural resources is thoroughly described in studies [76–78]. The use of industrial areas as an alternative to the building of free lands around the city and, consequently, their preservation should be considered an important component of ecosystem conservation. Today, the environmental component of the issue of adaptation of industrial areas and its need in Ukraine are not considered as sharply as, for example, it is done in Central Europe (Germany, Poland, Austria, Czech Republic) [79–81]. There are currently no mechanisms in Ukraine to encourage the adaptation of land contaminated with industrial waste. However, the creation of a healthy environment through environmentally friendly approaches is the key to the continued successful operation of the project.

In Ukraine, the problem of the social, economic, and environmental decline of urban areas requires a comprehensive approach, namely the adoption of a law on revitalization and the development of an appropriate program [82]. An important component of the success of the revitalization program should be public participation in the discussion and solution of problems to ensure sustainable urban development [83]. Liquidation of scarce residential buildings is connected with many risks in this field (of sustainable urban development) [84]. It should also be noted that cities usually face a lack of consolidated efforts during their transformation [85].

Lviv has a specific history, which is reflected in the stages of development of the city and its multicultural heritage. Therefore, revitalization measures do not only solve pragmatic problems but also take place under the influence of the modern vision of the city and the implementation of city development programs.

The protracted crisis after the collapse of the USSR and the disintegration of the former industrial potential in terms of urban planning contributed to the formation of vast degraded areas in cities, which became dangerous. All over the world in recent decades there has been a problem with the necessary revitalization of postindustrial urban

spaces in conditions of the growing population of large cities. The need to intervene in former industrial areas is also based on the need to eliminate permanent negative problems: social, economic, spatial, and environmental. Despite many problems that arise in these areas, they are, at the same time, potential areas of great importance in the context of urban development. Reuse of the former industrial areas gives a chance in accordance with the principles of sustainable development. A holistic approach to the revitalization process is desirable for many problem cities, and urban revitalization should be focused on human needs.

The hypothesis of the study is that the pressure of requests of a big modern city, which is under the process of transformation from socialist planning to a modern open society, the redevelopment of postindustrial territories and buildings allows quick adjustment of the development of the city in the right direction. This process results in certain functional models, which will be different with respect to the location of the territory, the state of the postindustrial heritage, its capacity, social requests, and investment opportunities.

## 2. Materials and Methods

The methodology of this research includes the components as follows: literature analysis (printed and online sources), archival materials (dedicated to the city planning), and documents about the development strategy of Lviv and its public discussion.

Some of the postindustrial territories in Lviv were selected for analysis: these are completed postindustrial facilities and territories located in the historic area of Lviv: the buffer zone around the historical center, which belongs to the UNESCO World Heritage Sites).

The following sequence of research was applied:

- connection of the new object with the main functions of the district;
- historical excursion of development of the previous object (territory) for the purpose of revealing valuable characteristics and a critical estimation concerning their preservation and continuation of the tradition of a place;
- comparative analysis of new objects (town-planning formations) with the purposes of the actual general plan of Lviv;
- inspection of a new object on-site—"in situ" and identification of problems or issues of discussion. The received materials were compared to conclusions from world practices, as well as checked if they comply with the development strategy of Lviv. Determining urban density is considered the main technical tool of comparative analysis.

The purpose of the work is to identify ways to use modern urban trends in the development of postindustrial areas located in the historic area of Lviv, as well as compliance of new development with local strategic plans and local regulations.

Formation of approaches to revitalization.

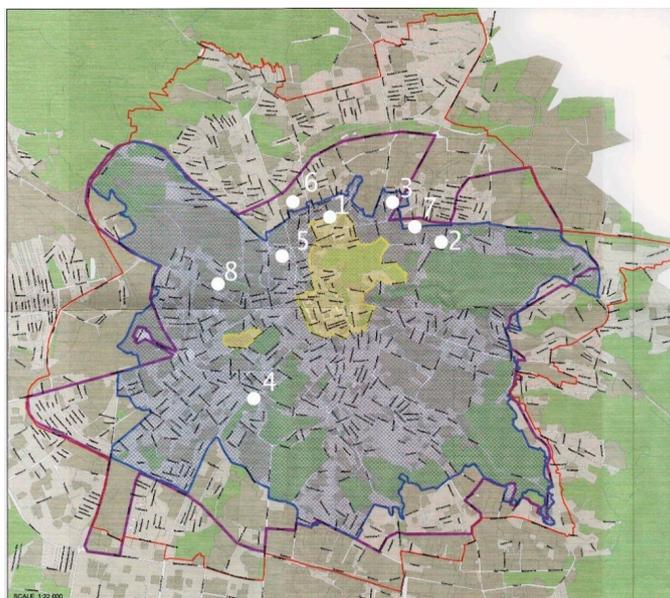
The iconic modernist Master plan of the city of Lviv, which embodied the ideas of Soviet industrialization, was developed by the State Institute of Urban Design (Kyiv), and it was approved in 1966 for the development period up to 1985 to 1990. The document provided for an increase in population from 450 to 700 thousand residents, thorough development of the transport network on the basis of modernist approaches, and mass housing construction on the outskirts of the city [86]. The location of new large industrial facilities in Lviv and the development of existing ones led to the formation of an agglomeration based on the constant migration of workers [87]. Given the high historical value, no significant alterations were planned in the historic center of Lviv, unlike earlier visions. Soviet industry in historic cities was formed in areas that were already used for industrial purposes earlier, and they were restructured with a different function again. Only in the 70–80th years were new types of industry developed in new areas on the outskirts.

In the project of detailed planning of the central part of Lviv in 1970 [88,89], which was developed as a detailing of the Master plan of 1966, the need to allocate the historic part of the city in a separate regime zone with its specific status was taken into account when preparing proposals for the creation of a historical and architectural reserve in Lviv. It was created in 1975 on a territory with mostly historic buildings and an occupied area of

120 hectares, a whole complex where unique architectural and urban ensembles of princely and medieval Lviv have been preserved [7] (Figure 1).

Thanks to forehanded measures to revitalize the environment, the historic center of Lviv is recognized worldwide today. In accordance with the regional building rules of Lviv region, adopted in 2009, in the presence of cultural heritage sites or subject to the inclusion of the settlement in the list of historical settlements of Ukraine, the historical and architectural reference plan was developed as part of urban planning documentation. This plan defines boundaries and modes of use of monument protection zones. In addition, the projects of town-planning documentation developed and approved in the order established by the legislation and which have passed the state examination are subject to public discussion [90].

In the project “Adjustment of the Master plan of Lviv” (2006–2008, approved in 2010, for the period up to 2025), the priority is the development of the city in the direction of its reconstruction, i.e., updating and increasing the capacity of existing systems to ensure its operation, restructuring production complex and expansion of the sectoral structure of economic activity, improvement of the planning structure of the city with a change in the functional use of a number of territories, preservation, and restoration of historical heritage, protection and rehabilitation of the environment. The Master plan analyzes the use of land within the existing city boundaries and identifies areas suitable for housing due to the removal and liquidation of enterprises, warehouses, bases, and plots due to the removal of military units and production facilities in different parts of the city. The General Plan takes into account the boundaries and regime of monument protection zones, adopted in accordance with the historical and architectural plan of the city of Lviv (2005), which states: the territory under the protection of UNESCO; historical area of Lviv; building regulation zone; historical landscape protection zone. For each protection zone, a regime has been established that meets the requirements for the protection of monuments and the environment as an integral complex, which plays a leading role in shaping the image of the city [91].

