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Source / Izvornik: **Buildings**, 2022, 12, 1 - 25

Journal article, Published version

Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

<https://doi.org/10.3390/buildings12020196>

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:133:862913>

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Download date / Datum preuzimanja: **2024-12-29**



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Article

Disappearance and Sustainability of Historical Industrial Areas in Osijek (Croatia): Three Case Studies

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Abstract: Historical industrial areas are considered as areas of particular importance in terms of their heritage value and cultural significance. They are usually located in city centers and have great potential for economic, cultural and urban development. At the beginning of the 20th century, Osijek was well known as an industrial city, but the globalization had a ripple effect on the industry, leaving industrial sites of Osijek in ruins. Although comprehensive studies have not yet been made, field research into historical industrial areas of Osijek showed that they are mostly abandoned. A literature review showed that there is not even one document that contains locations and basic information on the historical industrial areas that existed in Osijek from 1824–1945. The aim of this paper is to define exact locations of historical industrial areas that existed in Osijek from 1824–1945 and to analyze their current state, their architectural, urban and identity features. The research resulted in a database containing basic information about 59 historical industrial areas in Osijek. An analysis and comparison of the current state of 13 remaining existing historical industrial areas in Osijek is given. The three case studies present detailed analysis, comparison and evaluation of observed historical industrial areas.

Keywords: historical industrial areas; abandoned industrial areas; disappearance of historical industrial areas; analysis of historical industrial areas; industrial heritage; Osijek



Citation: Kraus, L.; Bojanić Obad Šćitaroci, B.; Karač, Z.; Kraus, I.

Disappearance and Sustainability of Historical Industrial Areas in Osijek (Croatia): Three Case Studies.

Buildings **2022**, *12*, 196. <https://doi.org/10.3390/buildings12020196>

Academic Editors: Paula Lopez-Arce and Ainara Zornoza-Indart

Received: 23 December 2021

Accepted: 1 February 2022

Published: 8 February 2022

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1. Introduction

Historical industrial areas in cities are referred to as areas of special interest because of their heritage value and cultural significance. Despite the fact that there is UNESCO's holistic approach to the management of historic urban landscapes by integrating goals of urban heritage conservation with social and economic development, so far Osijek has only several historical buildings within industrial areas partly preserved as industrial heritage, while the remaining whole historical industrial areas are devastated brownfield sites. This situation occurs mostly because of inadequate management, poor decision-making process and insufficiently developed awareness of the importance of historical industrial areas.

At the beginning of the 20th century, Osijek was a well-known industrial city [1]. Different industrial branches were developing until the end of the 20th century, when the homeland war and economic movements caused many industrial enterprises in the area of Osijek to close their business [2,3]. A review of archival material, available literature and field research showed that the historical industrial areas of Osijek were rapidly disappearing and that many traces of industrial areas are currently lost. The focus of this research is on the poor condition of existing industrial heritage and gradual disappearance of historical industrial areas in Osijek.

Historical industrial areas are witnesses of Osijek's former identity related to its economic strength and tradition of manufacturing. Moreover, they embody both the

memory of area and the place attachment. The most relevant industry sectors once present in Osijek were food, wood, textile, metal processing, leather and chemical industries (Table 1).

Table 1. Basic data on historical industrial areas existing in Osijek from 1824 to 1945. Source: authors, 2021.

No.	Name	Type of Industry	Year	Current State/ Demolished (D), Existing (E), Unknown (U)	Known Address (+), Known City Part (+/–), Unknown Location (–)
1	Wood Processing Workshop Rudolf Kaiser	wood	1865	D	+
2	The First Slavonian Furniture Factory Josip Povischil	wood	1884	E	+
3	Steam Sawmill, Karlo Axmann and Comrade	wood	1870	D	+
4	Sawmill and Wood-Industrial Public Company, Lavoslav Neuvirth and Comrade	wood	-	U	–
5	Steam Sawmill Josip Frank	wood	1872	U	–
6	Motor Sawmill Josip Burijan	wood	-	U	–
7	Sawmill Lavoslava Platzner	wood	1919	D	+
8	Industrial Crates Factory and Steam Sawmill Herman Steiner	wood	1924	U	–
9	Mechanical Barrel Factory Ogrizek and Comrade	wood	1919	U	–
10	Barrel Factory Antun Novosel	wood	1924	U	–
11	The First Osijek Wood Processing Factory d.d. Roller Mill, Josip	wood	1921	U	–
12	Krauss/Steam Mill of Josip Krauss and Sons	food	1879/1881	D	+
13	Motor Mill Dragutin Engelhardt	food	1880	U	–
14	Union Steam Mill d.d. Merkur Mill of Stjepan Urban/	food	1902	E	+
15	Merkur Mill of Herman Mautner and Comrades, Limited Partnership Osijek	food	1908/1911	D	+
16	Karolina Steam Mill/Karolina, Stjepan Piller Cookie Factory d.d./Karolina, Stjepan Piller Biscuit and Cookie Factory d.d. in Osijek/Karolina, Osijek Biscuit, Candy and Pasta Factory d.d.	food	1909/1928/ 1933/1935	E	+
17	Steam Mill of Nik. Pl. Szalopek	food	before 1892	D	–
18	Steam Mill of C. L. Pfeiffer	food	before 1892	D	–
19	Steam Mill of Josip Kellner The First Croatian-Slavonian d.d. for Sugar Industry	food	before 1892	D	+
20	Osijek/The First Croatian-Slavonian Factory of Sugar Products and Chocolate d.d. in Osijek	food	1905/1907	E	+

Table 1. Cont.

No.	Name	Type of Industry	Year	Current State/ Demolished (D), Existing (E), Unknown (U)	Known Address (+), Known City Part (+/–), Unknown Location (–)
21	The First Osijek Candy and Chocolate Factory Kaiser and Štark	food	1907	D	+/–
22	The First Osijek Hygienic Dairy Merkur	food	1912	D	+/–
23	Osijek Confectionery and Chocolate Factory, Gustav Krauss	food	1920	U	–
24	Osijek Trade d.d.—Production of Sweets	food	1922	U	–
25	Choloterien Francaise Soleil—Chocolates and Liqueur Sweets	food	1923	U	–
26	Bauera/Aleksandar Raith Brewery	food	1664/ 2nd half of 18th cent.	D	+
27	Steam Brewery, Malt and Ice Factory of Kajetan Šeper	food	1856	D	+
28	Starch Factory of Ivan Weinmüller	food	1874	D	+
29	Oil Mill of Mihael Lay	food	1825	U	–
30	The First Vinegar Factory in Osijek of Lavoslav Kramer	food	1851	D	–
31	Vinegar Factory Adela Knobloch (born pl. Reisner)	food	1885	D	+
32	Slaughterhouse	food	before 1892	D	+
33	City Slaughterhouse	food	1938	D	+
34	Osijek Workshop/Factory of Agricultural Machines Melchior Licht	metal processing	before 1862	U	–
35	The Company of the Berger Brothers and Comrade	metal processing	1896	U	–
36	Machine Factory and Metal Foundry of Josip Klarić	metal processing	1908	U	–
37	Osijek Iron Foundry and Machine Factory	metal processing	1912	E	+
38	Osijek Silk Factory	textile	end of 18th cent.	D	+
39	Silk Factory/Osijek Silk Weaving d.d.	textile	1926/1932	E	+
40	The First Mechanical Linen Weaving Mill— Ivan Fidler/Flax Industry d.d. Osijek	textile	1901/1926	E	+
41	Mara Knitwear Factory	textile	1909/1932	D	+
42	Fashion Confection Industry Slavonia Osijek	textile	1945	E	+
43	Silk Factory (colloq. Bubara) Handicraft Leather Company	textile	before 1892	D	+
44	Martin Gillming/ Handicraft Leather Company Josip Bartolović/Osijek Leather Factory d.d.	leather	1824/ 1870/ 1919	E	+

Table 1. Cont.

