

REVITALIZATION SPECIFICS OF INDUSTRIAL ENTERPRISES MADE OF BRICK AND CONCRETE. EXAMPLES OF LODZ, KYIV AND POLTAVA

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Abstract

The problem of revitalization of unprofitable industrial enterprises, which occupy large areas in the central districts of cities, has become international. Significance world experience in the conversion of such institutions for public, commercial, business and housing function has been accumulated. When an industrial building is an architectural monument, it imposes additional restrictions on preserving its authentic appearance and, in some cases, the interior. A unique example is the city of Lodz in Poland, a real "city of industrial monuments", the vast majority of whose historical and architectural heritage is made up of industrial objects of high architectural quality. Given this specificity, the city has accumulated a unique experience of revitalization, which can be successfully used in other countries. There are fewer such unique objects of high architectural level in Ukraine, because most of the preserved industrial objects belong to the Soviet period and were built according to typical projects. However, some of them are also of historical value and should be preserved, as shown by the example of an elevator in Kyiv. The revitalization of industrial enterprises in Poltava is connected with bigger problems, taking into account the problems of economic profitability of such projects.

Keywords: Revitalization; Monuments of industrial architecture; Authenticity; Preservation; Lodz; Kyiv; Poltava

Introduction

The political and economic changes, which accelerated in Poland after 1989, created a completely new situation for traditional industrial centres operating in the communist economy. The methods of production inherited from the previous system did not correspond to the new market realities, which forced application of radical actions.

In a situation of permanent underinvestment, the old factory complexes, most often dating back to the turn of the 19th and 20th centuries, largely retained their original appearance and structure, frequently with outdated technical and mechanical equipment. Due to this unique combination of circumstances, in post-communist countries very valuable industrial architecture complexes survived unaffected by intensive modernization. The first years of transformation and new social and economic challenges were not always kind to those complexes, which, while ceasing to function, were at the same time subject to free market mechanisms. Very soon their functional and historical potential was revealed. They were particularly important in those cities whose development was connected with the industrial era. One of them is undeniably

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Łódź, a large metropolis which grew rapidly in the second half of the 19th century and in the early 20th century thanks to the developing textile industry. Its collapse after 1989 opened a completely new chapter in the history of the city. During the 1990s, all local large textile factories collapsed. What remained was dozens of deserted factory buildings of varying scale and different historical and architectural value. Only a few were entered in the register of monuments and were covered by legal protection. Generally, the post-industrial heritage appeared to be a challenge. At the same time, accumulation of such objects and their location along the urban axis of the city was an opportunity, which enabled interesting revitalisation investments [1].

The revitalization of non-functioning industrial territories is relevant not only for Poland but also for Ukraine, especially for large cities, which are acutely aware of the lack of vacant land for new construction [2]. In cities which are regional centres of Ukraine, such as Poltava, examples of successful revitalization relate mainly to enterprises built in precast concrete in the period 1960s – 1980s (the Ekvator shopping and entertainment centre in Poltava in the buildings of the former Prodmarsh plant). However, the most common practice is the complete demolition of non-functioning enterprises and the construction of residential complexes in their place (the territory of a turbomechanical plant, a brick plant on Yevropeiska Street, etc.).

The practice of complete clearing of the site is also the most common in Kyiv, capital of Ukraine, but in many cases industrial facilities are of some historical value, and this should be taken into account, especially based on the positive world experience of such facilities revitalization. One of the revitalization directions is re-profiling for office, cultural, educational and commercial function, and in some cases even for housing. At the same time, it is necessary to take into account the structural scheme of such institutions, as well as the construction material. Thus, the Lodz factories were built of clinker bricks mainly in the second half of the 19th century, their facades are designed in the style of historicism-eclecticism. Instead, most of the Soviet-era plants and factories in Ukraine were built of monolithic and precast concrete according to typical projects. Very few factories built before 1917 have survived to the present day, especially in Kyiv. One of the few facilities, which by the way is in a terrible state of emergency, is the former Richert brewery on the Kyrylivska street, described in detail in the publications by O. Ivashko, where the revitalization project of this industrial architecture monument is offered, and also various aspects of revitalization of industrial establishments under various functions are considered.

Thus, during revitalization, it is possible to preserve partially the industrial function in individual buildings, and it is possible to change it completely, preserving only the image of the industrial building, partially – the structures and layout.

Materials and Methods

In conducting the study, the authors used scientific papers, archival and design materials, including their own project proposals.

The authors have developed a source base that addresses various aspects that arise in the revitalization of industrial enterprises. The connection between architecture, art and performance was highlighted by T. Markowski [1], M. Orlenko et al. [2], O. Ivashko [3, 4], T. Kozłowski [5], G. Sztabiński and P. Sztabińska, [6], P. Sztabińska [7, 8].

The problems of revitalization and the experience of revitalization are described in the publications of T.Yu. Kuzmenko and A.Yu. Dmitrenko [9], O. Ivashko [10], M. Iwaniec [11], J. Gałuszka [12], P. Lorens [13, 14], I. Popławska [15, 16], P. Szymański [17], B. Walczak [18].

Examples of individual industrial facilities revitalization are covered in scientific papers of A. Bogusławski and D. Włodarska, [19], M. M. Cysek-Pawlak [20, 21], M. Hanzl [22], M. Matys [23], W. Mirosław [24], W. Popławski [25], A. Rawicka [26], J. Salm [27], B. Walczak [28].

The authors of the study used the following methods: the method of historical analysis, the method of comparative analysis, the graphoanalytical method.

