The Contemporary Transformation of Post-Industrial Areas in Post-Socialist Polish Cities: Case Studies from Wrocław (Kleczków) and Kraków (Zabłocie)

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Abstract

The article presents a contemporary, multifaceted analysis of changes occurring in post-industrial sites within Polish cities. The research focuses on the demographic, morphological and functional changes observed in selected brownfields in Wrocław and Kraków. The findings indicate that such areas in large post-socialist cities are currently undergoing a period of intensive transformation, primarily characterised by increased land use intensity and functional changes. To preserve the cultural heritage of these areas, it is essential to continue monitoring these transformations in the future.

Keywords

post-industrial sites, transformation, post-socialist cities, industrial heritage, Poland

Introduction

In 1989, far-reaching political, socio-economic and spatial changes began in Central Europe, including its urban areas. These transformations were triggered by the collapse of communism and the centrally planned economic system, marking the beginning of the post-socialist transformation (Cudny et al., 2022). The consequences of these processes were multidimensional, encompassing socio-economic, demographic and spatial transformations that significantly impacted urban areas in Central Europe (Kavaliauskas, 2012; Cudny et al., 2022).

The changes and dynamics observed in Central European cities led to the emergence of a new academic term: the ‘post-socialist city’. This concept describes the multifaceted processes that have unfolded in these cities since 1989 (Stanilov, 2007; Kovács et al., 2019). Post-socialist cities are characterised by a state of transition, marked by dynamic change (Sýkora, 2009). Having previously functioned under the conditions of real socialism (Liszewski, 2001), these cities were subsequently subject to the rules and mechanisms of capitalist systems, following the transformation (Sýkora, 2009).

The transformations of Central European cities after 1989 have been extensively studied and presented in various interdisciplinary journals. Research on Czech cities has been conducted by Sýkora and Ouředníček (2007), Stanilov and Sýkora (2012), and Kubeš (2015), while Polish cities have been studied by Liszewski (2001), Słodczyk (2001), Cudny (2011) and Węcławowicz (2016). Hungarian cities have been examined by Berki (2014), Tosics (2005) and Csizmady et al. (2022), and Slovak cities by Ira and Boltižiar (2021), and Matlovič and Nestorová-Dická (2009), among others. Research on post-socialist cities has explored a wide range of themes. For example, socio-demographic changes have been examined by Stenning and Dawley (2009), while Cudny (2012) and Chapain and Stryjakiewicz (2017) have focused on functional-economic changes.

Among the phenomena that have significantly impacted the transformation and current status of post-socialist cities in Central Europe, researchers highlight the importance of suburbanisation (e.g. Stanilov, 2007; Gnatiuk, 2017), reurbanisation (e.g. Haase et al., 2017), urban shrinkage (e.g. Haase et al., 2016), urban sprawl (e.g. Kovács et al., 2019) and spatial development (e.g. Sandu, 2023).

It is worth noting that many early studies on post-socialist cities focused on capital cities. For example, Stanilov and Hirt (2014) studied Sofia, Bulgaria; Grigorescu et al. (2012), Bucharest, Romania; Kovács et al. (2019), Budapest, Hungary; Pichler-Milanović (2014), Ljubljana, Slovenia; Leetmaa et al. (2014), Tallinn, Estonia; and Šveda et al. (2016), Bratislava, Slovakia. However, in recent years, there has been a growing trend towards examining transformations in smaller and lower-ranking cities, such as Brno in Czechia (Kunc & Tonev, 2022), Łódź (Jakóbczyk-Gryszkiewicz, 2022), and Katowice in Poland (Krzysztofik, 2022).

Initially, research on post-socialist cities adopted took a holistic approach, treating the city as a single entity and describing the transformation processes as a whole. Over time, the focus has shifted towards analysing changes within specific parts of the city, such as housing estates and districts, or examining different types of land use, including industrial, residential, recreational and green areas.