No.	Name	Type of Industry	Year	Current State/ Demolished (D), Existing (E), Unknown (U)	Known Address (+), Known City Part (+/–), Unknown Location (–)
45	Imperial–Royal Privileged Match Factory / Drava Match Factory d.d.	chemical	1856/ 1909	E	+
46	Samuel Reintz Soap and Candle Factory / The First Osijek Soap Factory d.d. Osijek	chemical	1894/ 1919	E	+
47	Palzzeriano Brickyard and Lime Factory	building materials	1880	D	+
48	I. V. Schulhof, Steam Brickyard, Lime and Ice Factory d.d.	building materials	1882	D	+/–
49	The First Croatian–Slavonian Granite and Marble Grinding Grindery	building materials	1897	U	–
50	Carl (Dragutin) Lehman Printing House (bought from Dragutin Karl Divald)	printing	1857	U	+
51	Gustav Wagner and Jakob Frank Printing House	printing	1869	U	–
52	Dragutin Sandor Printing House/Julije Pfeiffer Printing House	printing	1874/1876	U	+/–
53	Eugen Rupert Printing House	printing	1880	U	+/–
54	Alois (Vjekoslav) Schaffer Printing House	printing	1880	U	+/–
55	Dragutin Laubner Printing House	printing	1882	U	+/–
56	The First Croatian Joint-Stock Printing House	printing	1902	E	+
57	Glass and Porcelain Factory Stjepan Heim and Sons	glass	1884	D	+
58	Gasworks d.d.	gas	1884	D	+
59	Power Plant, Tram and Water Supply System of the Municipality of the Free and Royal City of Osijek	electrification	1907	E	+

Note: The Croatian Companies Act uses the term *dioničko društvo* (d.d.) for a joint-stock company (JSC). The combination of the symbols U and +/- was used in the case when the exact address of the observed historical industrial area is not known, but only the part of the city in which it is located is known. Original names of industrial areas addressed here are provided in Table A1.

In general, a city's urban identity often correlates its immovable industrial areas with a collection of past memories and intangible cultural heritage [4]. It is argued that the place of memory and expression of history contribute to the spatial quality [5]. Furthermore, the loss of authenticity and the disappearance of historical industrial areas from cities often cause the urban fabric to become too generic and monotonous. It is suggested that knowledge and planning tools can be used in the process of preserving the authenticity of urban heritage [6]. Preservation of historical industrial areas can contribute to enrichment of local identity, urban tradition and city sustainability [7,8]. Continuity over time and compatible changes (e.g., material, form, usage) are important in terms of preserving cultural heritage [9]. All of these statements can be applied to historical industrial areas, which are intended to be preserved for future generations.

Historical industrial areas are often mentioned in the context of industrial heritage, urban renewal and the impact on the local community [10], in the context of potentials for redevelopment [11], tourism development [12] and place identity [13]. The disappearance of historical industrial areas has been addressed by many authors, including Airas, Hall and Stern [14], Belláková [15], Cenci [16] and Loures [17,18].

There is no unique definition of a historical industrial area. It is rather a concept that comprises a complex combination of areas and buildings, people, practices and machines. It is also a conflicting phenomenon of material heritage, industrial heritage, socially conscious architecture, polluted land, ruined and devastated areas, and destroyed and dilapidated buildings. It can be said that historical industrial areas are a blend of potentials and devastation. Related to the aforementioned, such areas include a wide range of industrial areas: existing industrial areas [19], former industrial areas [7,17,20], abandoned industrial areas [21–24], reused industrial areas [25,26], missing or demolished industrial areas, industrial heritage [17,27–29] and brownfield industrial areas [30–33].

In this paper, the phrase historical industrial area refers to those areas where industrial companies established their core businesses during the industrial revolution up to the end of World War II, and where the first forms of urbanization took place.

Historical industrial areas can vary in size. Thus, they can be observed at a small-scale level (i.e., the scale of a building), the scale of a part of a city block or a whole block, all the way to a large scale (i.e., a part of a city or an entire city) and even on a landscape scale [34]. This paper deals with the city of Osijek's structure of historical industrial areas, and with consequences that decaying of such significant areas has on the city's urban fabric.

In addition, historical industrial areas are usually located in today's city centers. As such, they tend to be revitalized as industrial heritage to contribute to the city sustainability and identity [35]. However, there are also negative examples of abandoning historical industrial areas, which are then devastated or turned into brownfields [36].

According to Landorf [36], two important approaches to sustainable development of industrial heritage sites refer to the long-term holistic planning process and to participation of several stakeholders in such processes.

Although Osijek comprises several historical industrial areas, up to present, there is not even one complete historical industrial area classified as an area of historical importance (<https://registar.kulturnadobra.hr/#/>, accessed on 22 December 2021). Instead, they are observed as areas containing obsolete and useless set of industrial buildings and related infrastructure. In order for these areas to gain historical significance, it is necessary first to change the attitudes and awareness of the decision makers, who are mostly local politicians. Only then it will be possible to undertake actions to preserve these areas according to the recommendations given by UNESCO and international experts. For example, in foreign studies and available literature, so-called obsolete industrial areas are viewed in the context of adaptive reuse of industrial heritage [21,35,37,38], regeneration of industrial brownfields [31,39] and revitalization of historical industrial areas [40]. Instead of following such recommendations, local authorities have allowed Osijek's obsolete industrial areas to decay and disappear.

This paper also elaborates the issues of exact quantity, locations and current conditions of historical industrial areas in Osijek for the period 1824–1945, and focuses on their present role in the city's urban fabric. The main aim of this paper is to determine exact locations and to analyze historical industrial areas in Osijek that existed from 1824 to 1945 in terms of their current state, and their architectural, urban and identity features. This time span of some 120 years was selected on the basis of available data documenting the beginnings of industrialization in Osijek. The research revealed the records on the Martin Gillming Handicraft Leather Company as an initial factory opened in Osijek in 1824 [1]. The year 1945, the end of World War II, marks a global turning point in the field of industrialization and economics.

The aims of the paper are (1) to identify and determine exact locations of historical and industrial areas in Osijek, (2) to select and analyze three existing historical industrial

areas in Osijek, (3) to evaluate three different historical industrial areas in Osijek in the period from 1824 to 1945 in the context of their current state and value of its constituent buildings and (4) to recommend measures for preservation of existing structures.

Architectural, urban and identity features of Osijek's historical industrial areas are described in this paper and three case studies are presented. These three case studies elaborate different parameters that indicate the possibility of sustainability and preservation of each historical industrial area studied. The concept and complexity of sustainability is discussed in detail in [41], which also points out that the exact definition of sustainability and sustainable development is ambiguous. In this paper, the term sustainability is observed at a relatively low level, which refers to preservation of the observed areas only from the aspect of preventing of their disappearance, since they are abandoned, unmaintained and in poor condition. The selected cases are similar to many other European industrial areas [15,36,40].

This research begins with an overview of the study area, materials and research methods implemented. Furthermore, the paper describes the selection of historical industrial sites for which a detailed analysis has been conducted. Finally, it summarizes the main results of analysis performed on three different industrial areas of Osijek.

2. Materials and Methods

2.1. Study Area

Located in Central Europe, the Republic of Croatia borders Italy, Slovenia, Hungary, Serbia, Bosnia and Herzegovina, and Montenegro (Figure 1). Osijek is the largest continental city in eastern Croatia and the fourth largest in Croatia, following Zagreb (the capital), Split and Rijeka.



Figure 1. Croatia's position in Europe (Osijek is marked with a black dot). Source: authors, 2021.

The city of Osijek is located in the plain on the right bank of the Drava River. It covers an area of 59.11 sq. km. According to the 2021 census, its population counts 96,848 inhabitants. It is a seat of the Osijek–Baranja County. In the period covered by this research, Osijek was a part of the Habsburg Monarchy, the Austrian–Hungarian Monarchy, the State of Serbs, Croats and Slovenes, and of the Kingdom of Yugoslavia [42] (Figure 2).

At the beginning of the 20th century, Osijek was a well-developed city with rich economic and cultural life. In many aspects, Osijek was more European back then than it is today. At the end of the 19th century, small and medium-size factories started their business in Osijek, along with many craftsmen and manufacturers. According to the 1890

census, there were five factories in Osijek with a total of 235 employees. In 1900, Osijek had 14 factories with 697 workers, and in 1910, there were 25 factories with 2057 workers [1]. It is worth mentioning that in 1910, Osijek had about 33,300 inhabitants [43]. If such a trend of linear increase in numbers of factories in Osijek continued from the end of the 19th century to present day, there would be about 135 factories in today's Osijek. Unfortunately, some hundred years later, Osijek is no longer the same city as it was at the beginning of the 20th century. The promising future turned its back on Osijek, making it at present a provincial city with a weak industrial base, less crafts and consequently smaller workforce and fewer inhabitants.

The historical industrial area of the city of Osijek has been dealt with by several authors from different points of view: historical [44,45]; economic [2,46], geographical [44], architectural [47–49] and spatial planning [50]. An overview of their research is provided below, both chronologically and by the authors.