Results and Discussion

Experience of light industry monuments revitalization in Lodz, Poland

The greatest challenge for the city was two largest industrial complexes in Łódź, namely Karol Scheibler's plant at the Priest's Mill (Księży Młyn) and Izrael K. Poznański's factory at Ogrodowa Street, which encompass the centre from two opposite sides. Their location illustrates former Łódź topography: two urban poles with a historical and representative axis developing between them. An important feature of these complexes was also their autonomy. Each of them is a very valuable example of a deliberately closed organism comprising a factory complex, its facilities with workers' buildings and the owner's residence. These features influenced a nature of further revitalisation projects.

Occupying much smaller space, with a compact composition and location almost in the city centre, Poznański's factory was a commercially attractive area [15]. In 1999 the factory was bought by the French company, "Apsys", which presented a concept of creating a large shopping and entertainment complex [17, 29]. Despite doubts of art historians and conservation authorities, implementing these plans within a few years was completed in May 2006 resulting in opening the "Manufaktura" centre (Fig. 1).



Fig. 1. "Manufaktura" – view from the East. Lodz, Poland. Photo by K. Stefański, 2019

It covered an area of 270,000 m², including a three-hectare Market Square, which forms the centre of the complex. As a result of far-reaching interference in the structure of historic factory buildings, what mainly remained was external walls and, partially, horizontal divisions. "Manufaktura" now houses catering facilities, shops, a multiplex, a museum, a theatre, and a branch of the Łódź Art Museum with a collection of contemporary art. 45,000 m² of brick facades and 12,500 m² of metal windows were renovated and 95,000 m² of new constructions were built. Renovation covered a total of 90,000 m² of historic interiors. This was complemented with a modern shopping hall. The whole investment cost about 200 million euros. The values of the complex were recreated with the use of the latest construction, design and architectural solutions as well as the state-of-art technologies of control of the individual systems.

Despite negative aspects related to blurring authenticity of the historic post-industrial complex, the project resulted in creation of the nice-looking space, which attracts tens of thousands of buyers and visitors and is slowly becoming one of the city's landmarks [18, 23, 30]. In commercial and image terms, "Manufaktura" turned out to be a success, gaining social recognition as well as numerous awards and distinctions. It is complemented by the "Andel's" hotel, built in 2009 as a result of adaptation of a huge building of the Poznański's spinning mill with authentic technological elements greatly preserved inside. A spectacular new element of the building is a glazed pool on the roof. This construction also received high marks and prestigious awards [25].

What turned out to be a much bigger problem were buildings at the Priest's Mill, being a very valuable, historic architectural complex with a compact, uniform spatial concept. It was divided into several parts of different character [15, 16, 31]. The first building adapted to the new requirements was a former fire station successfully adapted in 2000 by Armada Bussines Park for office purposes. The most important part of the complex, a large spinning mill in W. Tymienieckiego Street, was bought by the Australian company, "Opal Property Developments", and transformed in 2007–2010 into so-called residential lofts. It entailed removal of the upper story, built in the 1970s, and a number of low-value outbuildings. 421 apartments with a floor area from 40 to 200 m² were created in the edifice. Newly added buildings were adapted to the historic factory architecture. Another problem was the former workers' housing estate. According to various concepts, they were going to house student dormitories or art studios or to be transformed into a luxury housing estate, but no specific decisions were made for a long time [27]. After extensive discussions, it was decided that the complex would be revitalised with preservation of its residential function. That work began in 2012 and is still on-going: the concept creators say: *the most important goal pursued by the designers (...) was not to harm the Priest's Mill, not to spoil the historical buildings, to reconstruct the original detail in order to preserve the atmosphere of the whole complex* [19].

Two more smaller-scale projects are also worth mentioning. The first one being the Art_Inkubator complex, created in the area of the former bleachery in W. Tymienieckiego Street, which before the Second World War belonged to the Karol Scheibler and Ludwik Grohman's plants. In 2008, the authorities of Łódź and representatives of cultural institution, called "Fabryka Sztuki", signed an agreement under which former industrial buildings were to be transformed into a large and modern art centre. The investment, half of which was financed by the City Hall and the other half by the European Union, aimed at creating a space for presenting exhibitions, educational initiatives as well as activities supporting undertakings on the border of art and entrepreneurship. In 2012–2013 three buildings were adapted for the incubator (Fig. 2). Adaptation of the building to new functions was done with respect for the historic matter and the new space encourages users' creativity [32]. The other project is a multifunctional complex located in the city centre at 138/148 Piotrkowska Street, on the premises of the former spinning and weaving mill of Franciszek Ramisch, known as "OFF Piotrkowska" (Fig. 3). Adaptation works in this area began in 2006. Within several years, it led to creation of music clubs, restaurants, cafés and exhibition halls, but also studios of architects, fashion and art designers. The courtyard is used for music concerts. In 2014, the readers of "National Geographic Traveler" deemed OFF Piotrkowska the seventh "Miracle of Poland" [26].

Revitalisation projects in Łódź run over the last twenty years have not been limited only to the facilities of former textile factories. A flagship example is the 2010–2018 adaptation of the former power plant, known as EC1. This complex consists of two main parts. The oldest power plant building, from 1906–1907, with early modernist and Art Nouveau features, known as EC1 East, was rebuilt according to the designs of the company from Poznań, "Home of Houses": the original, futuristic architectural form of the edifice earned wide recognition (Fig. 4).