Industrial and post-industrial areas have emerged as a key focus of research in post-socialist cities, due to their dynamic and intensive transformations. This research predominantly targets cities with traditional industries affected by deindustrialisation and mass unemployment (Osman et al., 2015). Studies on post-industrial areas in Polish cities such as Kraków, Łódź, and Wrocław, as well as Budapest, have explored various themes, including functional changes (e.g. Domański, 2001; Płaziak, 2014; Sikorski, 2013, 2019; Brzosko-Sermak & Wantuch-Matla, 2020; Madeja and Smętkiewicz, 2021), gentrification, social segregation and socio-economic revitalisation (Kovács et al., 2013; Kaczmarek & Marcińczak, 2013; Kaczmarek, 2015; Holm et al., 2015; Sikorski, 2022) and demographic changes leading to the shrinking of cities (Rink et al., 2014; Kazimierczak & Szafrańska, 2019).

The transformation of former industrial areas in post-socialist cities in Central Europe has differed from that in Western European cities, influenced by factors such as the role of local authorities and policies, the implementation of grassroots initiatives, and the origin of capital (domestic vs. foreign). According to Słodczyk (2001), the transformation of these areas has been significantly influenced by the following factors:

- The evolving needs of industry, which necessitated upgraded facilities and installations, as the existing infrastructure in central areas became inadequate;
- The ground rent mechanism, which enabled other functions to outbid industry for land by offering higher prices;
- The implementation of large-scale urban projects in central areas of major cities, involving the renovation or construction of prominent office complexes and the development of new transportation infrastructure;
- The adoption of spatial planning principles, including zoning theory, which aimed to assign specific functions to designated areas;
- The policy of deglomeration or decentralisation, implemented in some countries, which involved the planned relocation of industrial plants from major agglomerations;
- Efforts to enhance the quality of life for residents and mitigate the negative aspects of industrial activity;
- The transition to post-Fordism in work organisation, which led to reduced employment in industrial plants due to the introduction of modern technologies and increased locational flexibility (Słodczyk, 2001).

The transformation of former industrial areas in post-socialist cities was also influenced by the size of the settlement unit, the nature of production, the size of production districts, and the location of industrial districts. In larger urban areas, transformations began in the 1990s, whereas in smaller settlements, they commenced at the start of the 21st century. The degree of monofunctionality in production also played a role, with areas characterised by a single dominant industry facing greater transformation risks. The size of production districts was a significant factor, with larger areas being

more likely to transform. Additionally, the location of industrial districts relative to major transportation infrastructure emerged as a crucial aspect, with areas situated along these routes transforming more rapidly than those on the outskirts (Sikorski, 2013, 2021).

The process of relocation, characterised by a deliberate policy of industrial deglomeration, involved the gradual withdrawal of production from the centres of post-socialist cities in Central Europe to their peripheries or outer urban zones. This shift was also driven by the desire to enhance the prestige and image of these areas, and the introduction of the ground rent mechanism, which led to urban land prices reflecting their location and potential. These conditions facilitated changes in the development of post-industrial areas, enabling them to acquire new functions through the process of functional succession (Sikorski, 2012; Brzosko-Sermak & Wantuch-Matla, 2020). In recent years, numerous former industrial areas in Central European cities have undergone transformation, retaining their industrial heritage to varying extents. These areas have been repurposed as new urban public spaces, incorporating a mix of residential, service, business, cultural and commercial, and recreational facilities (Brzosko-Sermak & Wantuch-Matla, 2020).

The focus of this discussion and research is the transformation of post-industrial areas, analysed from demographic, morphological and functional perspectives. Post-industrial areas are defined, following Domański (2001) as *areas where the continuity of industrial production and directly related auxiliary functions within industrial plants have been interrupted* (Domański, 2001, p. 51). Research conducted between 2022 and 2023 focused on the former industrial areas of Kleczków in Wrocław and Zabłocie in Kraków. Additionally, the article addresses the preservation and promotion of the industrial heritage in these areas, illustrating the transformations in their physiognomy and highlighting the potential for various stakeholders to leverage this industrial heritage in the revitalisation and development of these areas.

This article aims to present the contemporary, multifaceted transformations of industrial areas in post-socialist cities in Poland, using Wrocław (Kleczków) and Kraków (Zabłocie) as case studies. By examining these processes and their various dimensions, this research provides empirical evidence of the transformations, enabling the identification of their scale, directions and dynamics, which have been insufficiently explored in the existing literature. The findings of this research also allow for an evaluation and potential recommendations for similar transformations in post-socialist cities.

