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PRESERVATION, RECONSTRUCTION, AND EXPANSION OF THE FORMER SILK FACTORY COMPLEX IN LODZ, POLAND. CASE STUDY

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Abstract
The aim of this study is to conduct research on the construction and reconstruction of a post-industrial complex for the function of a residential and service building. The essence of the article is to describe the steps and stages carried out as part of revitalization. Conservation research and architectural design concern a large city tenement house with post-industrial buildings at 13 Wólczańska Street in Łódź. Adaptation of post-industrial buildings to new functions that meet the needs of residents and give a chance for a new life for historic buildings. In the presented case, it was decided to discover the atmosphere of the past, industrial nostalgia combined with modern details and solutions, which creates a new aesthetic expression. The article presents a conservation and architectural dialogue between old and new forms.

Keywords: *Revitalization; Reconstruction; Industrial building: Factory; Preservation; Residential building*

Introduction

In the contemporary world there can be seen a great architectural heritage of the industrial revolution. The city of Łódź is currently undergoing a dynamic transformation in which former factories are being transformed into modern apartments and service spaces [1]. Such places attract residents looking for unique spaces to live. Apartments in post-industrial buildings offer a unique style that is difficult to find in traditional apartments. Facilities of this type are often located in the city center, facilitating access to work, services, entertainment, and public transport. Transforming old industrial buildings into modern residential and office spaces helps revitalize neglected neighborhoods and improve urban aesthetics [2]. These types of buildings offer spaces that can be easily adapted to various functions and user needs, which is especially important in rapidly changing social and economic conditions. The ability of post-industrial buildings to adapt and their flexibility and revitalization potential make them an attractive alternative to traditional forms of development [3]. Studying the importance and potential of loft buildings may contribute to a better understanding of their role in the context of dynamically changing urban and social conditions [4]. Industrial buildings complement the urban identity of cities and provide an opportunity to act on pre-existing conditions, providing opportunities to reflect on criteria for restoration, conservation, intervention, and revitalization. The transformation of these spaces can bring comprehensive improvement in the quality of life of the community.

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Factory buildings are characterized by material simplicity, in which brick is most often distinguished by its composition and spatiality [5]. According to the theory of Jane Jacobs, author of the book "The Death and Life of Great American Cities," architects should use existing building resources in their new ideas [6]. It is a way to catalyze positive change and support diverse urban environments. Inserting new activities into existing frameworks is becoming an increasingly defining aspect of contemporary architecture [7]. This topic requires detailed considerations at several levels, from the perspective of urban planning, through design methodology, to technical aspects of construction. At the urban level, this phenomenon creates the opportunity to create more diverse and architecturally rich cities.

The aim of this article is to analyze how the historical and architectural values of the buildings were preserved and incorporated, respecting their original features, materials, and architectural details. Presenting the revitalization of a Silk Factory as a case study may be of value and inspiration for future revitalization projects in Poland.

Materials and methods

In order to understand the historical, architectural, and socio-economic context of the Silk Factory in Łódź, several research methods were used. The methods included literature review, analysis of books, scientific articles, reports, technical documentation, and publications on the revitalization and adaptation of industrial monuments. Additionally, archival materials were also used to conduct the research, such as examination of available historical documents, architectural plans, photos, and maps related to the silk factory. In order to assess the current condition of buildings and identify historical and architectural values, the research was based on conservation analysis, a detailed inventory of buildings, and interviews with experts (architects, conservators, and engineers). Sources from various areas were used for the research:

- Resolution No. VI/211/19 of the Łódź City Council regarding the approval of the local zoning plan for the part of the city of Łódź located in the area of Aleja Tadeusza Kościuszki and the following streets: 6 Sierpnia Street, Żeligowski Street, św. Jerzy Street, Cmentarna Street, Legionów Street, Zachodnia Street, and Wólczańska Street.
- Conservation guidelines for planned works, issued by WUOZ in Łódź—letter no. WUOZ-ZN.5183.1428.2019.AP, dated April 3, 2020.
- Conservation study of buildings at ul. Wólczańska 13 and Więckowskiego 22 in Łódź, author: conservator of monuments, *Anna Połomka* [8].
- Scientific sources were developed in the area of general restoration aspects—publications by *E. Małachowicz* [9] and *B. Marconi* [10].
- Expert opinions on the technical condition of buildings, prepared for buildings on plot no. 445, within P-9, and on adjacent plots, by *Jan Kozicki and Paweł Tejchman* in 2020 [11].