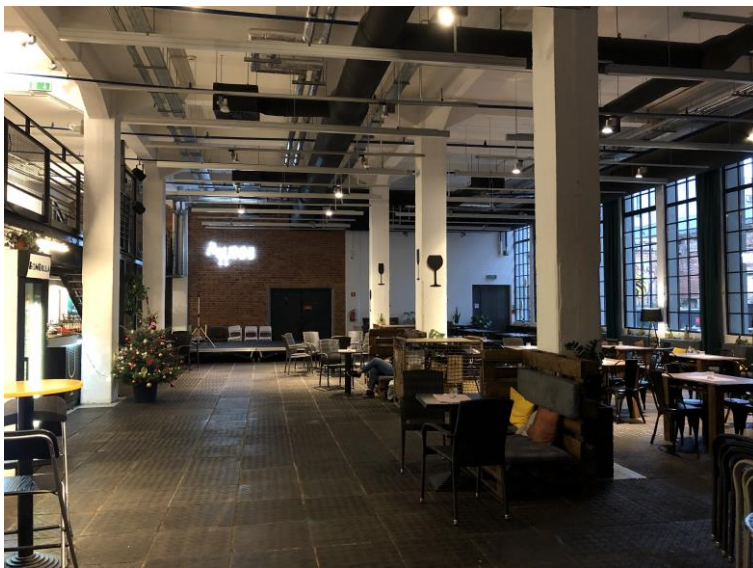


Fig. 2. Art_Inkubator (interior), Lodz, Poland. Photo by O. Ivashko, 2020.

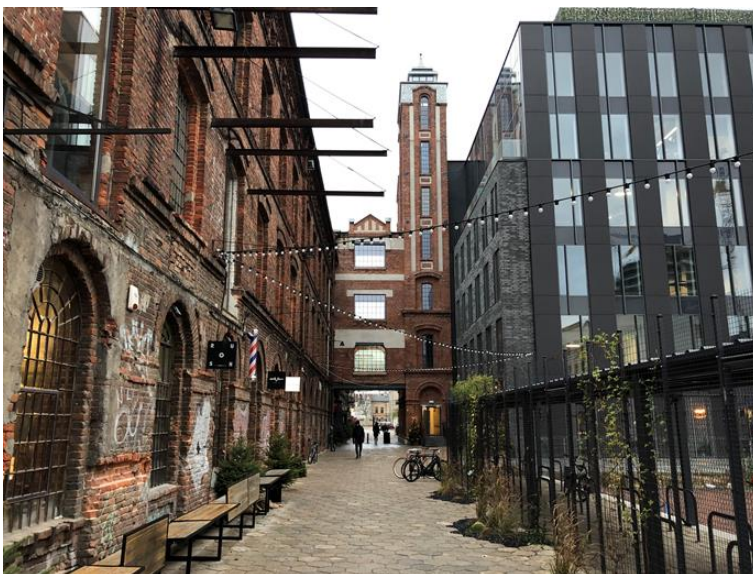


Fig. 3. OFF Piotrowska, Lodz, Poland. Photo by O. Ivashko, 2020.

It was turned into the "City of Culture" complex, housing the National Centre for Film Culture, Planetarium and exhibition spaces. The second part of the complex, EC1 West, consists of buildings from the interwar period. They were adapted, in line with the winning design of Miroslaw Wiśniewski's studio, as an Interactive Science and Technology Centre. It became a multifunctional museum-educational-scientific facility. Opened in January 2018, the centre is certainly one of the best examples of adaptive reuse of an old industrial building. The former power plant buildings, rebuilt in an original way, are an element of the currently shaped

New Centre of Łódź, which is being built in the area surrounding the new underground Łódź Fabryczna railway station [12, 20].



Fig. 4. EC1 building, Lodz, Poland. Photo by O. Ivashko, 2020

The above examples perfectly illustrate the situation of Łódź: a post-industrial city that struggles to preserve its heritage [33]. They also reflect various investment strategies. Reuse of post-industrial facilities is associated with numerous complex challenges, which can be considered on several intermingling planes [14]. A purely architecture and conservation level comprises all objectives related to technical conditions, preservation of components which are materially valuable and related to the construction. The priority was to preserve the original structure to the greatest possible extent, and at the same time to add elements serving new functions. The latest technologies and high-quality products were used to clean and strengthen brick walls, preserve iron and cast-iron elements and strengthen structures and ceilings. The aim was also to highlight characteristic elements of the industrial structure as attractive decorative details. Factory revitalisation investments in Łódź come as a result of the emerging needs and typological features of buildings themselves. In most cases, the buildings are multi-storey and not very wide, with an open layout and a large window area. Such features make it easier to adapt the function of the building, which in Łódź often means office spaces, universities, but also hotels and residential applications [28].

Large factory buildings from the turn of the 19th and 20th century were built using traditional methods: foundations made from pebble (field) stones and bricks with lime mortar, with unplastered facing bricks usually used for building facades. In the case of large factories, as far as we know, brick was made in the factory-owned brickyards, with quality brick being imported (among others) from Korwinów near Częstochowa, and decorative brick elements from Lower Silesia (brickyards in Małomice and Lubań). One of the main technical challenges was the maintenance of the brick itself, along with wooden window frames, as well as thermal insulation problems. Internal structure was made of cast iron pillars. In small buildings ceilings were made of wood, and in larger ones – iron beams with brick infill floor were used. Wooden roofs covered with roofing felt were also a difficulty in the construction process. A slightly different approach was used in shed-type constructions (one-storey buildings) with sawtooth roof featuring large, iron framed glazing. This technique was applied where good lighting was crucial – like weaving plants, for example the Poznański weaving mill and the Scheibler Nowa Tkalnia in Kilińskiego street. At the beginning of the 20th century reinforced concrete structures had already been developed: in Łódź, the first example of such being the Widzew Manufaktura from 1899, designed by Dawid Lande.