Study areas

Wrocław is a large city in southwestern Poland, with a population of 674,000 and an area of 292 km², boasting a rich history and a well-developed economy (*Powierzchnia…*, 2022). The city's development has been shaped by its strategic geographical and communication location at the intersection of three countries and cultures – Czechia, Germany and Poland (Sikorski & Szmytkie, 2021). Its complex history, spanning over a thousand years, includes the profound effects of World War II, which led to the destruction of over 70% of the city. Additionally, Wroclaw's economy was under socialist control from 1945 to 1989 (Kulak, 2006).

As of 2018, Wrocław's functional structure included multi-family and single-family housing (18.9% of the city area), public and commercial services (21.4%), industrial and storage areas (6.7%), technical infrastructure and communication (5.9%), and green areas, including forests and agriculture (47.1%) (Urban Atlas, 2018). In recent years, a prominent trend has emerged, characterised by a significant increase in the proportion of primarily residential areas within the city's total area, alongside a decline in the share of industrial zones.

Throughout its development, Wrocław has maintained a long and rich tradition of production, evolving from crafts to manufacturing and industrial activity (Kulak, 2006). However, in recent years, the city has undergone a gradual transformation and deindustrialisation of its industrial area, driven by political transformation and related processes (Sikorski, 2020; Sikorski & Brezdeń, 2021). Wrocław and its surroundings feature a well-established industrial base, including metal and machinery manufacturing, transportation, precision equipment, and the electrotechnical and electronic industries (Sikorski, 2019).

The city's industrial areas and plants are primarily located along major transportation routes, including roads and railways. Historically, their distribution was influenced by the need for raw materials and semi-finished products, which were transported by rail and water, as well as the benefits of technical and technological cooperation between plants. Notably, the location of Wrocław's leading industrial plants has remained relatively unchanged over time (Slenczek 1996; Sikorski 2019).

According to Sikorski's research (2019), over 50% of Wrocław's industrial areas have undergone functional and spatial changes since 1989. At the beginning of the economic transformation, industrial areas covered approximately 19.7 km², accounting for nearly 6.7% of the city. Today, post-industrial areas occupy around 11.6 km² (4.0% of the city's area), with approximately 8.1 km² still used for production. Among the 214 identified historical production areas, only 109 (50.9%) have retained their original industrial character, while other functions dominate in 105 (49.1%) of them (Sikorski 2019).

One area in Wrocław that has undergone significant functional transformations of industrial sites is the Kleczków suburb, situated in the northern part of the city, approximately 2 km from the Old Town (Figure 1). Kleczków has a long industrial tradition, having been home to the Rolling Stock Repair Plant (ZNTK), established in 1866, which specialised in the repair and construction of rail vehicles. By the end of the 20th century, production at the plant gradually ceased, leading to the repurposing of the available space for various new functions, including mechanical workshops and car washes. Initially, these changes were spontaneous and chaotic. However, in 2008, a decision was made to build a large complex of residential and service buildings in this area, known as Promenady Wrocławskie (Sikorski, 2022).