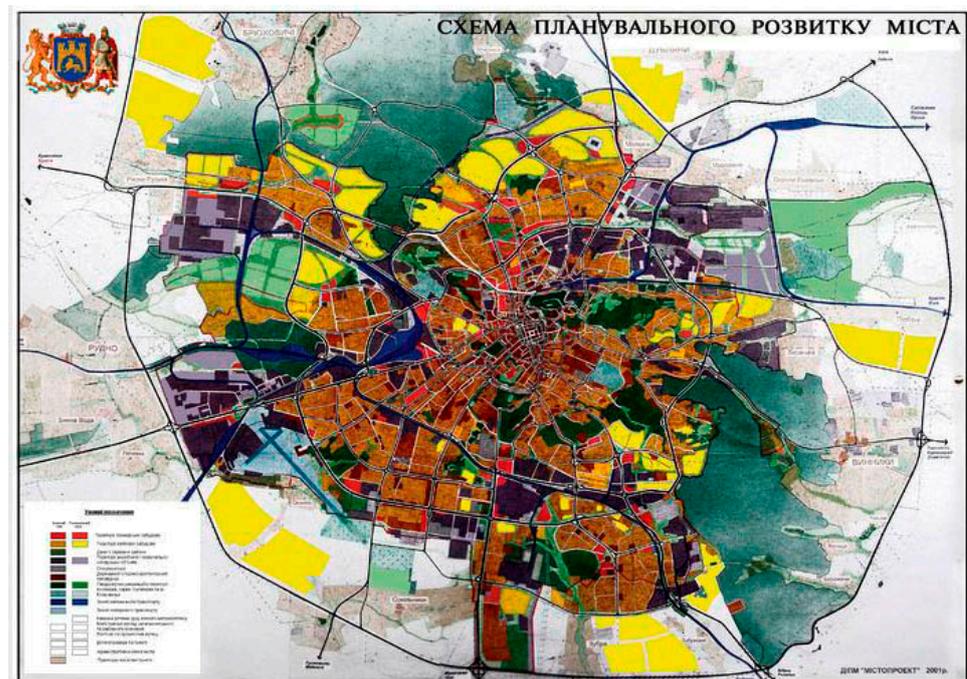


**Figure 1.** Boundaries of the Historic Area of the City of Lviv (2005) [92]. Symbols: zone A (yellow)—the territory of the ensemble of the historic center Lviv, listed as a UNESCO World Heritage Site; zone B (blue)—the proposed boundaries of the historic area; zone C (red line)—building regulation zone and (pink line)—boundaries of the territory of historical and cultural preservation. The locations considered in this paper are marked by dots and numbers (numeration is the same as in Table 1).

Within the historic area, according to the current Master plan of Lviv, it is impossible to launch new construction, with the exception of restoration works and partial reconstruction of residential quarters but strictly following the scale and character of the historic building. In this context, the construction of postindustrial areas cannot violate public rights and interests. Namely, the planned construction object cannot be a disharmonious structure within the historic area of the city of Lviv and its landscape, cause physical and aesthetic damage to monuments, their perception and the perception of the historic environment of Lviv, disrupt the architectural and spatial organization of the historical area, valuable historical layouts, or negatively affect the layout and form of buildings from previous periods.

For each territory or building which are subjected to reconstruction, urban planning conditions and land plot development restrictions are fulfilled. The document contains the set of planning and architectural requirements for the design and construction with respect to the floor plan and density of the land plot, margins of buildings and structures from red lines, land plot borders, its landscape, other requirements for construction objects established by legislation and urban planning documentation (clause 8, part 1, art. 1 of [93]). The reconstruction project includes a historical and urban planning justification for the reconstruction project, which is approved by the Department of Historical Environment Protection of Lviv.

Calculations carried out for the master plan of Lviv for the period up to 2025 note a chronic lack of residential buildings and identified a number of territories for developing residential areas and quarters. Some of them are located in postindustrial areas within the historic area (see Figure 2).



**Figure 2.** Areas provided for housing of varying intensity (highlighted in yellow) within the city edge (red line), according to the Master plan of the city 2025. Source: The map of detailed plans and public discussions [94].

### 3. Results

Based on the master plan and the strategy of development of Lviv, the main priorities in the use of postindustrial territories and buildings were determined as follows [91,95]: Priority 1—expansion of the list of city functions (expansion of central functions of the

city, development of private entrepreneurship, development of creative industries, etc.); Priority 2—housing construction.

The historical area of Lviv is the field of implementation of both priorities based on various models of urban development.

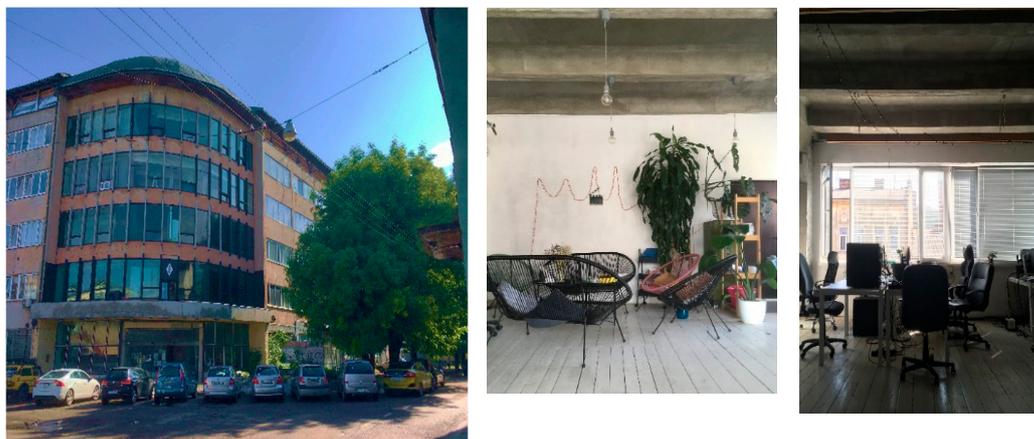
Let us consider some selected examples of the revitalization of industrial objects and areas in the historic area of the city, which characterize the directions of re-urbanization of the city in the buffer zone (zone B). This area surrounds the central part of the city. In fact, it is close to the boundaries of the built-up area of the city before the Second World War. The industrial heritage here has remained in the form of enclaves of different sizes, which are actively now subject to regeneration, but with other functions. The rules and regulations acting in the field of building and reconstruction are given in the State building rules of Ukraine [96]. The considered cases of the urban revitalization of postindustrial buildings and territories are grouped into five models according to new main functions and the concepts of their usage.

### 3.1. Model 1: Development of the Creative Industry

Successful projects have developed near the center thanks to private and municipal investments. There are some interesting examples of the revitalization of postindustrial buildings, which began to affect the environment. In this group, we consider a few popular locations that have got a second life without big investments.