The widespread use of unplastered brick in Łódź was justified economically, and decorative features were limited to ornamental arrangement of bricks, complemented by metal elements. Unplastered brick walls were vulnerable to weather conditions, particularly humidity. In addition, they were exposed to other destructive elements. The use of machines and their maintenance often caused walls and ceilings to soak with oil. Long-term impact of such factors resulted in significant damage and determines the nature of securing and preparation work carried out to protect the building. One of their most important stages is the protection against moisture and strengthening the structure itself [11]. One of the early examples of comprehensive protection of a post-factory building was the work carried out at the turn of the century at the Schweikert factory hall, which was rebuilt for the needs of the Lodz University of Technology. After cleaning work, a method of injection was used to inhibit capillary moisture wicking (rising damp). A chemical treatment was used create a horizontal water repellent. The next stage was filling the holes and gaps with a suitable type of mortar. The basement level was refurbished using bituminous mass as a method of vertical insulation. The floors were treated in a similar fashion: bituminous mass and mineral micro-mortars, which had high water resistance ratios, enabled adaptation of the basement level to a completely new function: archives and workplaces (to complete the work the following Deitermann preparations were used – Adexin HS, Cerinol BSP, Superflex 10, Superflex D1, Plastikol KM 10, Eurolan HL) [34].

In the case of adaptation work at the former electrical power and heating plant EC 1, the design challenges were somehow different. According to the conservator's guidelines, the endwalls of the engine and boiler houses were to be brought back to their original state. The poor technical condition of the walls, however, forced them to be demolished, following a complete re-construction. The original, reinforced metal skeleton was retained. The goal was to recover and reuse the original bricks, which turned out to be impossible. The newly added building segments were accented with using a slightly darker clinker brick compared to the original one, which was an interesting design feature. Efforts were made to keep pieces of the original machine equipment and decorations when possible, among which was a large gantry crane. Spots marking the removed machines were left in the floor as a decoration. Ceramic wall and floor lining, as well as old window divisions were preserved and partially reconstructed [21, 24].

A similar approach was used in the case of refurbishing the warehouse buildings of the former Joint Stock Society of Cotton Products of Karol Scheibler in Tymienieckiego street. Design work started in 2008 and was completed between 2012–2013, with Art Incubator becoming a role model for this type of initiative. The project was implemented with conservator's guidelines in mind, and a detailed item inventory was made, which included all structural and decorative elements – ranging from metal constructions, through window and door woodwork, to preserved wall and floor linings. The aim was to retain as many original elements as possible that could serve the new functions of the building. During the work attempts were made to eliminate modifications already made, and restore the original state where possible, while introducing some upgrades with the help of light and glazed elements. A glazed roof was installed between walls of two neighbouring warehouses, which created a new functional space, radically improving the aesthetic of the buildings, while not affecting the original form in a noticeable way. The retained elements emphasize the industrial character of the object. In addition to the metal and brick structure, the original cast-iron slabs lining the pavement surface around the buildings were preserved. The investment is one of the finest examples of post-industrial facility revitalisation in Łódź that successfully combine conservation and reconstruction of the original parts while introducing new elements that redefine the functions of the building [32].

The main challenging issues in this type of projects are related to adaptation of existing facilities to new, socially desirable functions. It means introduction of modern infrastructural elements: horizontal and vertical communication routes, water and sewage lines, storage

facilities with good access, securing an appropriate number of parking spaces, as well as the use of appropriate ventilation systems and fire protection. The basic problem being: to what extent we can introduce new elements, usually functionally and economically justified, and sometimes contributing to a new aesthetic value, into the existing complexes, not effacing authenticity of the historical style. This is accompanied by the question: where is the borderline between material authenticity and usefulness of the complex? Bearing in mind that the latter is an indispensable element of the revitalisation process, ensuring *de facto* economic existence of the historical building. It seems that an equally important issue that appears in relation to the revitalised buildings is connected with their structure as a valuable component of the urban tissue, often being a testimony of the city's past. The latter factor is crucial for all large post-industrial centres. This is also the case of Łódź, where smaller and larger industrial plants, woven into the urban layout, co-created the city image and were the foundation of its development, both economic and urban. In case of such facilities, therefore, there are complicated conservation and architectural challenges, as well as those related to self-definition of the urban complex historical identity. Another challenge is skilful reconciliation of sometimes distant interests of users on the one hand and the long-term social needs on the other [35].

In the above-mentioned revitalisation projects from the area of Łódź, we can follow various revitalisation strategies, both in the architectural-functional sphere, and in terms of sustaining historical values of the complexes. In retrospect, we can say that for the youngest generations the image of industrial Łódź is associated primarily with the "Manufaktura" complex, which is influenced by its more favourable location in comparison to the centre and commercialised ease of reception. "Manufaktura" also remains a coherent and quite uniform project, covering very different functional modules. The central point is the Market Square with catering, retail, but also service and museum functions. The whole is complemented with an extensive shopping mall and an impressive hotel. This complex has become an important spot in the urban tissue. At the same time, this new facility shows what the possible costs of economic success. The completed project has completely changed the original layout of the factory complex, retaining only the most visually distinct parts. They were highlighted in a new way, creating public space subordinated to contemporary commercial functions. As a result, the preserved architectural tissue has been reduced to the role of post-industrial scenography [13, 22].