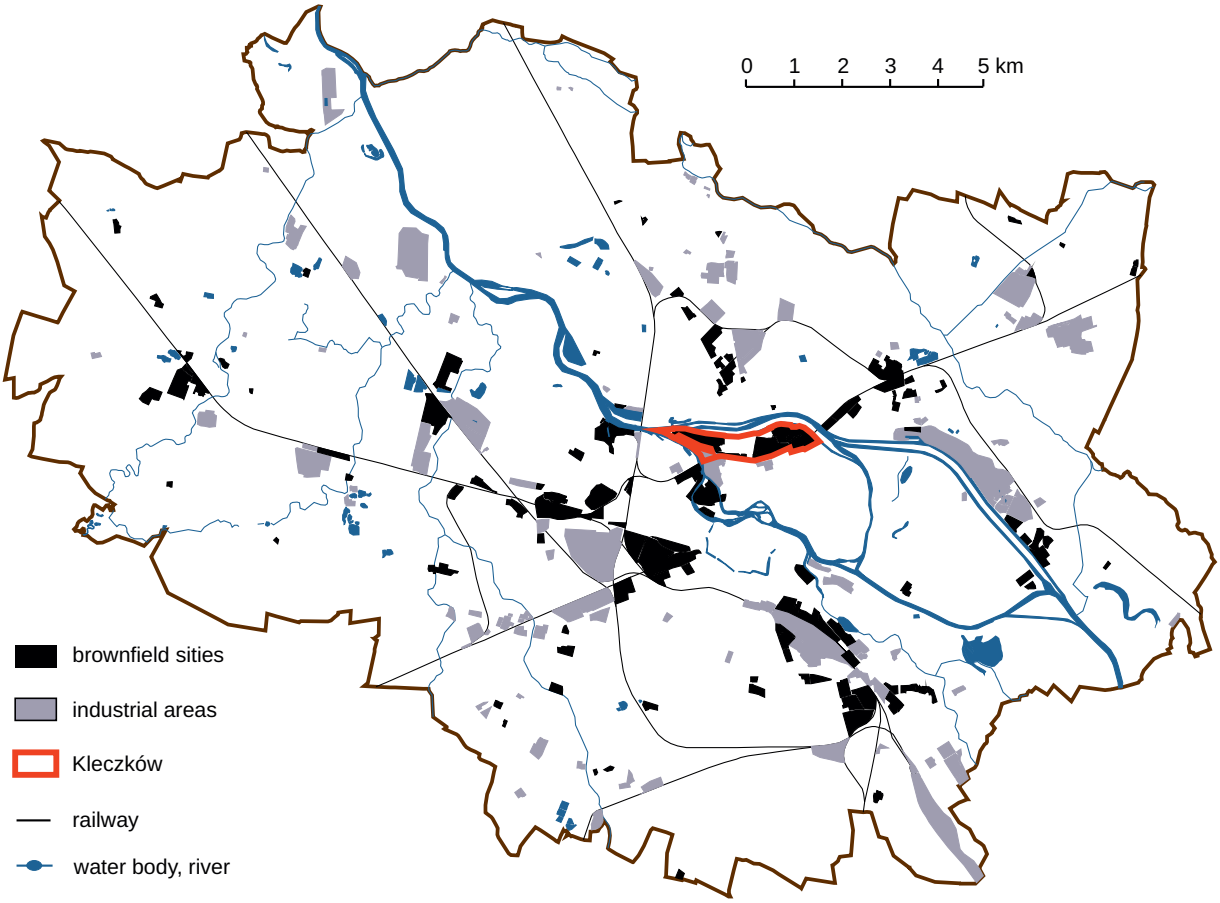

Figure 1. Distribution of industrial and post-industrial sites in Wrocław

Source: Author's compilation based on Sikorski (2019).

Kraków, located in southern Poland, is the country's second-largest city, with a population of 803,000 and covering an area of 326 km² (*Biuletyn statystyczny Krakowa*, 2023). Like Wrocław, Kraków boasts a rich history and a well-developed economy. The city's growth and development have been shaped by its strategic geographical, commercial and communication location, as well as its over 1,000-year history. Serving as the national capital from the 11th to the 16th centuries and emerging as a major academic centre, Kraków has played a significant role in Poland's social, economic and cultural spheres, both domestically and internationally.

As of 2014, Kraków's functional structure comprised multi-family and single-family housing areas, which accounted for 16.5% of the city's total area, a decrease from 23.4% in 2002. Public and commercial services represented 5.2%, down from 8.4%; industrial and storage areas made up 7.5%, down from 10.7%; technical infrastructure constituted 1.9%, down from 2.4%; and transportation and communication infrastructure comprised 9.4%, down from 10.3%. In contrast, green areas, including forests and agriculture increased to 59.5%, up from 43.1% (*Zmiana Studium Uwarunkowań*…, 2014). These data indicate that over the past decade, the proportion of areas with dominant residential, service, industrial, technical and communication functions have decreased, while those designated for recreational and green functions have increased.

Kraków also has a long and rich tradition of industrial production. However, it was not until after World War II that large industrial districts, functioning as distinct zones, were established in the city. One significant investment from this period was the Lenin Steelworks, established in the Nowa Huta district, which had a profound impact on the city's spatial development, as well as its socio-economic and environmental spheres. This district, now home to the Sendzimir Steelworks (currently ArcelorMittal Poland) remains a hub for industrial, warehouse and post-industrial land, along with the eastern section of the Vistula River valley. Other important industrial and post-industrial areas can be found in Łagiewniki, Czyżyny, Grzegórzki and Bonarka (*Zmiana Studium Uwarunkowań*…, 2014). The locations of districts associated with industry, both past and present, are illustrated in Figure 2. Some of these areas have been classified as degraded in local government documents, including revitalisation programmes, and have undergone corrective measures. Consequently, significant social, economic and environmental changes have been observed in recent years.