Results and discussion

Historical description of the investigated post-factory complex

The positive aspects of the revitalization of post-industrial areas in Łódź not only influence their development but also serve the city because they generate metamorphoses in the surrounding areas. The action leading to the transformation of the former Silk Factory in Łódź not only changes the function of the facility but also develops the degraded infrastructure and increases the level of safety of residents. The transformation of the described factory into contemporary residential lofts leads to a synthesis of the past and the present. Since the legalization of urban-industrial reuse in the 1960s in the United States, a new standard of desirable residential life has been established. Architects and designers used the features of converted warehouses and factories, and lofts became associated with an industrial, refined style. Converting factories in Łódź into residential buildings is consistent with the principles of sustainable development,

protection of history, and contemporary city life, which makes it a very beneficial approach to urban redevelopment. In Łódź, many abandoned factories gained a new life and were converted into residential buildings. There are multiple examples: Scheibler's Loft Apartments in the Księży Młyn complex, where the industrial character of the buildings has been preserved, with high ceilings, large windows, and original architectural elements [12]. The former tobacco factory, Tobacco Park, is also an interesting example of modern apartments in a unique, attractive space embedded in history. There is also the Fuzja project, which assumes the creation of a new district, corresponding to the contemporary needs of its users, respecting the historical heritage of the city [13]. Revitalization of a post-industrial area is a complex process, entailing challenges in the form of financial outlays and time-consuming technical procedures. Contemporary revitalizations show that designers are able to combine action instruments aimed at social and economic development and environmental protection [14].

An example of another modern revitalization of a historic area in the city of Łódź is the post-industrial complex, which is the subject of research in this article. This historic structure is located at 13 Wólczanska Street in Łódź. The beginnings of the industrial establishment date back to 1887, when Hugo Bressel launched a small leather glove factory. In the 20th century, the new owner was Gerszon Gerszner, who transformed the factory, launching the Cotton Weaving Plant. After 1900, the "Schmitz & Van Endert" company operated in the factory, which ran the Finishing Plant and the Silk Wash. In the interwar period, the plant developed dynamically. After World War II, the factory operated the Knitting Work Cooperative "Wzór," which continued the textile traditions of this place [15]. The post-industrial complex, which also includes a neo-Renaissance urban tenement house, is currently entered in the Municipal Register of Monuments.

The historic nature of the buildings testifies to the rich industrial history of Łódź and preserves the memory of the old factories that shaped the city. The described factory is a perfect example of the industrial transformations that have taken place in Łódź over the years. This plant adapted to changing market and technological conditions, remaining an important element of the history of Łódź industry. The factory was characterized by special architectural details that reflected the industrial and technological standards of the time, as well as the aesthetics of the era. Another characteristic feature of this site is the well-preserved factory chimney, which was used in the past to discharge exhaust gases and smoke generated during production processes.

Spatial layout of the designed building

Renovation and revitalization of old buildings is a complex and multifaceted undertaking that combines the preservation of history with the challenges of modern construction and engineering. These structures are treasure troves of cultural and architectural heritage. The revitalization process involves a deep commitment to preserving the past while meeting contemporary standards. These elements were introduced into the described Silk Factory project. The revitalization solution proposed by the design team retained the internal courtyard, typical of tenement houses in the metropolitan area of Łódź. The revitalization made by Marciniak and Witasiak Architects Office includes post-industrial buildings and a corner tenement house located at the intersection of streets. The facades of the existing post-industrial buildings inside the plot were designed with a brick texture, while the tenement house was left plastered with colors referring to historical ones. New buildings added to the historic complex were designed in brick and reinforced with the concrete construction. The structural elements of the existing parts were strengthened, renovated, or replaced in accordance with the construction and executive design of the structure. The external walls were designed with a reinforced concrete structural layer with concrete pins. Industrial spaces in factories offer a unique character and functionality, combining history with modern design. They are an ideal choice for people who value originality, spaciousness, and raw aesthetics. Lofts in the Silk Factory are an investment that meets the needs of people looking for comfort and relaxation while being in the center of a bustling city. Due to the post-industrial nature of the complex, the apartments are

extremely diverse in terms of layout, area, and number of levels, which allows them to respond to the needs of a diverse group of new residents (Fig. 1).