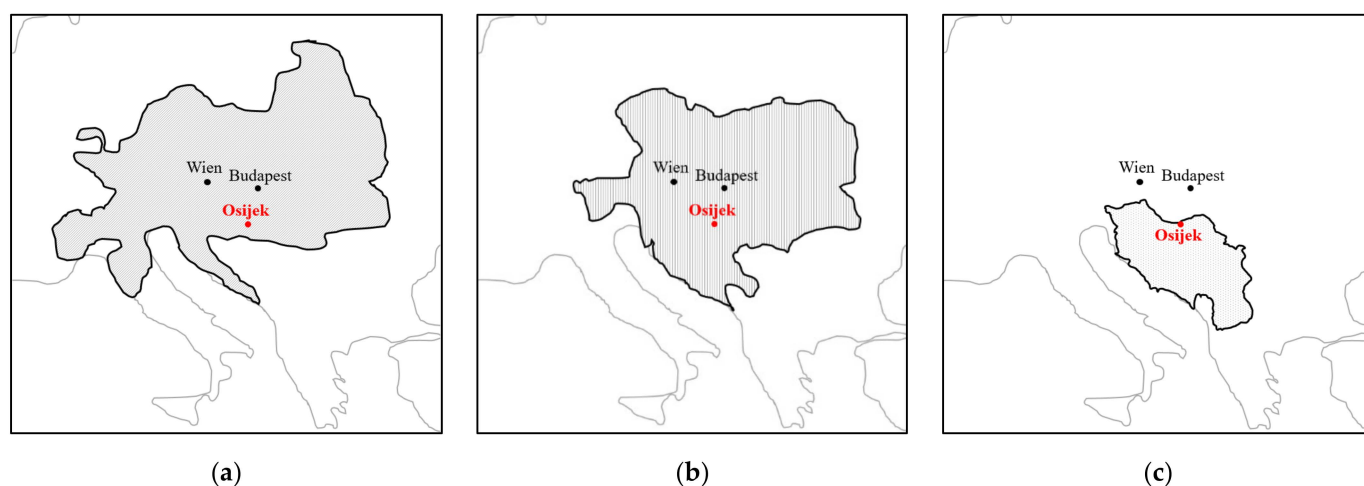


Figure 2. Osijek as a part of different countries: (a) Habsburg Monarchy (since 1687); (b) Austrian-Hungarian Monarchy (1867–1918); (c) The Kingdom of Serbs, Croats and Slovenes (1918–1929) and later the Kingdom of Yugoslavia (1929–1945). Source: authors according to Euratlas (<https://euratlas.com/>, accessed on 2 October 2021).

Mohorovičić [44] stated that Osijek during the 20th century was polarized because it possesses substantial natural and social resources: it had a good traffic position, it kept a central role in agricultural production and had well-developed specific industries. Singer and Turkalj [2] gave an overview of Osijek's industry from 1850 to 1996 from a historical and economic point of view. Živaković-Kerže [1] analyzed the development of industry in Osijek from 1868 to 1918 from a historical point of view. Jukić and Pegan [50] gave an overview of the spatial and urban development of Osijek in the 20th century, which included industrial and former industrial areas. Lončar-Vicković [49] dealt with Osijek's industrial architecture created in the period between the two world wars (1918–1945). Nje-gač, Gašparović and Stipešević [3] pointed out the most important change in the functional structure of Osijek, which occurred with the conversion of industrial land into land for commercial, business or residential use, and that after 1991, Osijek started to transform itself from an industrial city into a city with predominantly commercial activity. Lončar-Vicković and Stober [48] analyzed the historical origin and architectural heritage of the Osijek Iron Foundry and Machine Factory (OLT), while Lončar and Karač [47] proposed an inventory and systematization of industrial heritage documentation based on the Drava Match Factory. According to the GUP of the City of Osijek [51], the scope of the former OLT and the Drava Match Factory are planned for mixed, i.e., economic and business use, and there is no strategy of industrial heritage preservation. The nonexistence of the strategy is a significant issue, since the earlier studies and conclusions collected by reviewing the literature support the fact that the two industrial areas noted occupy a large area in the

wider city center. Despite the fact that Osijek was a main industrial center at the turn of the 19th to 20th century [45] and that it still has an evidently valuable industrial heritage, there are only several buildings and complexes under conservation protection. According to data from the Register of Cultural Heritage of the Republic of Croatia [52], these are a number of Povischil factory houses, the villa of the director of the Union Steam Mill, the Povischil factory building, the Union Steam Mill silo and the old factory building with a water tower and a chemical warehouse within the Osijek leather factory. Despite the protection, all the listed buildings are in poor condition due to the lack of maintenance. Although the idea of protecting the industrial heritage was developing globally in the second half of the 20th century [53], the analysis of published papers and studies written in Croatian language [54–57] demonstrated that there was no intention of protecting the industrial heritage of Osijek until the end of the 20th century.

In the literature reviewed, there was no overview of basic data on historical industrial areas and locations of existing historical industrial areas in Osijek. No evaluation of the sustainability of historical industrial areas in Osijek has been made to date. To the authors' best knowledge, this paper is the first to provide a detailed overview of historical industrial areas in Osijek, along with structured analysis and comparison of three selected case studies of historical industrial areas in Osijek.

2.2. Methods

An interpretive historical research method, a method of superimposing and comparing archival maps, plans, situations, drafts and postcards with present-day plans, maps, historical and contemporary photographs, together with field research, were applied to analyze, compare and evaluate selected existing historical industrial areas in Osijek. Furthermore, available scientific and professional literature published by domestic and foreign authors was reviewed.

Križaj [58] provided data standards in the inventories of architectural heritage in Croatia, while Ifko [59] developed a data standard for the inventory of industrial heritage in Slovenia. Paladino [60] presented a detailed chronological overview of conservation studies for industrial sites of Zagreb. Dumbović Bilušić [61] proposed a model for classifying cultural landscapes in Croatia that include urban and industrial landscapes. Under the editorship of Douet [28], a guide to best practices in managing, preserving and interpreting historical industrial sites was developed. For the example of three cities, Zagroba, Szczepanska and Senetra [62] conducted an analysis and multicriteria evaluation of architectural and urban features and their possibilities to meet the needs of modern society.

The research presented in this paper consists of three main stages:

1. Identification and determination of exact spatial location of historical industrial areas in Osijek;
2. Selection, analysis and interpretation of three case studies performed on the existing historical industrial areas in Osijek;
3. Evaluation of three case studies performed on historical industrial areas in Osijek originating from 1824 to 1945.

In the first stage of this research, historical industrial areas in Osijek that were in use during the period from 1824 to 1945 were identified and their exact spatial location was confirmed. Identification of demolished and existing historical industrial areas in Osijek was done by analyzing and comparing archival drawings and situations, historical maps, literature, postcards and photographs. Afterward, the exact locations of remaining units and fragments of historical industrial areas in Osijek were determined by using historical urban plans. Finally, an analysis of the current state of the existing historical industrial areas was made.

In the second stage of the research, the selection, analysis and interpretation of three case studies of the existing historical industrial areas in Osijek were carried out. The criteria according to which the observed cases were selected are (1) relation regarding current

conservation protection, (2) importance of the structure for the city fabric, (3) disposition in the city and (4) availability of archival and other documentation material.

The studied cases were chosen based on their different conservation protection status. One example refers to the devastated area as a whole, the second example contains some parts under conservation protection, while the third example refers to the oldest large factory in the city, which is neglected and gradually disappearing from the city fabric. The devastated area noted had great potential for becoming a protected industrial heritage site, yet such potential is now lost because that area no longer exists (a generic small shopping center and a parking lot were built on its place). The last example (large factory) still contains elements of industrial heritage, so it is still possible to preserve it if necessary steps are undertaken in this direction by the local and regional authorities.

The first selected case study focused on the historical industrial area with buildings under protection that were used by the Handicraft Leather Company Martin Gillming/Handicraft Leather Company Josip Bartolović/Osijek Leather Factory d.d. (the factory changed its name three times in the observed period 1824–1945). The second selected case study investigated brownfield areas of the Imperial–Royal Privileged Match Factory/Drava Match Factory d.d. (the factory changed its name twice in the observed period 1824–1945) that have potential of being classified as an industrial heritage site. The third selected case study refers to the historical industrial area of the Karolina Steam Mill/Karolina, Stjepan Piller Cookie Factory d.d./Karolina, Stjepan Piller Biscuit and Cookie Factory d.d. in Osijek/Karolina, Osijek Biscuit, Candy and Pasta Factory d.d. (the factory changed its name four times in the observed period 1824–1945) that is largely demolished. At this stage of research, within the selected case studies, historical plans and archival designs were analyzed to assess architectural and urban changes that took place over time. In addition, collected materials related to the selected case studies was visually and descriptively interpreted to define genesis and use of the respective area.

Lastly, the third stage of research focused on evaluating the three case studies of selected historical industrial areas. This stage comprised the evaluation of current state and value of each area and its constituent buildings for the purpose of recommending protection measures. The evaluation was based on archival drawings and situations, historical maps, literature, postcards and field research.

3. Development of the Case Studies

3.1. Identification and Location of Historical Industrial Areas in Osijek

A review of available literature showed that there is not even one document that contains locations and basic information (name, date, type of industry, current state) on historical industrial areas in Osijek from the period 1824–1945. Therefore, the first step in this research was to identify and locate historical industrial areas that existed in Osijek in the observed period (1824–1945) and to determine their current state, in terms of being demolished or existing.