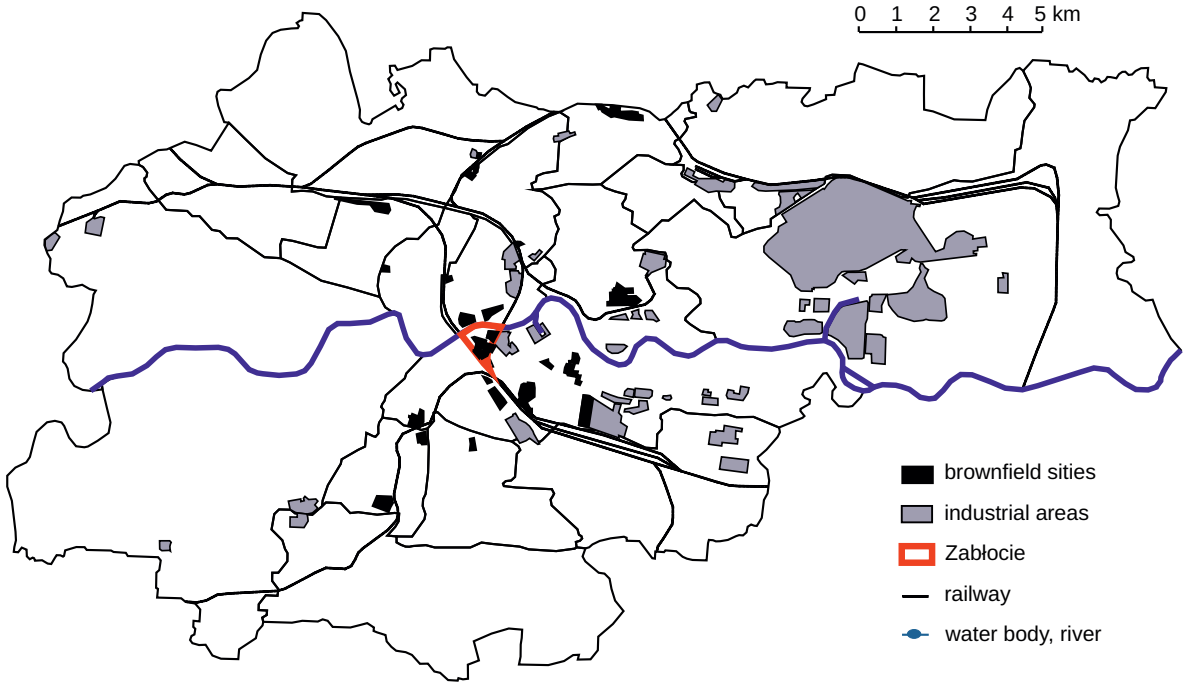

Figure 2. Distribution of industrial and post-industrial sites in Kraków

Source: Author's compilation.

A prime example of an industrial area undergoing dynamic transformations is Zabłocie, situated in the northwestern part of the XIII District Podgórze in southeastern Kraków. Bordering the Vistula River to the north, Zabłocie is relatively close to the city centre, approximately 3 km from the main market square (Figure 2). Industrial activity in the area ceased in the 1990s, following the onset of Central Europe's political and economic transformation. The collapse of enterprises led to widespread unemployment and the gradual deterioration of infrastructure. After a decade of stagnation, the area fell into comprehensive degradation and crisis, adversely impacting its socio-economic and spatial dynamics and diminishing its importance and appeal. This decline occurred despite the area's existing potential, which includes a favourable location, proximity to the city centre, and a rich industrial history. It was not until a dozen years later that local authorities initiated remedial action to revive and redevelop the area, incorporating new functions while preserving some of its industrial legacy. These revitalisation efforts have transformed Zabłocie into one of Kraków's most prestigious areas, attracting developers, investors and international companies. Consequently, the area has also drawn in new residents, employees and visitors (Madeja & Smętkiewicz, 2021).