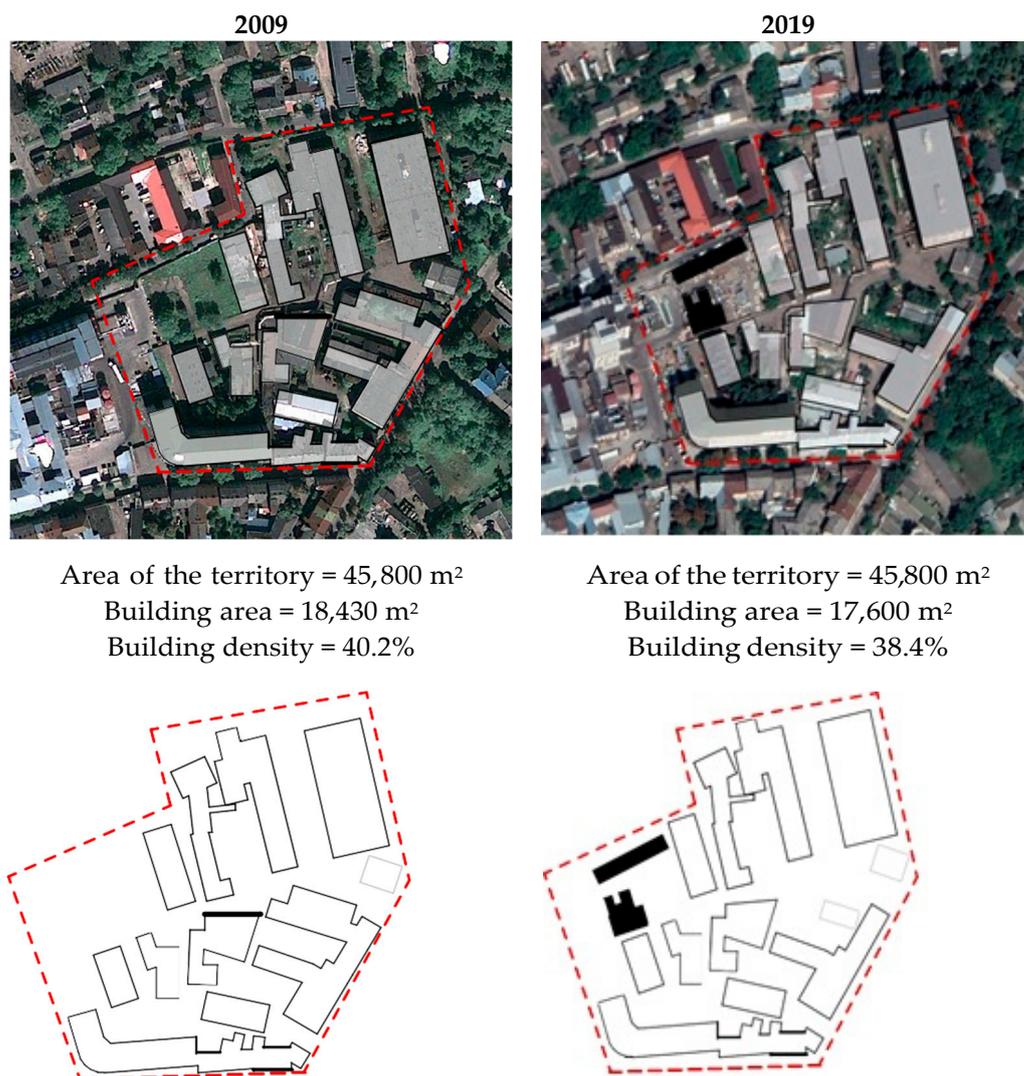
#### 3.1.1. Plant REMA-ReZavod: A Creative Quarter at Zavodska Street

Since 2015, the former plant REMA (Lviv factory of radio-electronic medical equipment) leases most of the production space, creating a creative environment ReZavod, where there are workshops, galleries of contemporary and street art, offices, a photo studio, a party area and a sorting yard (Figure 3) [97]. The area is located in the historical district of Pidzamche, with strict limitations on the height of buildings. Thus, private investors are not interested in constructing commercial and residential buildings.



**Figure 3.** New use of the former plant REMA = ReZavod (photo by O. Kryvoruchko, 2021).

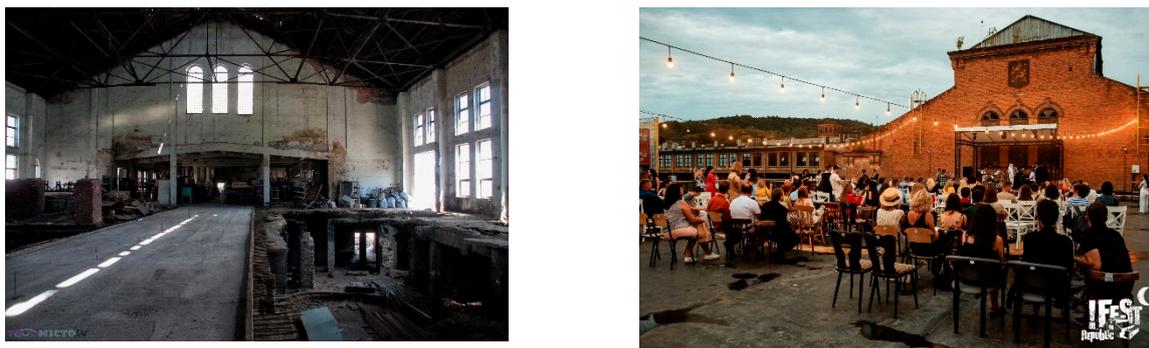
Architectural and design interventions carried out by numerous tenants relate to the interiors with the aim of rehabilitation to improve functional convenience. A common recreational space and a cafe on the ground floor were created. The flexible, functional structure allowed for quickly finding the room to accommodate more than 200 internally displaced persons from the east of Ukraine when the Russian aggression began on 24 February 2022. The development of the territory remains almost unchanged except for the dismantling of two auxiliary buildings and the construction of new ones instead of them (see Figure 4). It is possible that the stagnation (conservation) of the postindustrial state will change with a change of owner.



**Figure 4.** Comparative analysis of the territory of the former plant REMA (by O. Kryvoruchko, 2022).

### 3.1.2. Halychsklo Plant (Halychglass)—“!FEST Republic”

In 2015, the territory of the former glass factory, i.e., the Halychsklo (Halychglass) plant (Staroznesenska Street), was turned into a space for parties and work “!FEST republic” based on the holding of !FEST [98]. Back in the early 2000s, sand was brought to the Halychsklo plant, a glass furnace worked there, and bottles for the pharmaceutical industry were blown out. After several financial transactions and resales, the company went bankrupt, and the territory was put up for sale. The !FEST company thought that it would be profitable for them to buy this abandoned plant and convert it into a unique “!FEST town”. The idea of the new space is that this place will become an alternative to the city center, and people will find here all the necessary infrastructure for entertainment and recreation [98]. This area became a venue for festivals and numerous events, and today it is a popular gastronomic trending location [99]. The parameters of the existing brick building of the XIX century did not change, but new functions were added to the territory with some auxiliary light constructions (see Figure 5).



**Figure 5.** Left-hand side—conditions of the Halychsko plant before the revitalization [100]. Right-hand side—modern conditions [101].

Administrative building of the former Jam factory—Children’s library “Pid Vysokym zamkom” at Khmelnytsky Str. 127.

The administrative building of the former Jam factory on B. Khmelnytsky Street is not included in the modern concept of factory development [102]. Today it belongs to the city and is used as a children’s library. However, the building was restored at the expense of the city, and today is a powerful point for the youth in the Pidzamche district (see Figure 6). The project was implemented with municipal funding. The historical building is an architectural monument, and the facades have their details restored. According to the project, the library received modern interiors—a special podium for theatrical performances and for relaxation, many convenient reading niches embedded into bookcases, and a special green playground slide for the youngest visitors.