The identification was made by analyzing and comparing a historical map from 1892 [63], and books [1], and [46]. The research identified 59 industrial areas in Osijek established from 1824 to 1945 (Table 1).

Table 1 lists the historical industrial companies in Osijek, year of establishment and the type of their business, together with their current state (demolished, existing or unknown) and location. Information contained in Table 1 provides clearer insight into the current state and sustainability of observed historical industrial areas in Osijek. The majority of industrial facilities listed in Table 1 were involved in food (37%) and wood industry (18.6%), while the smallest number of facilities dealt with electrification, gas, glass and leather processing (one of each).

Out of 59 identified historical industrial areas that existed in Osijek from 1824 to 1945, currently (in 2021) there are 13 preserved as a full unit or in fragments, 24 are demolished, while no detailed and clear information is available for 22.

Exact location is known for 32 historical industrial areas, while for 7 areas it is possible to determine only a part of Osijek in which they were located. The location could not be determined for 20 areas (Table 1).

The research continued with mapping and analysis of the existing historical industrial areas in Osijek, which was done by using historical maps, archival drawings and site investigation. The authors analyzed and compared historical maps, i.e., the city plan from 1892 [63], the regulations from 1912 [64], the General Cadastral Plan of the Municipality of Osijek from 1934 [65], orthophoto maps of the city of Osijek from 1969, the General Urban Plan (GUP) of the City of Osijek from 2017, and the Cadaster Map of Osijek from 2021, and individual archival drawings for each existing industrial area in Osijek, all with the purpose of determining exact locations of historical industrial areas on a present-day map of Osijek (Figure 3).

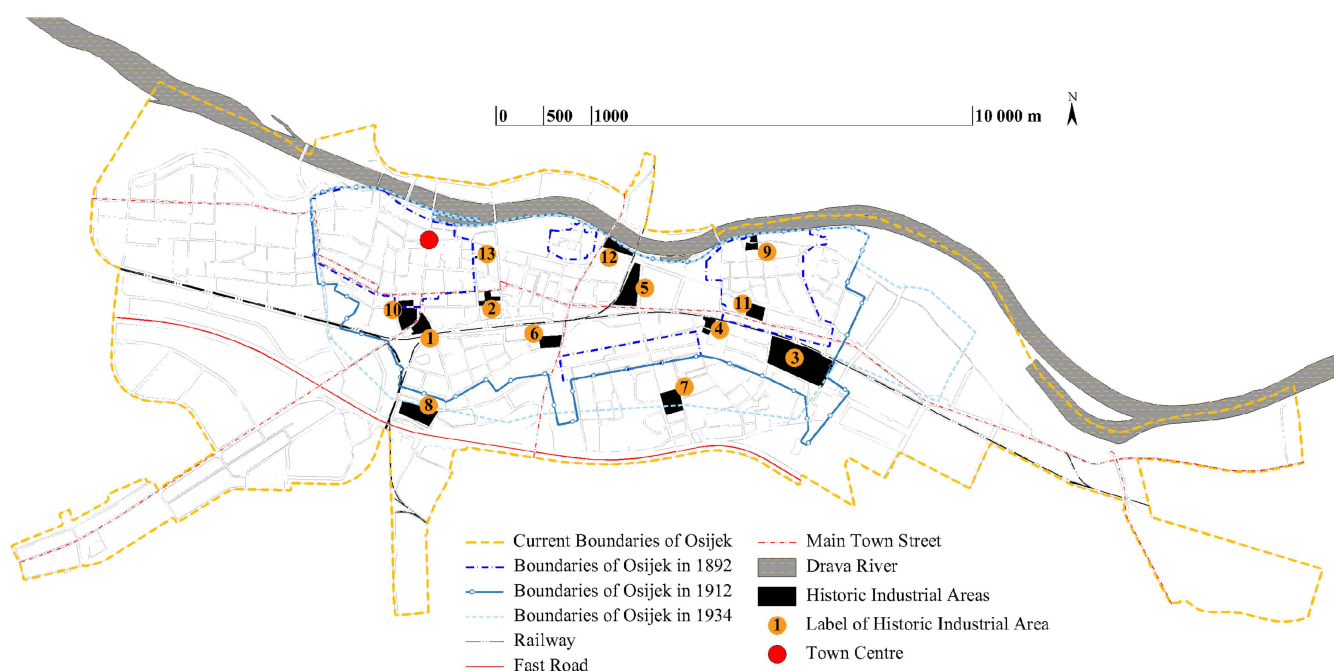


Figure 3. Existing historical industrial areas in Osijek. Source: authors, 2021.

Mapping of historical industrial areas in Osijek showed that nine areas were and still are located on the main streets of Osijek; two are located next to the waterway, while one historical industrial area was connected by rail to the waterway. Seven historical industrial areas comprised an in-house railway line, which was connected to the main railway (Figure 3 and Table 2).

Osijek consists of three historical parts—Gornji grad (Upper Town in the west), Tvrđa (Old Town the middle) and Donji grad (Lower Town in the east), which can be seen on the map from 1892. When comparing years of establishment of certain historical industrial areas with their locations in historical city parts (1892, 1912 and 1934), it is concluded that the historical industrial areas were established on Osijek's periphery. As a consequence of the city spreading, most of these historical industrial areas are now located in the inner city and, although abandoned, they have significant spatial and economic potential.

Out of 13 historical industrial sites that exist in Osijek at present, five are still working in their original industry branch (Figure 3 and Table 2). Field research confirmed that the Osijek Iron Foundry and Machine Factory is still engaged in the production of agricultural machinery in its former industrial area (tool shop building, production hall close to the side street and several storage halls inside the complex). Moreover, the Flax industry d.d. Osijek, i.e., present Tekstil-LIO d.o.o., works in a new building located in one part of the historical industrial area, while the remaining area is occupied by a shopping center and various small

shops. Considering today's production output and demand for products, the First Croatian–Slavonian Factory of Sugar Products and Chocolate d.d. in Osijek (today Sugar Factory Osijek d.o.o.) and the First Osijek Soap Factory d.d. (today Saponia d.d.) have developed and modernized their technological processes, which required demolition of old, historical buildings and construction of new buildings adapted to new technological standards.

Table 2. Current state of existing historical industrial areas in Osijek. Source: authors, 2021.

Mark (Figure 3)	Name	Year Established	Current State				
			Active Industry in Its Original Use	Abandoned Industry and/or Partially Abandoned	Existing Historical Industrial Buildings with New Use	Demolished Industrial Buildings/New Buildings with New Use	Historical Residential Buildings for Employees Created as Part of Industrial Areas
1	The first Slavonian furniture factory Josip Povischil	1884	–	+	–	+	+
2	Union Steam Mill d.d.	1902	–	+	+	+	+
3	The First Croatian–Slavonian d.d. for Sugar Industry Osijek/The First Croatian–Slavonian Factory of Sugar Products and Chocolate d.d. in Osijek	1905/ 1907	+	–	–	–	+
4	Karolina Steam Mill/Karolina, Stjepan Piller Cookie Factory d.d./Karolina, Stjepan Piller Biscuit and Cookie Factory d.d. in Osijek/Karolina, Osijek Biscuit, Candy and Pasta Factory d.d.	1909/1928/ 1933/1935	–	–	–	+	+
5	Osijek Iron Foundry and Machine Factory	1912	+	+	–	–	+
6	Silk Factory/Osijek Silk Weaving d.d.	1926/1932	–	+	+	–	+
7	The First Mechanical Fabric Weaving—Ivan Fidler/Flax industry d.d. Osijek	1901/1926	+	–	–	+	+
8	Fashion Clothing Industry Slavonia Osijek Handicraft Leather Company Martin Gillming/Handicraft Leather Company Josip Bartolović/Osijek Leather Factory d.d.	1945	–	–	+	+	+*
9	Imperial–Royal Privileged Match Factory/Drava Match Factory d.d. Samuel Reintz Soap and Candle Factory/	1824/ 1870/ 1919	–	+	+	–	+
10	The First Osijek Soap Factory d.d. Osijek	1856/ 1909	–	+	–	–	+
11	Munjara, Tram and Water Supply System of the Municipality of the Free and Royal City of Osijek	1894/ 1919	+	–	–	–	+
12	The First Croatian Joint-Stock Printing House	1907	+	–	–	–	+
13		1902	–	–	+	–	–

* Residential area next to the historical industrial area was built after 1945.