The Priest's Mill is an enclave, located away from the main city axis. Undoubtedly, the urban context was a factor co-determining different ways of functioning. In this case, the investment was significantly separated. The office space of the former firehouse and expensive apartments in the former spinning mill have different aims and functions. The apartments contrast with the plans of preserving the former character (together with the existing residents) of the workers' estate. Such a solution is subject to serious social and economic tensions. Paradoxically, the project which is the most consistent with the historical situation and preserves the former functions of the housing estate has the least chance of success from the commercial point of view.

Saving the post-industrial heritage is a part of the struggle for the future of the city, which used to be an industrial power, and now tries to develop new branches of economy, and focuses on education, service and logistics centres. Spectacular examples of "Manufaktura" and Priest's Mill make us aware of the challenges of all revitalisation investments. As we can see, they do not boil down to the question of preserving the authentic material function of the buildings, but concern the rescue of the original, historical ones as a testimony of the past. All this is to ensure that the preserved material tissue is not limited to function only as urban scenery in a temporarily fashionable post-industrial style.

In some cases, an industrial building cannot be fully revitalized, and then it can be turned into a work of art. These two examples are mentioned in the monograph by Tomasz Kozłowski

"Architektura a sztuka". He cites as examples two industrial facilities, which as a result of revitalization have become essentially on the border of architecture and artwork – the Mine F60 and Biotowers. The area between Berlin and Dresden has historically been known as a region for coal mining and related energy industries. The mines of the Lusatia region were widely known outside of Germany. However, after 1990, they lost their profitability. In order to save the F60 mine from destruction, in 2003 this "lying Eiffel Tower" (as it is called by Tomasz Kozłowski) 502 meters long and 74 meters high, was turned into a non-functional work of art. According to the Hans Peter Kuhn project, the tower has become an artistic element of Lake Bergheider See, and at night it is illuminated with colorful light. The second project of the non-functional building, which performs a purely artistic function after the revitalization, is the revitalization of the former coke plant in Lauchhammer, Germany. Since 1952, it has been a coal processing plant that produced coke for metallurgy. There are 22 meters of coke tower buildings left from the institution, interesting from the outside, but impossible for full-fledged redevelopment from the inside. Given the "medieval Romanesque" appearance of the towers from the outside, it was turned into a kind of theatrical scenery, which attracted lighting at night. This creative property has been open to visitors since 2008 and has been romantically named "Castel del Monte of Lusitania" [5]. In fact, architecture becomes an act of performance, as P. Sztabińska writes in her publications [7, 8]. In cases where the artistic component joins the architecture, it acquires partially or completely the features of a work of art. In the case of Lodz the presence of a strong artistic component (Lodz is one of the most powerful contemporary art centres in Poland), this also affects the nature of the revitalization of industrial facilities, some of which are transformed into art centres [6].

The experience of industrial enterprises revitalization in Ukraine: problems and prospects on the examples of Poltava and Kyiv

Unlike Poland, Ukraine has much fewer historic industrial buildings, and not all of them are recognized as architectural monuments. Therefore, it is often easier for investors to completely demolish industrial buildings of the late 19th – early 20th century and build in their place another residential complex or shopping and entertainment centre (as was done with the shopping and entertainment centre "Manufaktura" in Sumy, built on the site demolished cloth factory). This is a particular problem for provincial cities such as Poltava, Sumy and other regional centres, which have a population of 200,000 to 300,000 and lack investment. A typical example of a non-functioning industrial enterprise revitalization with a change of function is the "Ekvator" shopping and entertainment centre in Poltava, established on the basis of an industrial enterprise of the 1980s. Prefabricated reinforced concrete structures are relatively well preserved, so they were used as a structural basis. But the exterior and interior decoration was made of modern materials, and the task of preserving the authentic appearance was not even set (Fig. 5).

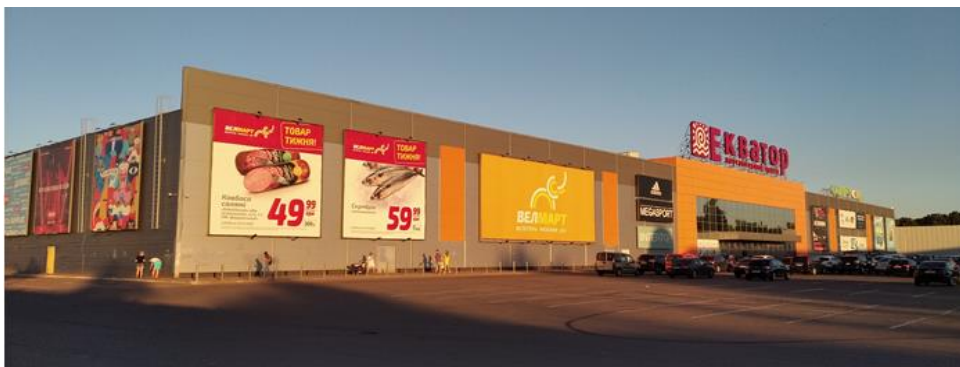


Fig. 5. Shopping and entertainment centre "Ekvator", Poltava, Ukraine. Photo by A. Dmytrenko, 2020

Unlike provincial cities, Kyiv, as the capital of the state and a significant cultural, industrial and financial centre, provides greater opportunities for experimental proposals for the revitalization of enterprises. It is easiest to re-profile the institutions of light and food industry, as evidenced by the experience of Lodz. At the same time, there is a practice in the world of re-profiling even such specific buildings as grain elevators.