**Figure 6.** An example of the revitalization of industrial architecture—the administrative building of the former Jam factory on B. Khmelnytsky Street. Later, in Soviet times, the house was used as a liquor store, and today—a children’s library. Restored at city expense. Project of restoration by O. Kryvoruchko, 2019. Source: photos by O. Kryvoruchko, 2020 [103].

### 3.1.3. Tram Depot of Sakharov and Vitovsky Streets—Lem Station

Since 2016, the old tram depot at the intersection of Sakharov and Vitovsky Streets has been transformed into an innovative, creative center Lem Station, which will become a crossroad of self-realization of artists, entrepreneurs, scientists, and other representatives of the creative industries (Figure 7).



**Figure 7.** Action in Lem Station, 2017, photo by O. Kryvoruchko, 2017.

The tram depot, together with the first Lviv power station at the intersection of the modern-day streets of Heroiv Maidanu, Vitovsky, and Sakharov, was built in 1894 according to the project of Alfred Kamieniobrodzki. It was rebuilt and extended twice: at the beginning of the 20th century and in the 1920s. The plan for the new project is to preserve the historical part of the station as much as possible without additional buildings and leave the facades, roof structure, and windows without changes. Tram tracks will remain, but they will have to be restored. The “Creative Quarter” was named the Lem Station—after Polish science fiction writer Stanislaw Lem, who was born and lived in Lviv. The project will combine innovation and the historic atmosphere of the depot.

The Lem Station will primarily be a place for entrepreneurs to communicate. However, there will also be centers for children, workshops, a post office, an amphitheater, an eco-park, a parking lot, and a concert hall. In 2019 the first concerts of instrumental music were carried out there. The Lviv City Council plans to announce an investment tender to find either Ukrainian or foreign companies willing to cover the project expenses. Under the terms of the tender, the depot will remain the property of the city community, but the investor will be able to use the Lem Station for commercial use. However, some buildings of the depot (in particular, the right-hand side hangar) remain the property of Lviv Electrotrans due to the considerable investments made by the Transport and Communications Department of the Lviv City Council. The left-hand side hangar—on the side of Heroiv Maidanu Street—is rented out by the Lviv Historical Museum, where twenty years ago, they planned to create a science and technology museum. Currently, exhibitions and trade events are carried out there [104].

### 3.2. Model 2: Revalued Multifunctional Areas

#### Gas Equipment Plant—FORUM

Until recently, Dzherelna Street was positioned as one of the centers of industry, which was once adjacent to the German gas equipment plant of the XIX century, as well as various production and repair shops. However, today most industrial buildings in this area are either converted to new functions—hostel, bakery, bank, nightclub, retail, and office space or abandoned. The former territory of the gas equipment plant was fragmented and sold in parts for various purposes, which has complicated the adoption of a common concept of re-urbanization of this object [105]. In a part of the privately owned plant, until 2018, there were gas buildings since 1858 with extensions of the postwar period. Today only the water tower is preserved there.

The owners of the northern part of the plant opened the Forum Lviv shopping mall in 2015, which at the time was the largest shopping and entertainment center within the city. It became a magnet for people and investment, launching the process of the area reviving. This event, in turn, became a catalyst for the active use of neighboring postindustrial areas, which, one by one, began to change their purpose. Some of these postindustrial areas are bordered or located in the immediate vicinity of the railway, which creates additional restrictions and difficulties in the process of returning them to active operation by the city [106]. The area has been closed for decades. Recently, it has become a

transit intersection for the massive flow of people. The underground parking freed up the surrounding streets to create pedestrian areas [107]. The building density of the territory has increased by more than two times. The newly constructed buildings correspond to the scale of the environment (see Figures 8–11).



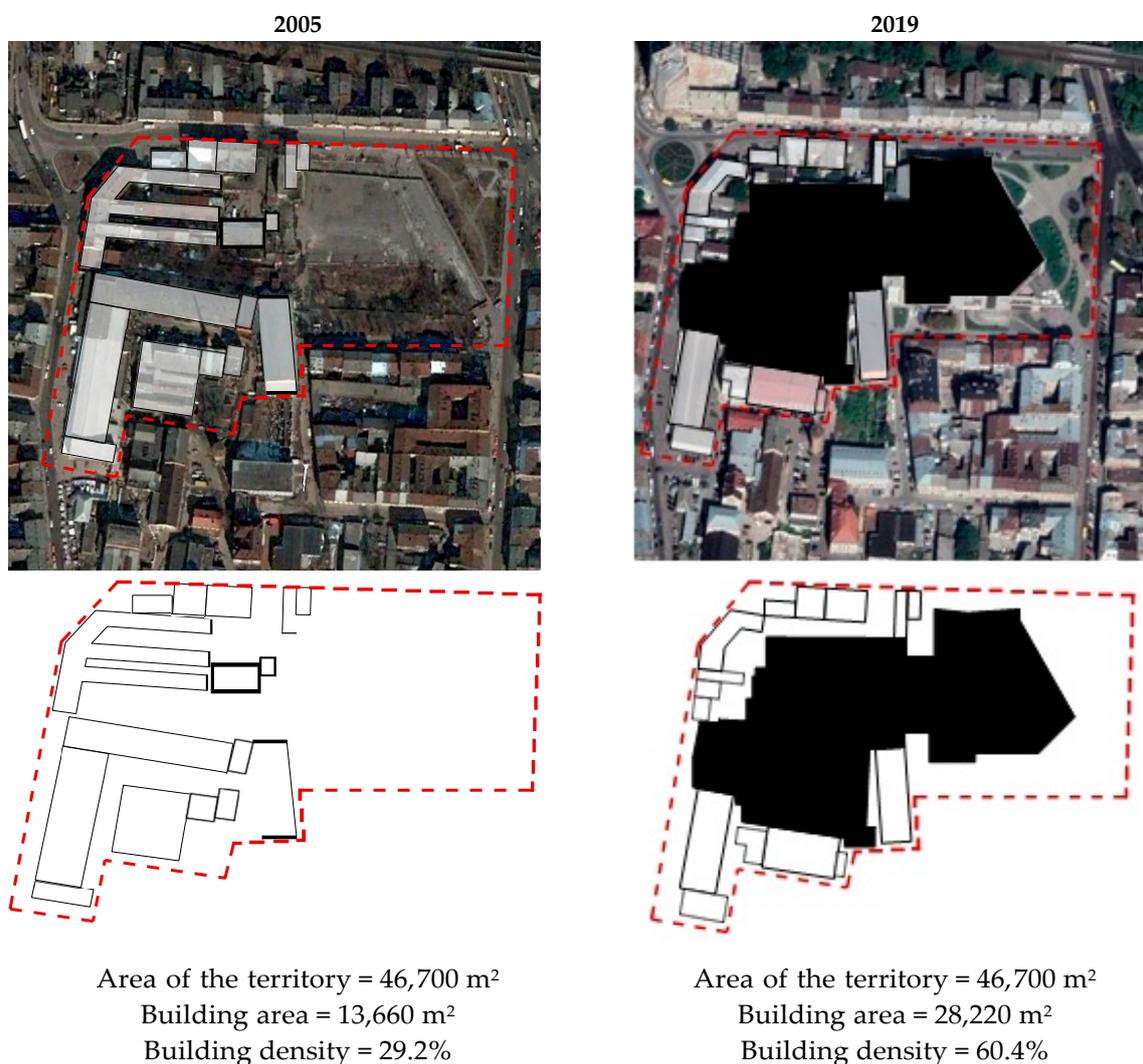
**Figure 8.** Forum Lviv shopping mall (photo by H. Petryshyn, 2022).