Thus, the area of the First Osijek Soap Factory d.d. is largely rebuilt and modernized. There are several historical buildings preserved along the main street, one part of old buildings is preserved along the side street and some storage halls remain along the western edge of the complex. Today, six historical industrial areas of Osijek have been completely or partially abandoned (Figure 3 and Table 2). Referring to the historical industrial area of the First Slavonian Furniture Factory Josip Povischil, there is one abandoned building under conservation protection along the main street. On the remaining area of the First Slavonian Furniture Factory Josip Povischil, there was a new building constructed for commercial use. The historical industrial area of the Union Steam Mill d.d. still retains four historical buildings, of which two buildings are used for business activities, one is residential, while the fourth building, i.e., the Union Steam Mill silo, is abandoned and under conservation

protection. A large part of the Osijek Iron Foundry and Machine Factory is abandoned; however, the remaining part still serves its original use for manufacture of agricultural machinery. A large part of the Osijek Leather Factory d.d. is abandoned, and only one small part is used for new purposes. Similarly, except its residential buildings, all industrial facilities of the Drava Match Factory d.d. are abandoned.

Buildings located in five historical industrial areas (Figure 3 and Table 2) are partially demolished or were reconstructed to serve new uses. There is a shopping center and an office building on the area of former First Slavonian Furniture Factory Josip Povischil (Figure 4). A residential building and a primary school are located in the area of demolished part of the Union Steam Mill d.d. A generic shopping center is now built on the area of the Karolina Steam Mill and Flax Industry d.d. Osijek. Also a new retail shop is located in one part of the demolished historical area of the Fashion Confection Industry Slavonia Osijek.



Figure 4. A shopping center replaces the historical industrial area in Osijek (former area of the First Slavonian Furniture Factory Josip Povischil). Source: authors, 2021.

Because of the social awareness of owners and managers of historical industrial companies, it should be mentioned that 12 historical industrial areas (Table 2) comprised residential buildings for housing for their workers, clerks and/or managers. Most of the observed areas contain three types of buildings: industrial, administrative and residential. This triplet is characteristic of the observed areas and is part of their integrity, which makes them valuable.

Despite the fact that the past of Osijek was determined by its well-developed industry, up to present, none of the remaining historical industrial complexes or buildings have been revitalized, and their potential as industrial heritage sites is not exploited.

3.2. Selection, Analysis and Interpretation of Three Case Studies of Existing Historical Industrial Areas in Osijek

In order to analyze the current state and sustainability of historical industrial areas in Osijek and to evaluate spatial and architectural changes in their structure, there were three historical industrial areas selected for case studies, namely the Karolina Steam Mill (1909) (hereinafter: Steam Mill), the Handicraft Leather Company Martin Gillming (1824)/Handicraft Leather Company Josip Bartolović (1870)/Osijek Leather Factory d.d. (1919) (hereinafter: Tannery) and the Imperial–Royal Privileged Match Factory (1856)/Drava Match Factory d.d. (1909) (hereinafter: Match Factory). These three case studies analyze the surface area, conservation status (or the lack of it) and the number of demolished or remaining historical buildings contained within. Table 3 gives an overview of the categories referring to their architectural significance, urban (spatial) conservation status and identity sustainability.

Table 3. Case studies. Source: authors, 2021.

Historical Industrial Area		Karolina Steam Mill	Handicraft Leather Company Martin Gillming/Handicraft Leather Company Josip Bartolović/Osijek Leather Factory d.d.	Imperial–Royal Privileged Match Factory/Drava Match Factory d.d.
In text (for easier reading)		Steam Mill	Tannery	Match Factory
Year established		1909	1824/1870/1919	1856/1909
Address		Josipa Huttlera 30/ Frankopanska 61, 156, 158	Mije Kišpatića 1, 1c, 2, 18	Reisnerova 80, 82, 115, 117 Sv. Ane 93
Area (m ²)		12,871	14,694	37,012
The original type of industry		food	leather	chemical
Today's ownership		joint-stock company (d.d.)/limited liability company (d.o.o.)/private (multiple owners)	simple limited liability company (j.d.o.o.)/private (multiple owners)	multiple joint-stock companies (d.d.)/limited liability company (d.o.o.)/social ownership/private (multiple owners)/city of Osijek
Today's function		supermarket/residential houses (historical buildings)/land with fragments of demolished industrial buildings	abandoned industry/new use in part of the former industrial area/residential houses (historical buildings)	abandoned industry/residential houses (historical buildings)
Today's state		new/partially preserved	not maintained/neglected/partially preserved	not maintained/neglected/partially preserved
Today's use according to the GUP		M—mix	M—mix/ R—residential	M—mix
Use in contact areas	North	infrastructure/rail and economic (business)	infrastructure/pedestrian promenade and waterway	mix
	East	mix and residential	residential	mix/economic (business)
	South	mix	public (school)	mix/economic (business)/infrastructure/rail
	West	residential	residential	residential/cemetery
Continuity of industrial activity		does not exist	does not exist	does not exist
Fraction of original historical buildings, demolished historical buildings and new buildings in relation to the overall scope	Original historical buildings:	3%	50%	14%
	Demolished historical buildings:	44%	2%	13%
	Newly built buildings (buildings built after 1945)	0%	22%	20%
	original use: Newly built buildings (buildings built after 1945) new use:	24%	0%	0%

Table 3. Cont.

Historical Industrial Area		Karolina Steam Mill	Handicraft Leather Company Martin Gillming/Handicraft Leather Company Josip Bartolović/Osijek Leather Factory d.d.	Imperial–Royal Privileged Match Factory/Drava Match Factory d.d.
Formation of urban area	City block	the demolished historical buildings were partially occupied by two city blocks	historical buildings partially form two city blocks	historical buildings partially form two city blocks
	Fraction of the historical industrial area in the city block	North block South block	83% 24%	47% 40%
	Street facade	demolished historical buildings: formed most of the facade on the west side of side street; historical buildings: form part of the facade on side street	historical buildings: form a facade on the part of two side streets	historical buildings: form part of the facade on main street
	Position in relation to transport infrastructure	along the main city street and the railway line in the north	along the waterway in the north	along the main city street and the railway line in the south
	Average number of stories of buildings	GF (ground floor only)	GF + 2	GF + 1
	Landmarks/recognition of historical industrial space	no (biscuit Factory existed until 2005)	yes: an old factory building with a water tower and a chemical warehouse building	yes: match factory building, connecting closed bridge over the road (demolished)
	Heritage protection category/heritage potential	no protection/ heritage potential exists: historical residential buildings	yes: old factory building with water tower and chemical warehouse protected cultural property and industrial buildings	no protection/ heritage potential exists: historical industrial and residential buildings that form the front of the main street; reconstruction potential of the closed connecting bridge
	State of protected heritage	–	unmaintained/neglected/in need of renovation	–
	Residential buildings in the scope	yes	yes	yes
	Residential buildings outside the spatial scope	no	no	yes (two-story residential building from 1940)
	Landscape areas	not provided in the original plans; spontaneously formed meadows in the area of demolished industrial buildings	not provided in the original plans; spontaneously formed on the part of the observed area.	on the part of the scope there was a planned tree line; not provided in the original plans; spontaneously formed on part of the observed area
Evaluation of the sustainability of the historical industrial area and recommended measures (see Figure A1)		sustainability of the historical industrial area is not possible; all industrial historical buildings have been removed; only residential buildings remain	possible, however, the GUP should be modified and genius loci preserved for: historical industrial, administrative and residential buildings along the main street and historical industrial buildings in north part	possible, however, the GUP should be modified and genius loci of the entire area preserved

The areas occupied by the observed cases are relatively large (Table 3). The Match Factory occupies the largest area (37,012 sq. m.), followed by the Tannery (14,694 sq. m.), while the smallest area is occupied by the Steam Mill (12,871 sq. m.). These large areas offer significant potential for development because they can be used within local or regional strategic project planning (e.g., for planning of residential areas, business districts, cultural institutions, amusement parks, etc.). At the same time, such large areas can be a source of legal problems because they are owned by several owners: from private owners to legal entities. Although historical industrial areas usually form a single complex, all three selected cases in this research are located on multiple cadastral parcels separated by traffic infrastructure (e.g., public road).

Comparing the current situation and the situation before demolition (Figure A1), the largest change was experienced by the Steam Mill area, which was largely demolished. On the other hand, the smallest change was experienced by the Tannery area. The Steam Mill area is now demolished, although it once formed a specific cityscape and had its own historical identity, which strongly influenced the silhouette and identity of that city part (Figure 5). On its place, there is now a generic, one-story shopping mall with a parking lot. In the area of the Steam Mill, there are only two historical residential buildings (one-floor houses) retained.



(a)



(b)

Figure 5. Former industrial area of the Karolina Steam Mill: (a) photographed before demolition (Source: Sanja Lončar-Vicković, 2003); (b) photographed in 2021 (Source: authors, 2021).