Fig. 1. The visualization of the factory complex.
Author of the project: Marciniak & Witasiak Architects

Silk factory in the context of ecological solutions

Łódź, as a city with a rich industrial and architectural history, is gradually adapting to modern trends, including green architecture. Roof gardens in buildings in Łódź are becoming more popular, especially in the context of the revitalization of historic industrial buildings [16]. These types of projects combine heritage protection with ecological and aesthetic benefits. One such example is the revitalization of the historic EC1 heat and power plant, which includes not only the transformation of the building into a cultural center but also the introduction of modern architectural solutions, which may include green roofs in the future. As part of pro-ecological activities, the Łódź Special Economic Zone implements green infrastructure solutions, including green roofs on some administrative buildings. Such solutions aim to promote sustainable development and improve the quality of life in urban industrial spaces. There are more and more new development projects in Łódź that include green roofs as an element promoting ecology [17]. Green roofs help reduce heat loss in winter and stay cool in summer. Additionally, such solutions have acoustic properties and can reduce external noise. Another advantage of using greenery on roofs is the protection of waterproofing against mechanical damage and solar radiation. They can also be a tool to promote rainwater retention, reducing the risk of flooding. The introduction of ecological solutions is very well developed all over the world. Renzo Piano, an Italian architect known for designing buildings such as the Center Pompidou in Paris and The Shard in London, is a supporter of the integration of greenery in architecture (Fig. 2). According to the Italian architect, green roofs are not only aesthetic but also a response to problems related to urbanization and climate change. By integrating greenery with buildings, we can create a more sustainable and people-friendly urban environment. Concrete jungles can be transformed into urban oases [18].

Fig. 2. Plan showing the green areas of the gardens in the inner courtyard and the greenery on the roofs

The residential buildings of the Silk Factory use solutions that can contribute to increasing the energy efficiency. This task can be achieved through the appropriate use of thermal insulation, but above all, the use of a large amount of green areas in the internal courtyard and on the roofs. These solutions contribute to increasing biodiversity in the city, reducing the urban heat island effect, and improving the quality of life of residents, creating places for recreation and relaxation.

Assessment of the technical and historical condition of the Silk Factory in Łódź

The main goal of conservation works for the "Lofts in the Silk Factory" investment is to stop the deterioration and restore functional and historical properties. The tenement house at the intersection of Wólczańska and Więckowskiego streets in Łódź is a two-story tenement house preserved in the Neo-Renaissance style (Fig. 3,4). The tenement house is a two-story building and built in a nine-axis rhythm. On the eastern side, it has a five-axis façade with an entrance gate in the fourth axis. The entrance gate is crowned with a flattened arch. The vault in the gate opening is segmental, with straight side walls. Window and door finials are characterized by a flattened arch. The main windows on the named stories have a simple lintel. The Neo-Renaissance style, part of the broad historicism movement, showcased the fascination with Renaissance culture and art and the desire to recreate harmony and elegance. The building has classic symmetry and well-balanced proportions, modeled on Renaissance architecture.

The story divisions are distinguished by profiled cornices. Window and door disturbances evoke longing for the event and Renaissance inspirations by creating window bands, pilasters with simplified capitals, and composite pilasters. The central axis accessible at the front is accentuated by a doorway topped with a tympanum. The remains of the balcony slab balustrades and window joinery have not been preserved in the building. The door joinery is also secondary, made of steel, and characterized by a different form. The façade facing the yard is no longer as representative as the façade facing the street. It is simple, without an avant-corps located in the stairwell. The balcony slabs on the horizontal, eastern equipment are heavily damaged due to the lack of waterproofing, which is provided by the installed steel elements and subsequent local loosening of the plaster. They enable conservation research to uncover open

surfaces on accessible surfaces in order to gain access to the color data of the tenement house. On their basis, it was determined that the facade had a difference in shades of beige.

Fig. 3. View of the original tenement house from the intersection of Wólczańska Street and Więckowskiego Street in Łódź
Author of the picture: Anna Połomka

Fig. 4. Visualization of a revitalized tenement house with a planned superstructure and adaptation of a silk factory
Author of the project: Marciniak & Witasiak Architects

The factory building currently has a smoothly plastered and painted eastern façade. A spatial mural by Łukasz Berger was painted on the southern façade in 2015. The window openings are rebuilt in places, while on the ground floor they have nets. According to conservation studies, the plinth zone is heavily damp, which resulted in the plasters loosening in the ground floor zone (Fig.5,6). The building's window joinery is made of wooden profiles; its condition is poor, and the original layers of paint have not been preserved. The factory building is preserved in its original form. The plasters have shrinkage cracks, moisture and loosening, especially on the eastern side and in the ground floor area. The building's façade is characterized by secondary roofs.