**Figure 9.** Quarter between Kulisha and Dzherelna streets. Left-hand side—the plan of the quarter—new buildings are marked in dark red (the largest of them at the top is Lviv-Forum shopping mall), and depressive industrial facilities are marked in purple (2018 survey). Source [108]. Right-hand side—new buildings, which appeared after the reconstruction of small industrial enterprises after constructing the Forum Lviv shopping mall (photo by H. Petryshyn, 2022).



**Figure 10.** Gastronomic pub “MolodoZeleno” (Young and Green), 20 Dzherelna Street, made in the reconstructed plant shops of the 19th and 20th centuries, in loft style (photo by H. Petryshyn, 2018).



**Figure 11.** Comparative analysis of the territory of the Gas equipment plant (by O. Kryvoruchko, 2022).

### 3.3. Model 3: Implementation of the Concept of City Center Expansion

#### Former H. Blumenfeld Varnishing and Painting Factory—Quarter “Avalon”

The territory of the city of Lviv has quadrupled in the last 100 years, and the population has grown by 3.5 times. This process of city development was accompanied by the spatial expansion of the city center and the development and complexity of its functional organization. Ideas and project proposals for the territorial expansion of the center of Lviv

were laid down in the master plans of the city, starting with the Master plan of 1940. With political changes and under the influence of economic factors, the concept of territorial expansion of the center has undergone some evolution. The most promising, given the communication links, flat terrain, and resources, was the northern direction of its development. In the last decade, the existing territorial reserves (which are the territories of bankrupt industrial enterprises and free from construction, degraded areas) have been built up mainly by multi-story housing at the expense of private investors. Opportunities for the development of public centers of citywide importance in this area have been significantly limited due to the current priorities of urban policy, with a goal to increase the number of residential buildings in the city [109].

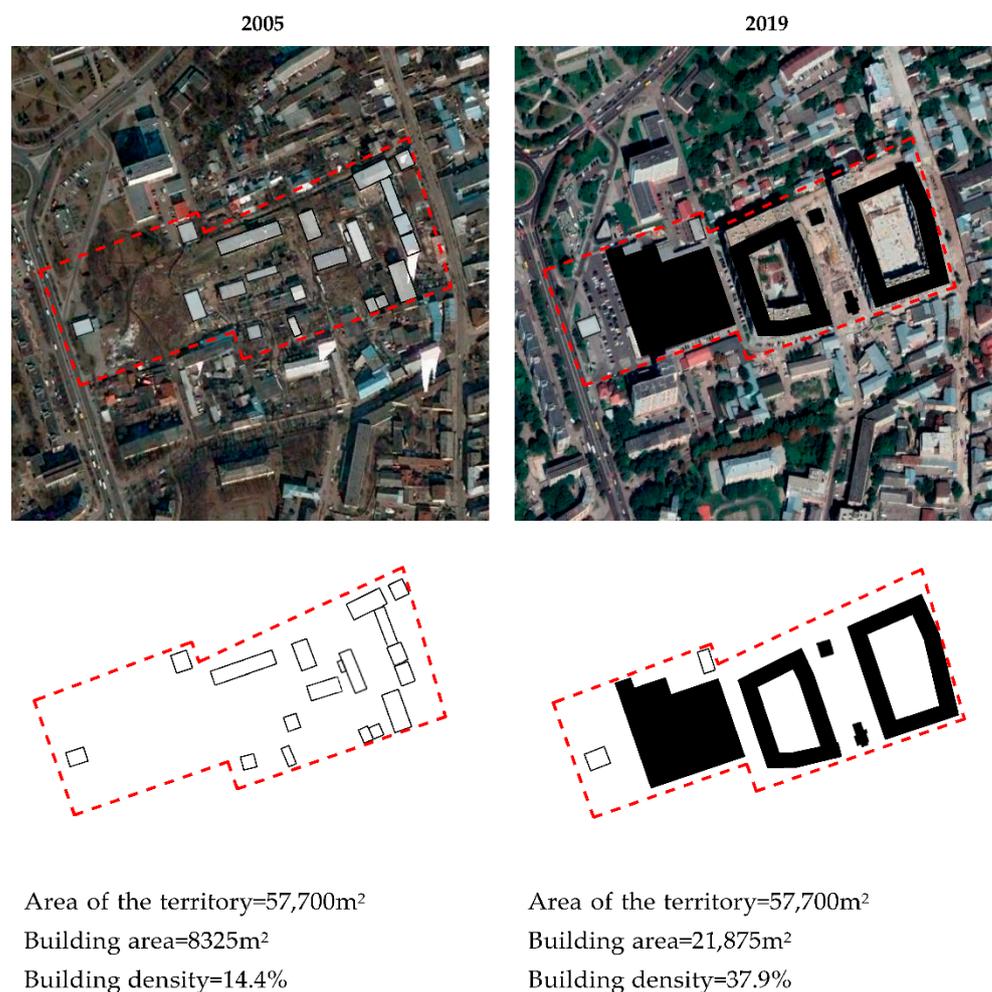
The most recent measures concerning reconstruction are related to the city quarter of Zamarstnivska-Chornovil-Lypynskyj-Khimichna Streets. The territory to the east of the modern V. Chornovil Avenue borders the historical district of Pidzamche. From the XIXth century, a Jewish district was formed here, where residential quarters were adjacent to industrial establishments. At the end of the XIXth century, Nathan Mayer's mill and bakery were famous here.

After a fire that destroyed this husbandry, these lands were acquired in 1902 by a well-known Lviv industrialist of Jewish origin, Henryk Blumenfeld. In approximately 1904, while he was expanding the acquired area, he began to equip one of the first chemical enterprises in Lviv for the production of varnishes and paints. In 1912, a new fire destroyed the plant again. Only in the interwar period, in the mid-1930s, was the factory completely rebuilt, reorganized, and expanded. In 1939, with the Soviet occupation of Lviv, the Blumenfeld family managed to move to Switzerland. During the Nazi occupation of the city, Blumenfeld's enterprise was part of the "working zone" of the Lviv ghetto. In Soviet times, the company was nationalized and renamed "Chemical Plant No. 1". After the war, it became known as the Lviv Paint and Varnish Plant, and the territory was significantly expanded.

This place is attractive for investors, for it is located beyond the border of the historic area. Thus, there are no architectural and urban planning restrictions here. Several design studies have been developed for this site over the past 20 years. According to the town-planning documentation of 2002, it was proposed to place shopping and entertainment centers along Chornovil Avenue and to build a territory behind them with office-commercial, partially residential quarters, as well as to place a multi-story garage for 300 cars. In 2006, new town-planning documentation was developed for the placement of a commercial, public, office-hotel and residential complex. In 2016, a detailed plan of the territory was developed for the same section as the Mistoproekt (City project) detailed plan of the territory. Housing, unlike previous projects, was the main objective of the site. The design of a quarter building with apartment houses of various sizes—from 5 to 13 floors—was worked out. In the previous project, it was proposed to be built next to the existing administrative and office complex "Ukrtransnafta," the shopping, office, and hotel complex with a 21-story hotel building and a 14-story administrative building was planned to be built [110]. This quarter has a very high density of buildings (Figures 12 and 13), functional inconveniences due to collisions of pedestrian and traffic flows, combining trade and service functions, and overload of the educational sphere of the district with additional residents (Figures 12 and 13). Model implementation of the concept of city center expansion under the conditions of high demand for housing is not fully implemented according to the plans accepted in the documentation of previous years.