Referring to current functions of selected areas, the Tannery and the Match Factory are largely abandoned (Table 3). Only the residential areas of the Match Factory are still in use. In addition to the housing facilities of the Tannery, there is just one small part of it used as temporary space for a printing shop/printing house, and the rest of the area has been rearranged to a certain extent. In general, both the Tannery and the Match Factory are largely abandoned and unmaintained.

According to the GUP of the City of Osijek from 2017, all three observed areas are classified for mixed use. However, one part of the Tannery is also classified for residential use. It should be noted that none of the observed cases have been assigned special recommendations for (re)construction, which would in some way preserve the genius loci of historical industrial areas.

Regarding the uses in the contact areas, all three areas studied are mostly surrounded by areas of mixed and residential uses (Table 3, Figure A2). The Match Factory is closest to the city center (Figure 3), so it is surrounded by apartment buildings (Figure A2). South of the Match Factory, there is another historical industrial area, namely the First Slavonian Furniture Factory Josip Povichil, which also houses today a shopping center and a parking lot (Figure A2). A large city cemetery is located west of the Match Factory (Figure A2). The Tannery is strategically located along the Drava River (Figure A2), since the waterway

facilitated specific leather processing technology and provided easier transport of finished products. Today, this advantage of favorable location is not used in any way. An elementary school and a faculty building are located south of the Tannery (Figure A2). The Steam Mill is surrounded by lower houses, while in the north there is an in-house railway line that was used for transport of products from the Steam Mill and the Biscuit Factory Stjepan Piller d.d (Figure A2).

There is no continuity of original or any other industrial activity in any of the observed areas.

As much as half of the total surface area covered by historical industrial buildings in Osijek is located in the area of the Tannery itself. The smallest portion of the total surface area of historical industrial buildings (3%) is located in the Steam Mill. However, the latter site contains the greatest portion of newly constructed buildings (24%). At the Match Factory, historical industrial area occupies only 14% of the total observed surface area.

There are no newly constructed buildings for new uses either in the Tannery or in the Match Factory. In these areas, in addition to already mentioned historical areas, there are buildings of original use, created after 1945. A smaller percentage of demolished historical buildings was observed near the Match Factory and the Tannery, in contrast to the area of the Steam Mill, where almost all historical industrial buildings were demolished (Table 3).

All three observed areas were dominant in the city part in which they are located and formed two city blocks in the past (Figure A1, interpretation) and (Table 3). Thus, the Match Factory with its historical industrial buildings formed one part of the main street and one part of the side street (Figure 6), while the Tannery formed one part of the city block of Lower Town (Figure 7). The Steam Mill formed parts of two side streets, until destruction of its historical industrial buildings in 2005 (Figure 5).



(a)



(b)

Figure 6. Former industrial area of the Match Factory: (a) around 1900 (Source: Živaković–Kerže, 1999); (b) current (Source: Google Earth, 2021).

All three observed areas are located along the main Osijek traffic infrastructure. The Tannery is located along the main waterway, the Steam Mill is located along the city street and railway, while the Match Factory is located along the main city street and railway (Table 3). Traces of the railway line that penetrated the observed area are still visible on the spans of all three areas. The railway facilitated the delivery of raw materials and shipment of finished products; it is no longer operational.

Referring to the number of floors, all observed historical industrial buildings are relatively low. The lowest is the area of the Steam Mill, which consists of only ground-floor buildings. The highest area is the Tannery, which consists of ground-floor and two-floor buildings. The Match Factory area consists of ground-floor buildings and one-floor buildings.

Historical industrial areas contribute to distinctive features of Osijek's urban image and to the cityscape's quality. With its industrial facade lined with red bricks and a tall,

narrow water tower building, the Tannery is one of the landmarks of the Lower Town (Figure 7). With its warehouses and production buildings located along the main street, the Match Factory marked the cityscape of Osijek's Upper Town. The bridge that spanned the street and connected the two buildings was a structural achievement of that time and one of the most important architectural landmarks of the Match Factory (Figure 6). The bridge connected the southern and northern spans of the factory until its demolition in 2007. The area of the Steam Mill is greatly devastated, without any landmarks, so that a foreigner who wanders into these areas would never recognize them as a former industrial plant with a steam mill and a biscuit factory.



(a)



(b)

Figure 7. Former industrial area of the Tannery: (a) around 1920 (Source: <http://slavonia-baranja-travel.com/wp-content/uploads/2017/04/47.jpg>; accessed on 22 December 2021); (b) current (Source: authors, 2021).

Only one of the observed areas is partially under conservation protection. There are three protected cultural assets in the area of the Tannery, i.e., three protected industrial buildings: the building of the old factory, the building of the water tower, and the building of the chemical warehouse. Despite the fact that these buildings of the Tannery are protected as cultural heritage, they, together with the surrounding ones that are not under protection, are decaying due to lack of maintenance (Figure A1).

Historical industrial areas functioned as a small town. They consisted of industrial, administrative and residential buildings. Therefore, all three observed areas (the Steam Mill, the Tannery and the Match Factory) contain residential buildings used for housing of officials and workers. In addition, the Match Factory was the only one to have a residential building for workers outside of the factory area.

Landscape areas were not planned in any of the observed historical industrial areas, but they were created spontaneously due to abandonment and lack of maintenance. At the Match Factory, it is noticed that the expansion of the industrial area to the south formed a planned tree line alongside the street leading to the cemetery. The remains of that alley tree line are present even today (Figure A1).

Lastly, but equally important, this research assessed the intangible identity of historical industrial areas, which is a perfect complement to cityscape quality. The identity of selected historical industrial areas, the Steam Mill, the Tannery and the Match Factory, is still preserved in different shades (or in different ways). In the Steam Mill area, the identity of the place has been almost lost because important visual architectural markers of that site were demolished in 2005. The inscription "Osijek Leather Factory" is still visible on the northern facade of the southern part of the Tannery. In addition, the old factory building and the chemical warehouse building are visible from the street. The Match Factory's identity is also maintained, since the historical industrial facade of former matchbox production facility facing the main street is easily recognizable.

4. Discussion

As a follow-up of the research, sustainability of three observed industrial areas in Osijek was assessed in order to determine the architectural and urban disappearance and the sustainability potential of historical industrial areas in Osijek.

The urban and architectural analysis showed that, despite the abandonment, carelessness and lack of maintenance, the historical value of the observed historical industrial areas has been preserved to a certain extent.

Among the three investigated areas, the Tannery has the greatest value as an industrial heritage site, since it retains most of its historical industrial buildings, and it is the only site where some buildings are already under conservation protection. The Match Factory, which is not under conservation protection, has industrial historical value, as its remaining buildings that face the main streets are considered as witnesses of former industrial power of Osijek. The only area without industrial historical value is the Steam Mill area. All historical industrial buildings of the Steam Mill, except for residential buildings, no longer exist (Figure A1).

When considering current conditions and recommended conservation measures, the areas of the Tannery and the Match Factory are mostly abandoned and unmaintained, so it is necessary to restore most of those buildings to turn them into valuable industrial heritage sites. Some of the buildings (e.g., sheds, auxiliary buildings) in both these areas can be removed because they are in bad condition and do not have historical, spatial or economic value (Figure A1). The removal of the Steam Mill's historical industrial buildings in 2005 completely destroyed the potential of that city part for preservation of industrial heritage. The newly built commercial building and a parking lot in the area of the historical industrial site degraded the city's historically and architecturally valuable spatial characteristics (Figure 5b).

The Tannery and the Match Factory have potential for sustainability of historical industrial space, but due to abandonment and lack of maintenance, these spaces are currently unsustainable. For both the Match Factory and the Tannery, it is necessary to change the GUP of the City of Osijek in order to provide a legal framework for preserving these historical industrial buildings and to assure architectural heritage identity of the industrial areas.

Disappearance of historical industrial areas, together with the loss of authenticity of existing historical industrial areas caused part of Osijek's cityscape to become generic and monotonous. However, it is clear that reactivation of the original purpose of the observed areas is not possible (it is neither cost-effective nor feasible). These areas do not allow for a modern reinterpretation of the original production. Further research should provide assumptions for their new uses and adaptive reuse of industrial heritage buildings.

5. Conclusions

The research resulted in the following conclusions:

1. Historical industrial areas created in Osijek from 1824 to 1945 are currently mostly abandoned or completely lost.
2. The research showed that, so far, there is not even one existing document that contains basic data on all historical industrial areas in Osijek that were developed during 1824–1945.
3. The research identified 59 historical industrial areas created in Osijek from 1824–1945. At present (in 2021), there are 13 retained in their whole or in fragments, 24 were demolished and 22 historical industrial areas disappeared. The exact location is known for 32 historical industrial areas; for 7 areas it is possible to determine only a part of Osijek in which they were located, and the location could not be determined for 20 areas.
4. Disappearance of historical industrial areas, along with the loss of authenticity of existing historical industrial areas caused the part of Osijek's cityscape to lose its

quality and to become generic and monotonous. Moreover, disappearance of historical industrial areas causes the loss of place identity.