As a non-standard Kyiv example of an industrial object re-profiling for a cultural and public function, it is worth mentioning the conceptual project of revitalization of the grain elevator adapted for lifting, drying and storage of a large amount of grain on 10, Naberezhno-Khreschatytska street, in the Podilskyi district of Kyiv. This conceptual project (authors Stepan Reshetnyk, Janosh Vig, Yulia Ivashko) was created according to the strategy of removing industrial enterprises from the Kyiv central districts, as such enterprises are obsolete, closed, in "dead" areas of a large area, actually separating from urban space the river Dnipro – a water-green corridor that runs through the whole city. Back in 2002, the Master Plan for the development of Kyiv until 2020 provided for the revitalization by 2025 of the port area of Kyiv Harbor as part of Podil, occupied by port facilities, as well as the Rybalskyi Island with industrial development. The expediency of preserving the industrial facility with its further revitalization is justified by the favourable urban location, significant plot size, high level of reliability and durability of building materials and structures, high level of adaptability, as well as the historical value of the grain elevator complex.

Kyiv grain elevator is located on the Dnipro river bank near the central square of the Podilskyi city district – Poshtova Square, occupying the territory of the river port on a plot of 2.83 hectares. During the construction of the elevator in 1951–1954, this location of the building was justified by transport logistics both on the river side and with the existing at that time organized entrances from the central districts of the Right Bank and Podolsk district of the Kyiv. The elevator was built near the river port, where the grain transport industrial area has traditionally developed.

The development of the master plan of the city, its transport network for the last 50 years has refuted the functional expediency of the location of the grain elevator on the Naberezhno-Khreschatytska highway determined in the last century. Today, the building is an unfortunate example of the industrial production function location among residential neighborhoods and public buildings.

The construction of the elevator type M-3-175 as a complex with a variety of transport and technological equipment was carried out by the "Ukrzahotivbud" company, the project was performed by the institute "Promzernoproekt" (architect V. Holstein, eng. Y. Gemmering, etc.). Typical elements of the M-3-175 grain elevator with a capacity of 32 thousand tons of grain per day were used. The elevator is located near the Dnipro River, on a fairly calm terrain.

The main production elements of the elevator are a working tower, three norias of the TNS-175 type, a grain dryer, and an elevator complex for grain storage. The elevator complex, in turn, consists of two blocks-cases with a total of 44 silos (the first – four-five-row on 20 silos, the second – four-six-row on 24 silos), the two-storeyed bottom connecting gallery, the receiving device, pneumatic device for receiving grain from water transport. Silos are of the same type and have a gap of 5.7 m.

The three-dimensional composition of the grain elevator consists of three clearly identified main elements – the tower, the first and second block of silos. All three main components of the building are connected by a technical floor-bridge (with floor height of 3.3m) at the height of the silo blocks and a stylobate – the ground floor. All geometrical parameters of the constituent elements of the complex were determined by the functional and technological needs for the period of the 1950s.

The structure of the elevator under the silo blocks (each silo is the same type, 6m in diameter, 30 m in height and 600 t capacity) on the ground floor is a diagonal system of

mushroom-shaped reinforced concrete supports with developed heads in the upper part of the support in the vertical-horizontal direction relative to the diagonal are the supporting elements of the cylindrical silos volumes. Starting from the second level, annular cylindrical walls are installed on a monolithic reinforced concrete slab. According to the original design, the concrete silo was 160 mm thick, with hole in the central part of each one. Subsequently, during operation, the walls of the silos were reinforced with a system of reinforced concrete transverse perimeter annular structural elements. The first block of the building has a length of 36 m, the second block – 30 m.

The working tower, measuring 19.2x7.0 m in plan, is constructed of monolithic reinforced concrete and has extensions – buttresses – found on the façade in the longitudinal reinforced concrete walls. The height from the top of the foundation slab to the roof of the tower is 59.2 m. A two-storey brick superstructure was built on the tower, which increases its height to 66.9 m. The load-bearing walls are longitudinal with a floor made of prefabricated reinforced concrete standard slabs. Coatings of both blocks of silos are reinforced concrete monolithic slabs.

According to technological needs, the tower is divided into two floors. The first floor of the tower is 3.2 m deep, the walls of the deep part of the tower are built of monolithic reinforced concrete 80 cm thick.

The connecting bridges-transitions have brick walls with glazed light openings and overlapping with prefabricated reinforced concrete slabs along the bearing longitudinal walls. Above the reinforced concrete slabs on light metal trusses, the roof is made of metal sheets.

As already mentioned, during the operation of the grain elevator complex the authorities did not pay close attention to the scale of urban planning, historical environment, the value of the relief of the Kyiv hills, which formed the historic center of Kyiv, the planning value of Podilskyi district. This led to a situation where the Kyiv grain elevator became one of the unsuccessful urban-planning unsubstantiated examples of placing industrial buildings among residential buildings in the central right-bank part of the city, which forms one of the important points of visual perception of Kyiv from the wide floodplain of the Dnipro.

However, given the architecture and historical value of the object, it must be preserved externally with modernization of facades, redevelopment of the site and internal layout for another function, especially since the asymmetrical composition of the elevator complex actively forms the "river facade" of the city, the vertical volume of the tower accentuates the area on the coast. One of the options to change the function could be the transformation into a cultural and social complex, thereby increasing the urban, architectural and aesthetic value of this building.

The revitalization project proposes to change the space of the complex from technological to recreational with access to the Dnipro River, with the formation of a modern pedestrian space and landscape space for active recreation. This involves revitalizing the port area of Podol Harbor, understanding the silhouettes of the complex of buildings as public multifunctional objects, rethinking the high-rise part of the complex as an accent in the panorama of the Right Bank. The transformation of the elevator into a cultural and public center for 1,600 visitors (residents of the district and visitors) is justified by the lack of such facilities in this part of Podil, as both the Harbor and Rybalskyi Island developed as industrial areas.