**Figure 12.** Zamarstnivska-Chornovil-Lypynskij-Khimichna Str. quarter in the process of completion of construction. Residential complex “Avalon” (Photo by H. Petryshyn, 2022).



**Figure 13.** Comparison of the territory of the “Chemical Plant N° 1” (by O. Kryvoruchko 2022).

#### 3.4. Model 4: Reconstruction of Historical Localities

The Example of Pidzamche Sites in the Locality of B. Khmelnytsky Street (Plant Almazinstrument—“Pidzamche Town”)

In the 1860s, Pidzamche, the historic suburbs of Lviv from princely times, became the place of radical changes. Their beginning dates back to 1869, when a railway line appeared here, which initiated the expansion of the area along the railway. It brought changes in the functional and planning structure. The factories began to be developed in the area, as well as cheap housing for workers. Currently, Pidzamche is a locality of interest in terms of architectural and spatial planning, divided into several districts with different functions.

There are residential and industrial buildings of the early twentieth century and medium-rise residential buildings from the 19th to the early 20th century. In the 1980s, new industrial buildings were also erected, and in the last 20 years—complexes of multi-story residential buildings have been. The total area of the district is 38.5 hectares, of which 19.55 hectares are part of the UNESCO World Heritage Site and have 17 monuments of national importance. Currently, most industrial facilities in Pidzamche do not function. In the territory, which occupies about 10% of the area, apartment buildings are built without access to ancillary functions: administrative, cultural, and recreational. On the border of the historic area of the city the houses with a height of 20 to 30 m have appeared. The residential complex is designed with built-in public buildings, services for preschool children, underground parking, a roof boiler room, and an electric transformer station. Part of the territory of the plant Almazinstrument is included in this area as well.

As a result, residential and industrial neighborhoods remain the worst places to live when the quality of life is concerned. The area, which was expanded during the 19th century, like the others, became minor in terms of the quality of buildings and sanitary and hygienic conditions. That is why in the imagination of many Lviv residents, it is still considered the outskirts of the city. However, the layering of historical stages can be regarded as the architectural and cultural potential of the district and industrial facilities of the Soviet period—as functional and territorial reserves of the district development. The disadvantages of the district are its abandonment and the fragmentary nature of its planning. The industrial zones of the district occupy about 80% of the area, and there is no pedestrian connection between them, which would facilitate the communication of different parts of the district with each other and with natural areas.

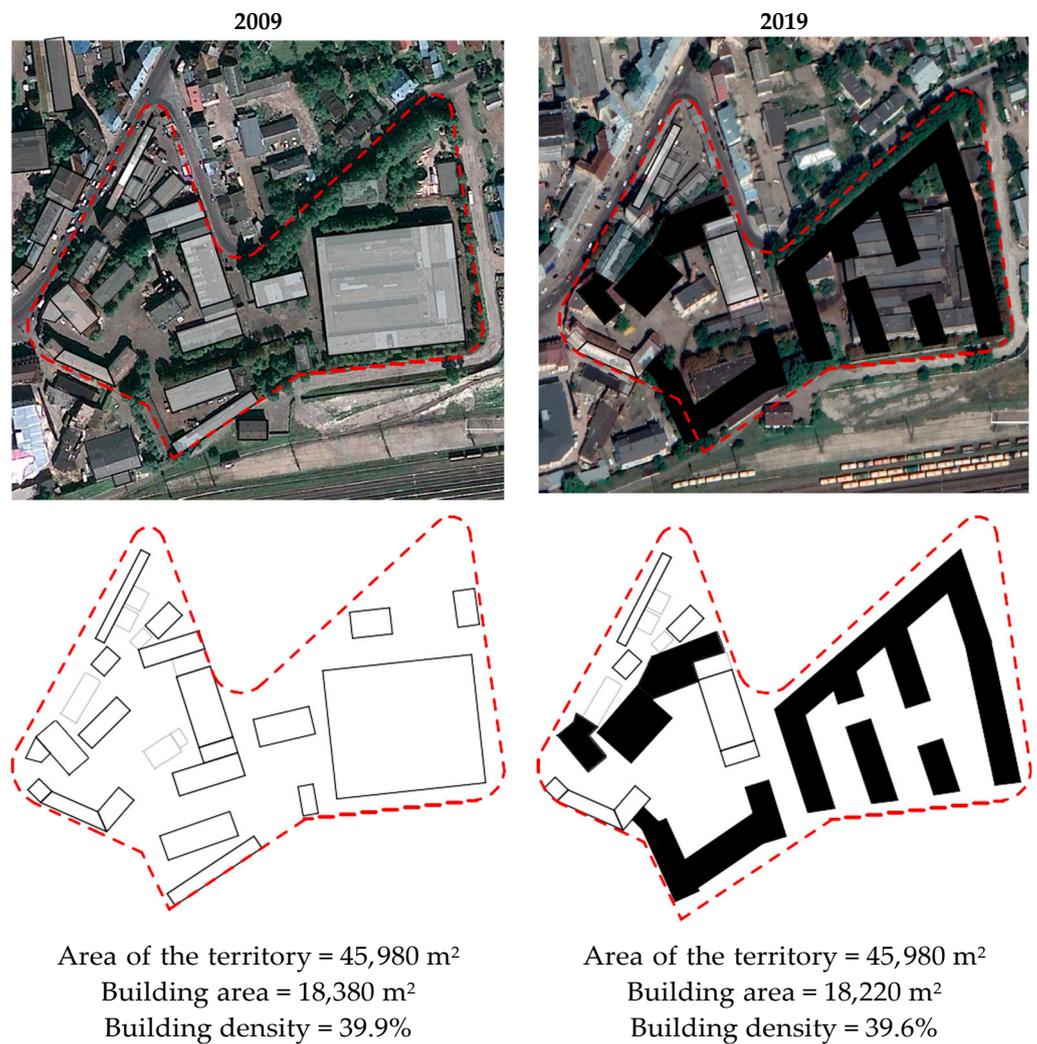
On the territory of the former plant Almazinstrument in Pidzamche (116 B. Khmelnytsky Street), the Executive Committee of the Lviv City Council, by decision on 20 December 2019, approved the next phase of construction of the residential complex “Pidzamche Town”, the company is obliged to preserve valuable historic buildings as part the historic area. The development plan also provides for the construction of shopping, entertainment, and market infrastructure. The building area should occupy 44% of the territory. The maximum allowable height of buildings in the historic area of Lviv is set at 18 m, and the taller buildings will be built outside the historic area. Commissioning is scheduled for the end of 2021. The authors of the project try to emphasize the industrial identity in the volume of buildings and in their architectural details (Figures 14 and 15). Despite the considerable reconstruction of the territory and the change in its functions, the scale and density of the buildings remained the same (see Figure 16).



Figure 14. Project proposal of the residential complex “Pidzamche Town” [111].