5. Despite the rich industrial history of the city of Osijek, until now, there is not even one revitalized historical industrial area or building. Thus, it is necessary to establish a revitalization concept and to raise awareness of the importance of Osijek's industrial heritage.

This paper elaborated three selected cases of historical industrial areas (the Tannery, the Match Factory and the Steam Mill). These three case studies analyzed their surface area, conservation status (or lack of it) and the number of demolished or remaining historical buildings contained within. Upon performing detailed layered analysis, comparison and evaluation of the selected three cases, the following conclusions were reached:

1. The historical industrial areas of Osijek can be classified into three categories according to their architectural value, spatial preservation and identity sustainability: complete preservation (the Tannery), hybrid (discontinuous) preservation (the Match Factory), and brownfield type (the Steam Mill).
2. Urban and architectural analysis showed that, despite the abandonment, carelessness and lack of maintenance, the historical value of the observed historical industrial areas has been preserved to a certain extent.
3. Among the three historical industrial areas investigated, the Tannery has the greatest value in terms of industrial heritage, since there are many historical industrial buildings still preserved. In addition, the Tannery is the only historical industrial site with protected immovable cultural property. However, the Match Factory, which is not under conservation protection, also has significant industrial historical value, because its remaining industrial historical buildings face the Osijek main street and witness the past industrial glory of the city.
4. The Steam Mill is the only area without historical industrial value, because all its historical industrial buildings, except for residential buildings, were destroyed.
5. Two of the three observed cases, the Tannery and the Match Factory, have potential to become sustainable industrial heritage areas. However, due to abandonment and lack of maintenance, these areas are currently unsustainable. It is necessary to change the GUP of the City of Osijek in order to provide a legal framework for preservation of these historical industrial buildings and to assure architectural heritage identity of both the Tannery and the Match Factory.
6. Two of the three observed areas, the Tannery and the Match Factory, still form a recognizable cityscape and are associated with former industrial times. In addition, they are preserved to a significant extent and still form a full unit of the former industrial area. Thus, the two areas noted can be observed as historical industrial areas and they should be protected as an ensemble (comprising historical buildings) in accordance with the UNESCO recommendations.

Author Contributions: Conceptualization, L.K., B.B.O.Š., Z.K. and I.K.; methodology, L.K., B.B.O.Š. and Z.K.; formal analysis, L.K.; investigation, L.K.; resources, L.K. and I.K.; writing—original draft preparation, L.K.; writing—review and editing, L.K., B.B.O.Š. and I.K.; visualization, L.K.; supervision, B.B.O.Š. and Z.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

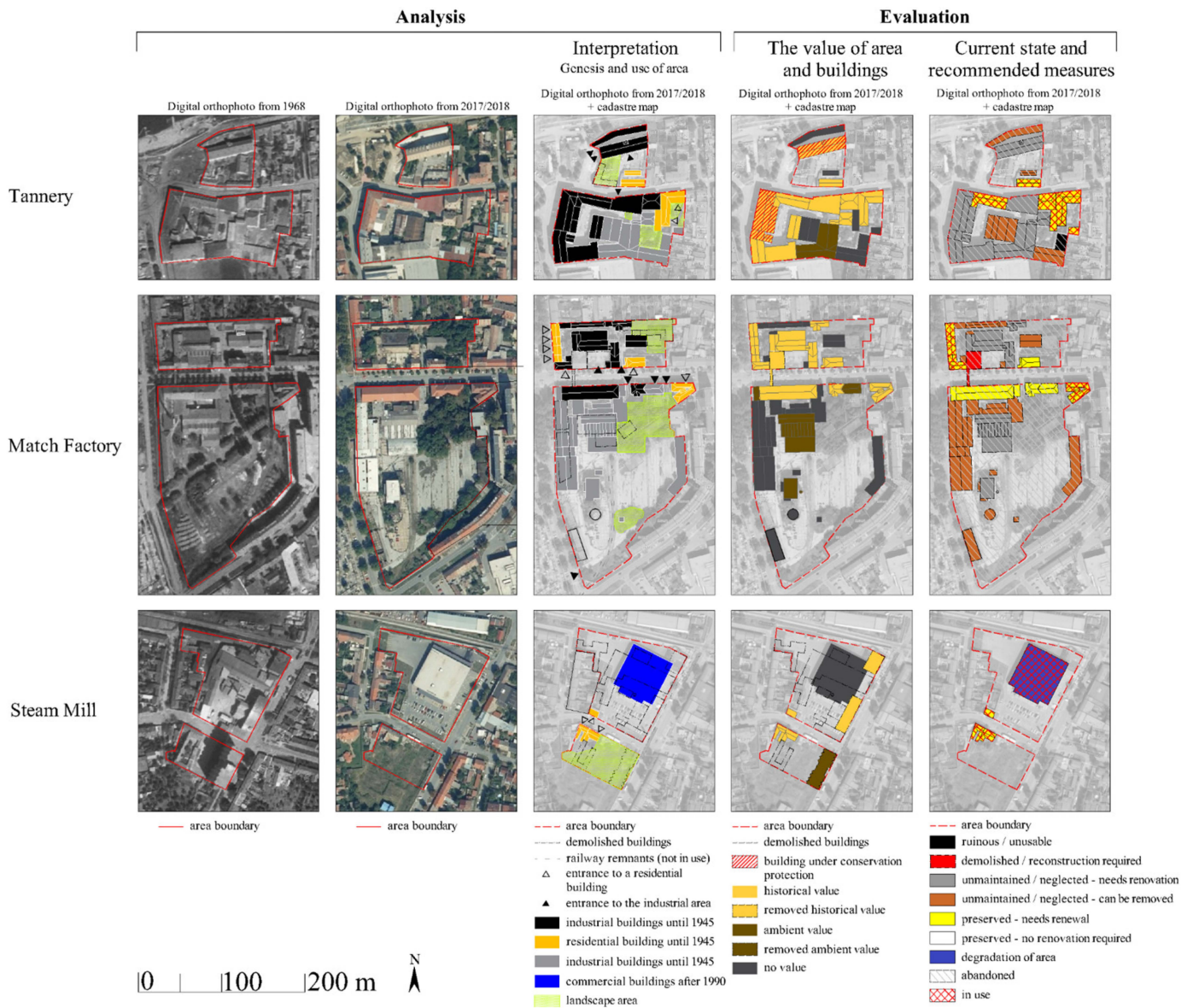


Figure A1. Graphical analysis and evaluation of historical industrial areas in Osijek: three case studies.

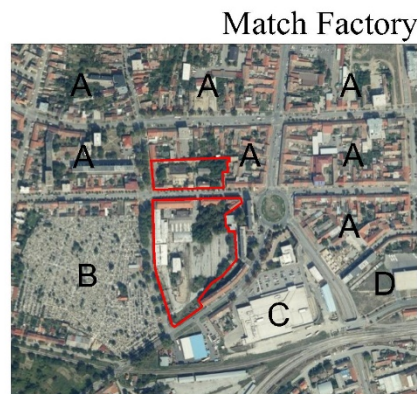


Figure A2. Cont.

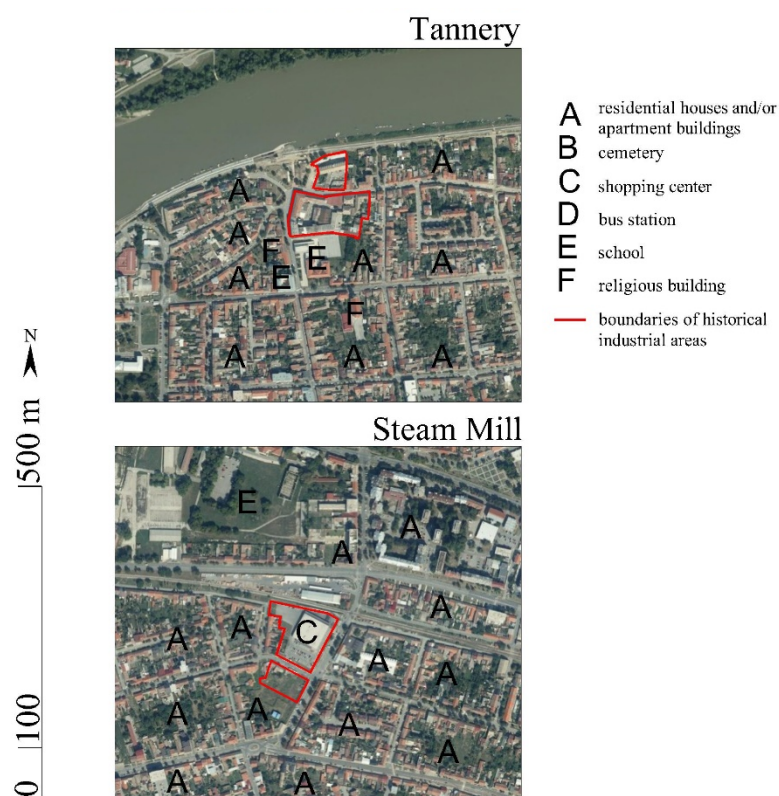


Figure A2. Three case studies: historical industrial areas in Osijek's urban context.