The authors of the project analyzed the world experience of revitalization of silos on the example of Finland, Belgium and South Africa. In Oulu, Finland, cylindrical silos from the 1950s (when the Kyiv grain elevator was built) were converted into housing – 95 "smart" apartments with balconies in round silos – from one-room to three-level with attics. The authentic appearance of the object was preserved as much as possible, but due to the accident most of the structures had to be dismantled.

The silos of the old malting plant near Antwerp in Belgium, 28 and 31 m high, were successfully converted into residential apartments, workshops, museums and offices, and underground parking was arranged.

In 2017 in Cape Town in the complex of grain silos – a monument of industrial architecture of South Africa on the area of 9,500 m² nine-storey Museum of Contemporary Art of Africa and its Diaspora was opened. The galleries and the atrium space in the center of the museum were cut from the dense cellular structure of the 42 silos that make up the building. 6000m² of exhibition space are located in 80 gallery premises, there is a roof garden, a sculptural and architectural complex, a bookstore, a restaurant, a bar, reading rooms. These projects became the basis for the development of the Kyiv grain elevator revitalization project.

According to the functional zoning of the designed complex, it provides zones: exhibition, catering, informational, educational, recreational, business, economic, sports and entertainment, pedestrian communications with landscaping and landscaping, separate areas of internal and external transport. The buildings are divided into floors of standard height for exhibition halls and public spaces – conferences, seminars, trainings, etc.

The project provides for a number of measures to repurpose the facility. There is a restaurant on the ground floor, and a summer event area in the courtyard in summer. Dismantling of the non-bearing longitudinal wall of the ground floor of the outer stylobate part of the silo blocks of the building, completion by "lowering" the walls of the silos to the level of the area in front of the building is envisaged. Some proposals relate to additional natural lighting, which is due to the location of exhibition halls in the silos. It is proposed to cut light holes in the outer walls of the cylinders, without violating their structural bearing capacity. Given the structures durability, it is proposed to preserve the walls of the cylindrical silos as a support for the organization of floors in different parts of the object for new functions and space development (Fig. 6).

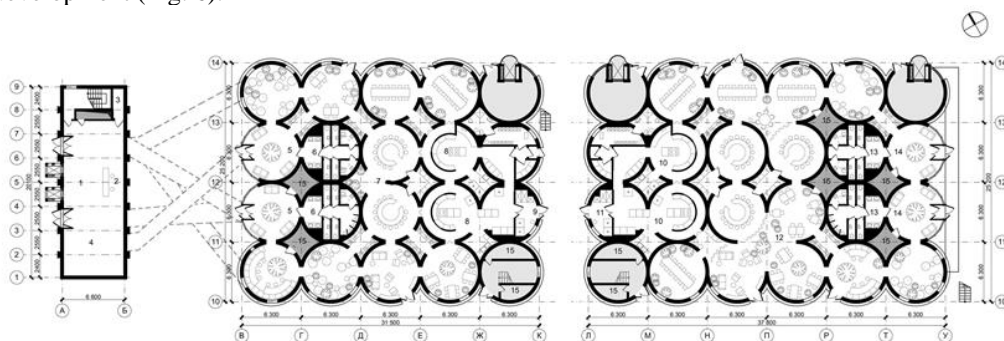


Fig. 6. The project of the Kyiv grain elevator reconstruction for cultural and public function (plan at the level mark 0.000). Authors S. Reshetnyk, J. Vig, Y. Ivashko, 2020

The vertical load-bearing walls of the silo cylinders are additionally combined with new horizontal floors as diaphragms. The space of the two silo blocks is combined by a system of transitions at different levels, and the technical bridge transitions over the silo blocks are dismantled.

The new multi-level internal space of the grain elevator silo units is united by the asymmetrical arrangement of horizontal and vertical communications (passages, stairs, ramps, escalators). In the planning structure of the main tower panoramic elevators designed, rising which to the upper floors of the complex, you can see the landscape of the Dnipro River and both its banks. On the top floor of the main tower there is a panoramic covered terrace and a viewing 24-hour lounge and cocktail bar. The volume of silo blocks-buildings according to the new plans provided by the project, are also equipped with panoramic elevators with views of the parks of the left bank of the city.

Taking into account the needs of the new functions, the height of the cylindrical silos is reduced in height to various levels on the facade, which provides the volume with asymmetrical compositional expressiveness (Fig. 7). The cylinders are completed with completed transparent glass volumes of various heights, which aim to "dematerialize" the modern brutal industrial character of the building architecture.