Fig. 5. Upper picture: Original façade of the silk factory building
Author: Anna Połomka Lower picture: visualization of the project by Marciniak & Witasiak Architects

Fig. 6. Upper picture – original view of the tenement house from the courtyard.
Lower picture – visualization of the project by Marciniak & Witasiak Architects
Author of the picture: MSc Anna Połomka

The original locksmith windows made of cast iron profiles are preserved in their original form, are partially devoid of glazing, and are heavily covered with corrosion products. The gate opening located in the third axis from the north has been preserved in its original form. However, the original gates have not survived and were replaced with a modern steel gate. The interior of the gate opening has re-plastered walls and a preserved sectional vault. The wall surfaces in the lower zones are damp and have loose plaster and peeling layers of secondary paints. From the side of the yard, two cast iron bumpers have been preserved; one of them has a missing upper element in the form of a ball. The outcrop on the surface of the clearance wall revealed the presence of limestone. The interior of the factory building is devastated; the ceilings and walls are damp, divided, and modernized, and the interior has no historical value.

The single-story post-industrial building has extensive plaster defects caused by moisture, which is caused by the lack of functional gutters and sheet metal flashings. Locksmith windows are made of flat steel profiles covered with secondary paint coatings and corrosion products. The building is "connected" with a steel structure that serves to support the transport structure running above it. The brick chimney has been preserved in its original form; the brick faces are covered with carbonate layers and pollution caused by atmospheric factors.

Detailed technical analysis of selected structure elements of one of the revitalized post-factory buildings – B5

The building is a single-bay structure with reinforced concrete ceilings and brick walls, covered with a wooden roof. The original locksmith windows made of cast iron profiles are preserved in their original form, but the lack of glazing and corrosion can be seen. The steel gates have also been preserved but are now covered with secondary paint coatings. The interior of the building is neglected and re-adapted. Reinforced concrete ceilings and wall surfaces have peeling coatings of secondary paints. The author focuses on the analysis of the front elevation of the building B5 (Fig.7). Characteristic damages to the front façade include plaster defects on large wall surfaces, moisture and surface damage, oil stains on the façade, scratches on lintels, destruction of the ramp, dampness of the lower surface of the wall, and damage to the external stairs in the basement located near the southern wall (Fig. 8-10).

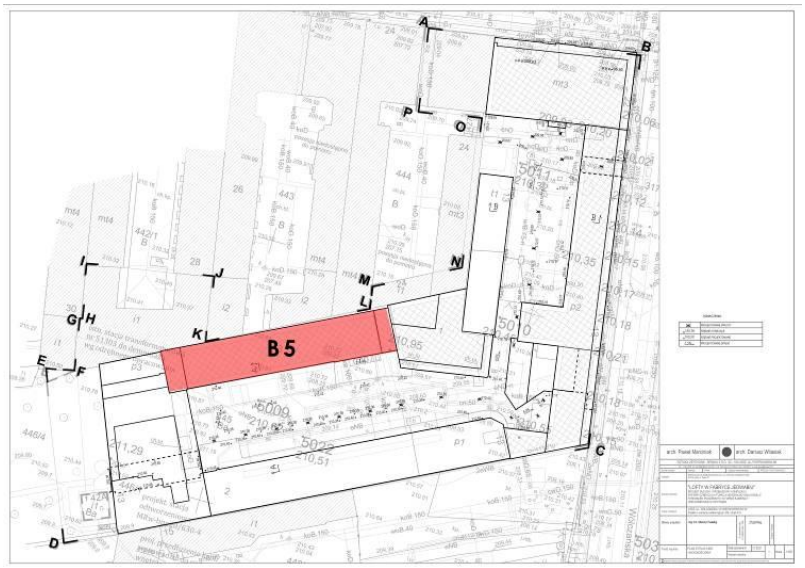

Fig. 7. Plan with the location of the building nr. B5. Author: Marciniak & Witasiak Architects

Fig. 8. The condition of the building's façade with the secondary roofing
Author of the picture: MSc Anna Połomka

Fig. 9. The state of preservation of locksmith windows. Author of the picture: MSc Anna Połomka

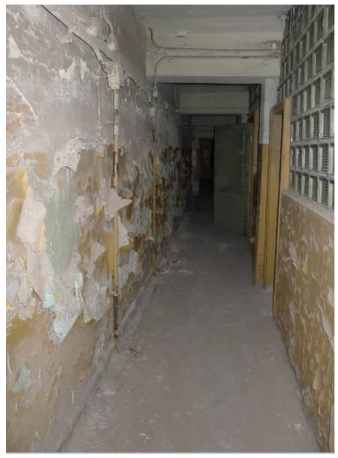

Fig. 10 Building B5 – dampness in the northern wall in the basement. Author of the picture: Dr. Eng. Jan Kozicki