Table A1. English and Croatian names of historical industrial areas existing in Osijek from 1824 to 1945.

No.	Name in English	Name in Croatian
1	Wood Processing Workshop Rudolf Kaiser	Radionica za preradu drva Rudolf Kaiser
2	The First Slavonian Furniture Factory Josip Povischil	Prva slavonska tvornica pokućstva "Josip Povischil"
3	Steam Sawmill Karlo Axmann and Comrade	Parna pilana Karlo Axmann i drug
4	Sawmill and Wood-Industrial Public Company Lavoslav Neuvirth and Comrade	Pilana i drvno-industrijsko javno poduzeće Lavoslav Neuvirth i drug
5	Steam Sawmill Josip Frank	Parna pilana Josip Frank
6	Motor Sawmill Josip Burijan	Motorna pilana Josip Burijan
7	Sawmill Lavoslava Platzner	Pilana Lavoslava Platznera
8	Industrial Crates Factory and Steam Sawmill Herman Steiner	Tvornica industrijskih sanduka i parna pilana Herman Steiner
9	Mechanical Barrel Factory Ogrizek and Comrade	Mehanička tvornica bačava Ogrizek i drug
10	Barrel Factory Antun Novosel	Tvornica bačava Antun Novosel
11	The First Osijek Wood Processing Factory d.d.	Prva osječka tvornica za preradbu drveta d.d.
12	Roller Mill Josip Krauss/Steam Mill of Josip Krauss and Sons	Mlin na valjke Josip Krauss/Paromlin Josipa Kraussa i sinova
13	Motor Mill Dragutin Engelhardt	Motorni mlin Dragutin Engelhardt
14	Union Steam Mill d.d.	Union paromlinsko d.d.
15	Merkur Mill of Stjepan Urban/Merkur Mill of Herman Mautner and Comrades, Limited Partnership Osijek	"Merkur mlin Stjepana Urbana/Merkur mlin Herman Mautner i drugovi,
16	Karolina Steam Mill/Karolina, Stjepan Piller Cookie Factory d.d./Karolina, Stjepan Piller Biscuit and Cookie Factory d.d. in Osijek/Karolina, Osijek Biscuit, Candy and Pasta Factory d.d.	Karolina Paromlin/Karolina tvornica keksa, Stjepan Piller d.d./Tvornica keksa i biskvita, Stjepan Piller d.d. u Osijeku/Karolina, tvornica keksa, bombona i tjestenine d.d. Osijek
17	Steam Mill of Nik. Pl. Szalopek	Paromlin Nik. Pl. Szalopek (kasnije Kožara?)
18	Steam Mill of C. L. Pfeiffer	Paromlin C.L. Pfeiffera
19	Steam Mill of Josip Kellner	Paromlin Josipa Kellnera
20	The First Croatian-Slavonian d.d. for Sugar Industry Osijek/The First Croatian-Slavonian Factory of Sugar Products and Chocolate d.d. in Osijek	"Prvo hrvatsko-slavonsko d.d. za industriju šećera Osijek/Prva hrvatsko-slavonska tvornica šećernih proizvoda i čokolade d.d. u Osijeku"
21	The First Osijek Candy and Chocolate Factory Kaiser and Štark	Prva osječka tvornica kandita i čokolade Kaiser i Štark
22	The First Osijek Hygienic Dairy Merkur	Prva osječka higijenska mljekara Merkur

Table A1. Cont.

No.	Name in English	Name in Croatian
23	Osijek Confectionery and Chocolate Factory Gustav Krauss	“Osijek” tvornica poslastica i čokolade Gustava Kraussa
24	Osijek Trade d.d.—Production of Sweets	“Osječko trgovačko d.d.”—proizvodnja slatkiša
25	Choloterien Francaise Soleil—Chocolates and Liqueur Sweets	Choloterien Francaise “Soleil”—čokolade i liker slatkiši
26	Brewery J.A. Bauera/Aleksandar Raith Brewery	“Pivara J.A. Bauera/Pivovara Aleksandra Raitha”
27	Steam Brewery, Malt and Ice Factory of Kajetan Šeper	Parna pivovara, tvornica slada i leda Kajetana Šepera
28	Starch Factory of Ivan Weinmüller	Tvornica škroba Ivana Weinmüllera
29	Oil Mill of Mihael Lay	Uljara Mihaela Laya
30	The First Vinegar Factory in Osijek of Lavoslav Kramer	Prva osječka tvornica octa Lavoslava Kramera
31	Vinegar Factory Adela Knobloch (born pl. Reisner)	Tvornica octa Adela Knobloch (rođena pl. Reisner)
32	Slaughterhouse	Klaonica
33	City Slaughterhouse	Gradska kalonica
34	Osijek Workshop/Factory of Agricultural Machines Melchior Licht	Osječka radionica/tvornica poljoprivrednih strojeva Melchiora Lichta
35	The Company of the Berger Brothers and Comrade	Tvrtka braće Berger i drug
36	Machine Factory and Metal Foundry of Josip Klarić	Tvornica strojeva i ljevaonica kovina Josipa Klarića
37	Osijek Iron Foundry and Machine Factory	Osječka ljevaonica željeza i tvornica strojeva
38	Osijek Silk Factory	Osječka svilara
39	Silk Factory/Osijek Silk Weaving d.d.	Tvornica svile/Osječka tkaonica svile d.d.
40	The First Mechanical Linen Weaving Mill—Ivan Fidler/Flax Industry d.d. Osijek	Prva mehanička tkaonica platna—Ivan Fidler/Lanena industrija d.d. Osijek
41	Mara Knitwear Factory	“Mara” tvornica trikotaže
42	Fashion Confection Industry Slavonia Osijek	Industrija modne konfekcije “Slavonija” Osijek
43	Silk Factory (colloq. Bubara)	Bubara
44	Handicraft Leather Company Martin Gillming/ Handicraft Leather Company Josip Bartolović/Osijek Leather Factory d.d.	“Rukotvorno kožarko poduzeće Martin Gillming/Rukotvorno kožarko poduzeće Josip Bartolović/“Osječka tvornica kože”“ d.d.”
45	Imperial–Royal Privileged Match Factory/ Drava Match Factory d.d.	“Cesarsko-kraljevska privilegirana tvornica žigica”/Tvornica žigica “Drava” d.d.
46	Samuel Reintz Soap and Candle Factory/ The First Osijek Soap Factory d.d. Osijek	“Tvornica sapuna i svijeća Samuela Reintza/Prva osječka tvornica sapuna d.d. Osijek”
47	Palzzeriano Brickyard and Lime Factory	Ciglana i tvornica vapna Palzzeriano
48	I. V. Schulhof, Steam Brickyard, Lime and Ice Factory d.d.	I. V. Schulhof, parna ciglana, tvornica kreča i leda d.d.
49	The First Croatian-Slavonian Granite and Marble Grinding Grindery	Prva hrvatsko-slavonska brusionica granita i mramora
50	Carl (Dragutin) Lehman Printing House (bought from Dragutin Karl Divald)	Tiskara Carla (Dragutina) Lehmana (prekupio od Dragutina Karla Divalda)
51	Gustav Wagner and Jakob Frank Printing House	Tiskara Gustava Wagnera i Jakoba Franka
52	Dragutin Sandor Printing House/Julije Pfeiffer Printing House	Tiskara Dragutina Sandora/Tiskara Julija Pfeiffera
53	Eugen Rupert Printing House	Tiskara Eugena Ruperta
54	Alois (Vjekoslav) Schaffer Printing House	Tiskara Aloisa (Vjekoslava) Schaffera
55	Dragutin Laubner Printing House	Tiskara Dragutina Laubnera
56	The First Croatian Joint-Stock Printing House	Prva hrvatska dionička tiskara
57	Glass and Porcelain Factory Stjepan Heim and sons	Tvornica stakla i porculana Stjepan Heim i sinovi
58	Gasworks d.d.	Plinara d.d.
59	Power Plant, Tram and Water Supply System of the Municipality of the Free and Royal City of Osijek	Munjara, tramvaj i vodovod općine Slobodnog i kraljevskog grada Osijeka

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