**Figure 15.** Construction of the residential complex “Pidzamche Town” (photos by O. Kryvoruchko, 2021).



**Figure 16.** Comparison of the territory of the plant Almazinstrument (by O. Kryvoruchko 2022).

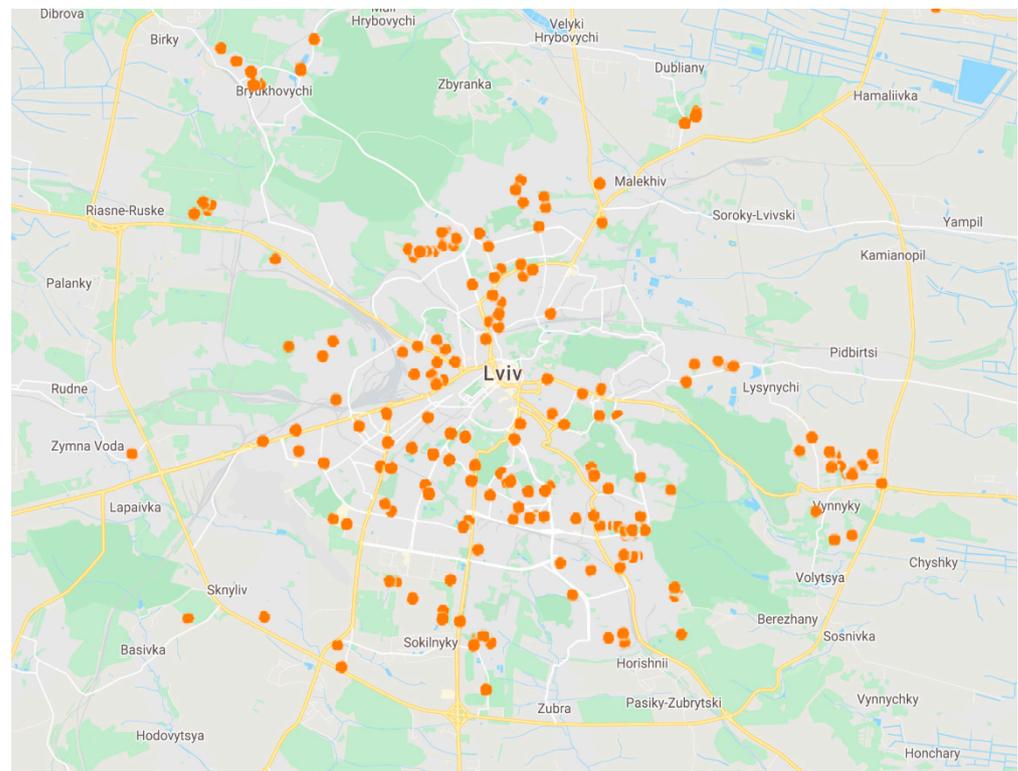
### 3.5. Model 5: Creation of New Residential Complexes

#### Glas Fabric = “Semitsvit” Residential Area

The analysis of the housing construction in Ukraine has revealed that the main construction is concentrated in the capitals of regions that have a metropolitan character. When the city limits remain unchanged, the basic concept of urbanization processes is “urban densification”. For each city, the issue of new urban density is the task of finding a balance between further densification of the urban environment and the preservation of free areas. The current construction praxis, scarce housing in the real estate market over the

past decade, shows the tendency of the developer's approach to intensifying the use of land. Today, more than 200 so-called "residential complexes" with separate territories have been registered in Lviv, which are formed either by a group of residential buildings or by a multi-section building and an adjacent area. In addition to the areas allocated for residential buildings according to the master plan, residential quarters are often built using the reconstruction projects for postindustrial areas and buildings in the historical area of Lviv. The process of approving project documentation reveals a conflict of interest between developers and the local authorities. Usually, due to court decisions, the developers win since there are different interpretations of the constitutional right to housing [112].

Semitsvit residential complex in the revaluation of the city territories, the basic concept is "urban density". An important task for each city is to find a balance between further consolidation of the city and the preservation of undeveloped areas necessary for a sense of comfort. The practice of construction, which is still in short supply in the real estate market in recent decades, rather indicates a developmental example of the intensification of land use. As of 2018–2020, 234 newly built residential complexes with a separate territory, formed by a group of residential buildings or a multi-section building and an adjacent plot, were registered in Lviv (Figure 17).



**Figure 17.** Map of the location of residential complexes in Lviv under construction (2021). Source: [113].

The area of residential buildings in Lviv, which was put into operation in 2016, exceeds the city Master plan by 66.8% [114].

Since the end of 2014, the quarter, with an area of 7.7 hectares, has been actively emerging between Shevchenko 60, Skliana 16, and Zolota Streets. Once a large steam mill of Joseph Tom with a pond and the house of the owner with an attached greenhouse was situated in this area. After the end of the Second World War, since 1947, Lviv Mekhsklozavod (Glass fabric) has operated here, producing various types of glass, and exporting it to the entire Soviet Union and even abroad. During its heyday, the plant employed more than 1500 people. However, in the early 2000s, due to many circumstances, the plant began to decline sharply and in 2006 it was declared bankrupt [115]. In the materials of

the 2006 General Plan of Lviv, until 2025 the territory of the plant is marked as a site of potential residential multi-story buildings. At public hearings in April 2007, the feasibility of changing the purpose of the site was discussed, and the project of the company Patriacom Ltd. to build a residential area within Shevchenko and Skliana Streets was presented [116]. Although most of the participants in the hearing approved of the change of purpose of the industrial territory, the spatial planning solution and functional content were the subjects of considerable discussions and some criticism. According to preliminary estimates, the residential quarter should have about one and a half thousand new residents. The investor Patriacom Ltd. proposed to perform construction by sections of 9–10 floors, with underground parking, public buildings, and infrastructure in the form of playgrounds and sports grounds between houses. Due to the proximity to the historic and populated city center, such a high number of floors and population density has caused concern among the specialists in the field of housing.

Even more, questions arose regarding the excessive projected number of car parks. It became clear that by leaving the built complex on Shevchenko street in a car—one of the main highways of the city, anyone would inevitably cause complications in the already heavy traffic in the area. According to a large number of residents and the percentage of children (because the vast majority of the social stratum of potential buyers are young families with little children or those who are planning to have children), the complex should have an additional school, although the project does not provide for it [117]. Implementation of the complex by the developer Intergal-Bud started in late 2014, has already been completed. In addition to housing, the active front of Shevchenko Street is separated from the premises by the Trade and Office Center and the restored and partially reconstructed (within the greenhouse) house of Józef Tom, where a small private kindergarten is located today.

According to the latest version of the project, the houses of the Semitsvit residential complex are formed into four blocks with courtyards and playgrounds and passages between the blocks. Due to the difficult terrain and the height difference of 30 m between Shevchenko and Zolota streets, the concept of terraced site planning was adopted. All industrial buildings were demolished, and the ancient pond was backfilled and razed to the ground. Despite the wishes and comments expressed by experts at the public hearings of the predecessor project in 2007, the number of floors in 2014 not only decreased but, on the contrary—increased and, according to the project, is from 8 to 16 floors. The effect of pressure from such a high-rise building is somewhat offset by the location of the quarter in the ravine between Skliana and Zolota streets and the visual division of 148 sections by color and slight differences in the appearance of facades, alternating high sections with less high. However, the high-rise sections of the Semitsvit have a very aggressive effect on the panorama of the city (Figure 18). The changes of the territory can be seen in Figure 19.