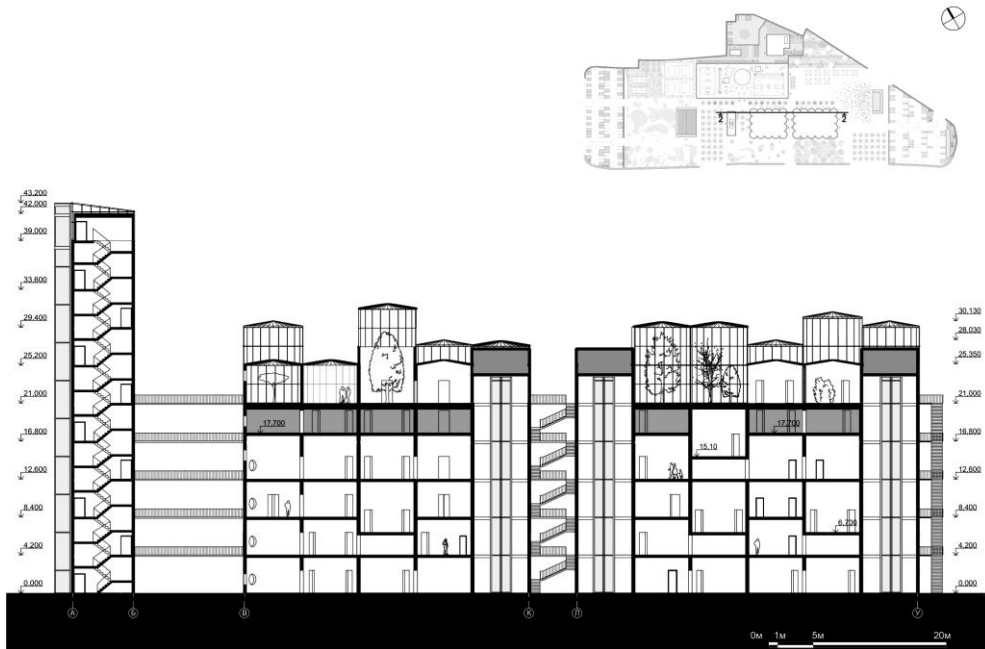


Fig.7. The project of the Kyiv grain elevator reconstruction for cultural and public function (longitudinal section).
 Authors S. Reshetnyk, J. Vig, Y. Ivashko, 2020

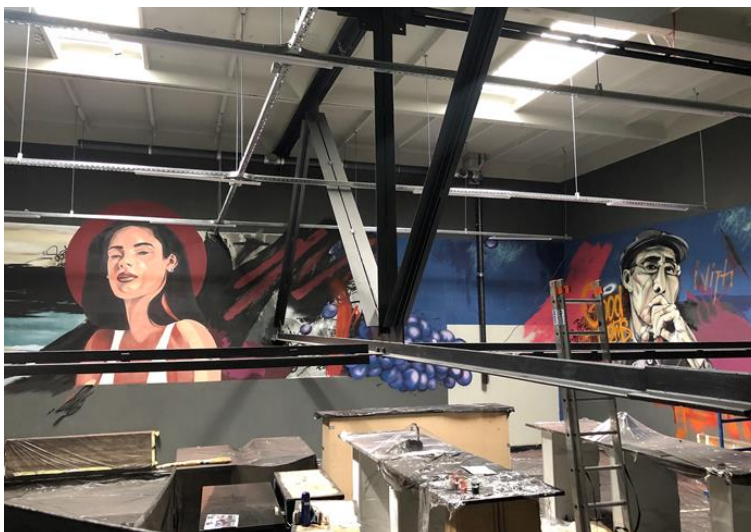


Fig. 8. Paintings in the interior of the former industrial building at 47 Elektrotekhichna Street in Kyiv, Ukraine. (authors O. Ivashko and Splay.co)

The new facility corresponds to the concept of "green architecture" or "ecological architecture". In the transparent glass end of the newly rebuilt space, an open recreational space is organized towards the Dnipro – a garden of public use from the natural areas of Ukraine flora: trees, shrubs, flowers, exotic plants.

An example of the revitalization of typical industrial buildings by artistic means is the project implemented in July 2020 by O. Ivashko with the co-author-artist Splay.co of interior painting for the showroom (Fig. 8).

The industrial facility is located on the 47, Elektrotekhnichna Street, in Kyiv. The street itself was laid in the 1980s and built up with industrial buildings. Initially, it was planned to move industrial enterprises from the central districts of Kyiv to this zone, but due to the collapse of the USSR in 1991, not everything was possible, and over time there was a problem of re-profiling capital buildings that lost their original purpose. Subsequently, these buildings were repurposed for warehouses, offices, production. Since the buildings were built according to standard designs, there was a question of aestheticization of their interiors. The problem was that the original long-span structures remained in the interior. The artists chose the option of decorating the walls with thematic murals, which in style match the existing structures and give the showroom the look of an art object.

This indicates another possible direction of aestheticization of the appearance of an industrial building and its transformation into an art space exclusively by artistic means.

Conclusions

The analyzed experience of revitalization of monuments of industrial architecture shows that the most common is the re-profiling of light and food industry, although there are examples in the world of successful revitalization and industrial institutions of another profile. The described and analyzed examples show that most often such objects are re-profiled for various public functions, although in Łódź there is an example of re-profiling factories for luxury housing (Książy Młyn).

Revitalization of a historic industrial building with its redevelopment instead of complete demolition and construction of a completely new object becomes an attractive option for the investor only at a certain level of economic development. Therefore, revitalization is much more common in Poland than in Ukraine, and in Ukraine it is much more common in Kyiv and other major cities compared to such provincial centres as Poltava or Sumy.

There are the following types of revitalization: the enterprise as a whole (complex of buildings and structures), a separate building (structure) or part thereof.

Thus existing designs can remain open (especially if it is a bricklaying of high quality), or be completely closed by modern finishing materials both in an exterior, and in an interior (most often in case of buildings of 1960s – 1980s from precast reinforced concrete).

If an object cannot be repurposed for another function, it can be completely transformed into a non-functional art object (Mine F60 in Poland). The transformation into an art object can be partial (the interior of the showroom at 47 Elektrotekhnichna Street in Kyiv, Ukraine).

It is obvious that the question of finding the best methods of revitalization of historic industrial buildings is closely related to the level of socio-economic development of the country as a whole and the individual city and will remain a matter of debate for a long time.

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