Research methods and data sources

For a comprehensive study on the transformation of industrial and post-industrial areas in Wrocław and Kraków, two areas with similar characteristics were selected: Kleczków in Wrocław and Zabłocie in Kraków. The selection was intentional, based on long-term observations aimed at identifying regions that have undergone significant changes in recent years (using the expert method). Both areas share key attributes, including a central location, well-developed transportation infrastructure (such as railway lines and major roadways), and a high level of industrial development prior to 1989. Following the decline of industry, both areas experienced a period of degradation, which was followed by gradual revitalisation through targeted 'repair' processes, leading to their recent revival.

To gain a deeper understanding of the changes in these post-industrial districts, the following research and analyses were conducted:

1. Demographic analysis, based on data from the PESEL[1] database (Universal Electronic System of Population Records) provided by the Ministry of Digitisation, which included:
   a) an examination of population changes in the study areas between 2000 and 2020, categorised into sub-periods: 2000–2004, 2004–2008, 2008–2012, 2012–2016, 2016–2020;
   b) an analysis of the population structure by economic age group in 2020, categorised into pre-working age, working age and post-working age;
   c) an assessment of population density per dwelling unit in the years 2000–2020.
2. Morphological and functional analysis, based on field research (2022) and cartometric analysis of cartographic sources[2], which focused on:
   a) the number of buildings and changes in their proportions in the examined areas between 1998/2003 and 2022;
   b) the proportions of land use by a dominant function, categorised into industrial, service or residential, between 1998/2003 and 2022.

The data and cartographic sources employed in this study have a dual nature. They facilitate a relatively detailed examination of the trends, directions, scale and dynamics of changes occurring on brownfield sites. However, their limited precision makes it impossible to confirm with absolute certainty that the presented picture accurately reflects reality.

The research primarily employed the retrospective method, commonly used in urban morphology studies (Miszewska, 1979). This method involves comparing the same information across two or

[1] The PESEL database, while useful for assigning a specific number of residents to specific addresses, can underestimate the actual number of residents by several to over 100%, depending on the type and location of the area. However, it remains one of the few available databases in Poland that provides this level of detail (Kuzara & Szmytkie, 2022).

[2] The following cartographic sources were used in the study:
For Wrocław: the topographic map of Poland (M-33-35-C-a-1 Wrocław-Różanka: 1:10,000; 1998)
For Kraków: the orthophoto map 1: 10 000 (2003) from the Municipal Spatial Information System of Kraków

more periods to determine the directions and dynamics of changes. To gain a deeper understanding of the transformations, the results obtained for the former industrial sites in the studied areas were compared with analogous results for the entire cities where these changes occurred (Table 1).

Table 1. List of research methods and tools

Research methods and tools	Characteristics
Expert method	Selection of research areas
Analysis of statistical data	Presentation of a statistical picture of the observed demographic, morphological and functional changes
Field research	Field inventory of morphological and functional changes
Analysis of cartographic sources	Analysis of the distribution of buildings
Retrogressive method	Comparison of the tested parameters over time
GIS tools and software	Visualisation of the results of the analyses

Source: Author's compilation.

Results

Demographic changes

Between 2000 and 2020, the population of both Wrocław and Kraków remained relatively stable, according to the PESEL database. In Wrocław, the population decreased slightly from 603,988 to 583,385 (-3.4%). In Kraków, the population increased marginally from 707,272 to 708,572 (+0.2%). However, the post-industrial areas of Kleczków and Zabłocie exhibited much more pronounced changes in population. In Kleczków, the number of inhabitants increased from from 1,385 to 2,431 (+75.5%), while in Zabłocie, it increased from 336 to 1,442 (+329.2%) (Figure 3).