**Figure 18.** Semitsvit residential area (Photo by H. Petryshyn, 2022).



As far as population density is concerned, it has also increased—now housing will number about 1430 apartments, which is, accordingly, more than three thousand inhabitants. Within the projected complex, there is not enough infrastructure for such a large number of people, and the entire burden of service falls on the surrounding infrastructure, which is already overloaded due to the point consolidation of buildings in the central part of the city. It was found that the underground level for parking declared in the previous project proposal was preserved only in part under the shopping and office center and will be able to provide only 200 parking spaces, which is much lower than the norm. According to the ratio of housing and service functions, the residential area Semitsvit can be unambiguously recognized as a monofunctional housing entity [115].

#### 4. Discussion

The processes of the revitalization of postindustrial areas in the historical area of Lviv take place according to the general requirements of the current master plan of the city, which determines the purpose of plots, but in the process of creating local development plans, priority is given to the investor (who invests private capital due to low financial potential of the city).

It is also a task that among the old industrial enterprises, a very small number have the status of an architectural monument and are accordingly protected by the state. Several successful examples of the revitalization of postindustrial buildings based on creative functions show how powerful their impact on the environment can be.

The continuity of the tradition of the place due to the preservation of details and elements of post-industry as signs of previous use is not interesting for developers, because of which the city loses its identity. The postindustrial territories designated for construction are mainly filled with the same type of multi-story sectional buildings of 9–12 floors (Chornovol Avenue, Shevchenko Street) or medium-rise buildings of 4–6 floors (Dzherelna Street, B. Khmelnytsky Street), which surround the inner quarter space, forming courtyards—the centers of newly built neighborhoods. In newer implemented objects, the historical industrial context of the territory and information about the history of the place are already displayed in the form of preserved artifacts or special installations (for example, the town of Pidzamche).

An in situ inspection of new facilities revealed a number of common problems or issues. The level of infrastructure in postindustrial formations is quite low. According to regulations, there are usually not enough household facilities—grocery stores, pharmacies, children's and sports sections, parking spaces, and a lack of properly organized garbage collection points. All the burden of serving new residents is transferred to the existing household infrastructure of the city, which is already quite outdated and overloaded. There is a weak planning integration with the surrounding buildings—new housing units usually have a closed structure, occasionally with transit routes. The organization of the intra-quarter recreational space usually remains unfinished: playgrounds are too small, there are no places for recreation of adults and young people, and insufficient landscaping of yards.

Today's methods of revaluation of postindustrial territories are carried out in a pragmatic way to attract private investors to the development of the city. This situation is caused by the economic factor: when residential buildings, as well as buildings intended for commercial purposes (renting), are the fastest way to make a profit. This approach is negative for the urban structure of Lviv, as it will contribute to a number of problems. First of all, it is a transport collapse because the construction of residential neighborhoods leads to a sharp increase in the number of inhabitants, which will increase the load on transport infrastructure. There is also an additional burden on the existing social infrastructure—there are problems associated with the lack of educational institutions and spaces for public recreation. Sanitary and hygienic requirements are not observed everywhere. Residential complexes are being built on the site of enterprises with harmful production. These areas are somewhat polluted, but preliminary rehabilitation is not carried out. This can negatively affect the health of new residents.

## 5. Conclusions

The process of rethinking the industrial heritage of Lviv, as well as the development of postindustrial buildings and territories, is appropriate for the functional and territorial consolidation of the city. It allows implementing of the polycentric model of the city, is accepted in the modern master plan of the city development, and implements modern requirements for the “compact city” concept.

The article considers the examples implemented in a very “sensitive” area of the city, such as the historic area where spatial and architectural restrictions are valid, and new functions are created taking into account the location and the future service area.

Ukraine has regained its independence since 1991 and is in permanent economic change. The transition from a planned to a market economy stopped and then changed the system of financing the construction market. There is still a shortage of housing, which stimulates the development of housing construction.

The last few decades in Ukraine have occurred against the background of a declining population in the country. There is a growth of cities—regional centers, which have reached a population of almost 1 million, where active architectural and urban communities have formed, which actively influence the quality of urban development: in the west—Lviv, in the east—Kharkiv, in the south—Odessa, and in the center—Kyiv. These professional communities support the search for the identity of old postindustrial areas through the implementation of creative industry projects. This phenomenon is especially characteristic of Lviv, in the current development strategy of which the development of the tourism industry has changed the Soviet military-industrial paradigm and, accordingly, has given way to the introduction of creative industries to support the tourism industry. The close location of Lviv to the border of the European Union (60 km) and the rapid transfer of technology due to intensive human exchange have contributed to the implementation of numerous pilot projects, which have successfully spread to other cities in Ukraine.

There were studied common functional models accepted for the revitalization of postindustrial buildings and territories in the historical area of Lviv:

1. The development of the creative industry—objects that were important for urban city development and had valuable architectural features are subjected to adaptive reconstruction, mainly as a quick response to the city’s request;
2. The revalued multifunctional areas—the more valuable postindustrial heritage is preserved, which plays the role of a landmark, and new buildings are constructed on the vacated territory;
3. The implementation of the concept of city center expansion—these postindustrial areas are intensively rebuilt in the places where the general city functions are accumulating;
4. The reconstruction of historical localities—multiple approaches are used with respect to new functional purposes, but the solution to the housing problem remains the top priority;
5. The creation of new residential complexes—the low-value postindustrial heritage is not preserved, and the functional and planning integration of the new buildings with the surroundings and a significant rise in the urban density is planned.

The examples of residential complexes reveal the situation with the housing market in Ukraine. Recently, it has been desirable to implement the neighborhood model—a quarter or micro-district in which, in addition to housing, there are opportunities for work, services, and public spaces, and at least the related functions are partially solved. Therefore, housing construction is a priority, especially in cities that have positive development trends. It is advisable to consider the planning and urban process of construction of apartment buildings and complexes in postindustrial areas not as separate objects but in combination with the development of the transport network, social infrastructure, and compliance with sanitary and hygienic requirements. It is necessary to take into account the mistakes that were made during the implementation of previous revitalization projects in order to solve them in the future and prevent the emergence of new ones.

The authors consider the process of re-urbanization in some particular postindustrial areas and objects as a search for ideas to generalize their use for the whole city. The intensive industrial development of the city during the Soviet period led to strict regulation of other areas. After obtaining independence, there is an opportunity to fix the imbalance. This process occurs in different ways. In particular, the “in situ” review provides an opportunity to understand the development of the territory—whether it follows the master plan (or contradicts it), whether it meets the new development strategy of the city, whether it meets the needs of the local community, or meets the interests of developers only. This is summarized in Table 1.

Implemented projects of the revitalization of postindustrial territories and objects in the most valuable territories of Lviv—the historical core and its buffer zone, which differ in scale, innovation, functional content, image, and semantic content, connection with modern urban trends, etc., created a value scale—to successful projects. This experience, due to numerous discussions in the professional community, as well as economic and social effects from the implementation, is valuable for the further development of Lviv.

The following studies of the use of postindustrial buildings and territories in Lviv and similar cities of Ukraine with respect to development activity should preferably be carried out in areas outside the historic buildings. Since the industry was formed there in the second half of the 20th century, the scale of the plots and buildings is different. Accordingly, more significant urban planning processes take place there, and other development models are used.

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