The technical condition of the building varies in different places. The condition of the wood in the roof truss is poor. There is a visible leaking problem as a result of wet ceiling lining and falling plaster, as well as wet ceilings and walls on all floors. Moreover, there can be noticed scratches in the ceilings above the ground floor. The condition of the wall should be assessed as poor because of the moisture visible on all floors and the accompanying plaster on the outer surface of the wall. The outer surface of bricks from both sides presents losses and destruction. Separation of cracks in concrete window lintels is known from the exact edge of the jambs.

After the technical and conservation expertise of the building, there were several recommendations that should be followed. The building should be protected against moisture. The method of foundation of the building should be verified, especially the northern walls. The results of ground tests in detail ought to be specified. There should be performed vertical and horizontal moisture insulation. The pillars between the windows have to be reinforced, as well as the scratched wall fragments, which should be secured. New stairs and ceiling protection must be considered, taking into account fire safety conditions. Designers had to create projects of the external partitions, taking into account the use of thermal protection (Fig.11) [8].

Fig. 11. Visualization of the inner courtyard. Author of the picture: Marciniak & Witasiak Architects

Summary of revitalization in the silk factory

According to the conservation research, technical expertise, and opinion on the condition of the historic facades, the project had to take steps to carry out the necessary repairs. These include removing roof leaks, cleaning roof surfaces affected by biological corrosion, relieving the ceiling above the second floor by replacing the plaster with hard mineral wool, spreading mineral wool on the attic ceiling and beams, sewing up scratches in the staircase lintels, and removing loose elements from the façade and balconies.

The project provides for comprehensive repair (reconstruction) of the façade decoration, including removal of weak parts of plaster, strengthening of walls, pillars, and lintels, execution of vertical and horizontal insulation, reconstruction of architectural elements, application of new plasters, and execution of sheet metal workings, in accordance with the design structure and a program of conservation works.

If it is necessary to remove details from the façade of a historic building or a corner tenement house. They should be retained or casts made in order to make the recreation of the elements possible. From the inside of the existing brick walls, the plaster should be removed, and the existing walls should be repaired or reconstructed. The surfaces of the existing walls should be leveled before laying the thermal insulation with Multipor blocks.

The project followed the recommendations by demolishing the existing roof (including structural elements, roofing, and covering), building one story in a brick and reinforced concrete

structure, and constructing a new roof in a reinforced concrete structure. All ceilings were also demolished, and new reinforced concrete ceilings with tie beams were created. The project also included the demolition of the existing staircase flights and landings, and new flights of reinforced concrete structure were designed, reproducing the shape of the existing staircase. Reinforcements of the existing walls and lintels were designed, as well as the new balcony slabs in a reinforced concrete structure, reproducing the shape of the existing balcony slabs, along with new barriers that meet the requirements of construction law. Conservation work also had to be carried out on all building facades, including the removal of falling plaster [19].

The aim of revitalization is primarily to reverse negative trends, such as the degradation of space and industrial buildings, intensification of social pathologies, marginalization of the area, outflow of wealthy layers of society, and devastation of architecturally valuable nineteenth-century buildings.

Conclusions

The revitalization of the complex, which combines a neo-Renaissance tenement house, historic factory buildings, and new buildings, constitutes one of the greatest conservation and architectural challenges. This project requires not only the preservation of the historical and aesthetic values of individual elements but also the creation of a coherent and functional whole that will meet contemporary functional and ecological requirements.

The research methods used for the revitalization, expansion, and adaptation of the former silk factory complex in Łódź include a multi-aspect approach that takes into account both technical, historical, social, and ecological aspects of the project. Thanks to the use of various research methods, it is possible to obtain a comprehensive picture and implement new revitalization projects in a sustainable, effective way and in line with the expectations of various stakeholders. This is an inspiring example for future activities in the field of protection and adaptation of monuments. The work carried out emphasizes the importance of a sustainable approach and innovative solutions in the procsess of revitalization of historic buildings.

The revitalization process encountered numerous challenges, such as the poor technical condition of the building and the need to meet modern construction standards. Thanks to careful planning, cooperation with experts, and innovative technological solutions, all these challenges were successfully overcome. It is recommended to continue monitoring the technical condition of the building and its energy efficiency to ensure the durability and sustainable development of the project.

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