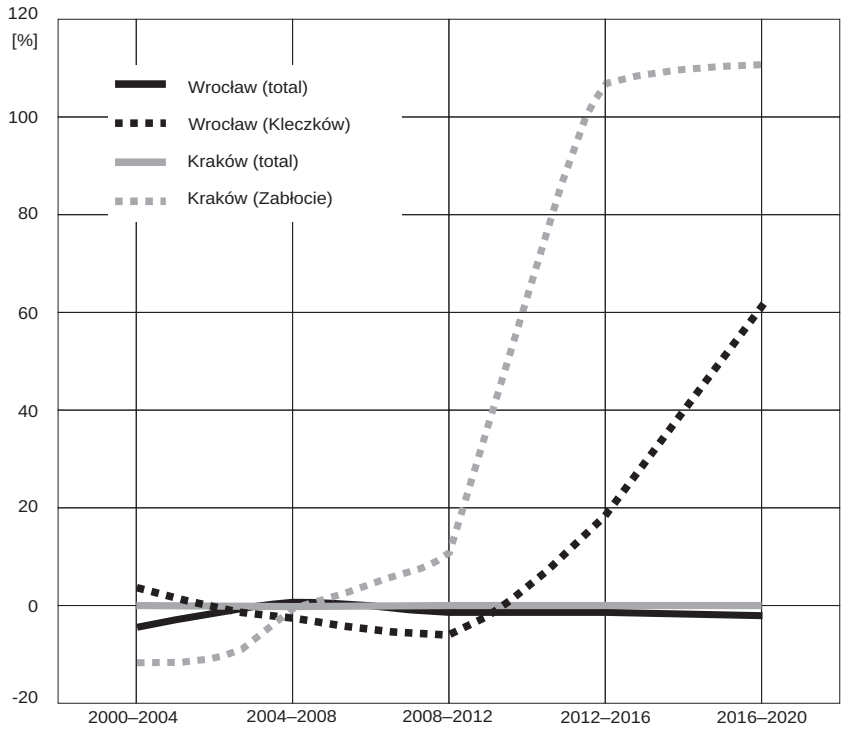

Figure 3. Changes in the population of the examined cities and their selected post-industrial areas: 2000–2020

Source: Author's compilation based on the PESEL database.

Significant changes have occurred not only in the number of inhabitants of post-industrial areas but also in their age structure. The influx of new residents has led to a significant increase in the

proportion of individuals in pre-working and working age groups compared to the average for the analysed cities. Specifically, post-industrial areas tend to have several to over a dozen per cent more inhabitants in those age groups compared to other parts of the cities. In contrast, these areas have a significantly lower proportion of individuals in post-working age groups compared to the average. This trend is particularly pronounced in the Zabłocie area of Kraków (Figure 4).

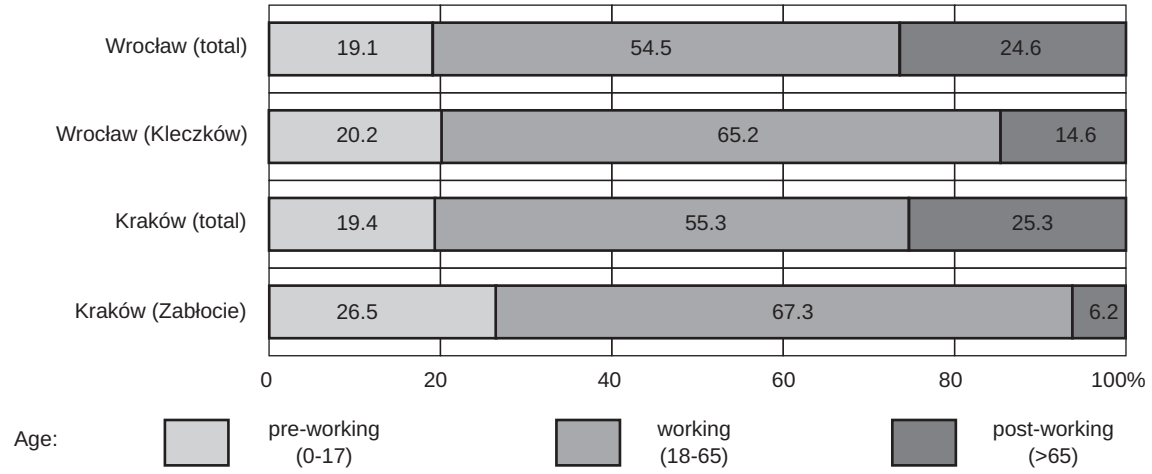

Figure 4. Population structure by economic age group of the surveyed cities and their selected post-industrial areas in 2020

Source: Author's compilation based on the PESEL database.

The transformations also led to changes in the density of inhabitants per dwelling unit. Between 2000 and 2020, Wrocław experienced a 4.9% decline in density from 2.44 to 2.32 inhabitants per unit. However, the examined post-industrial areas saw a more significant decline, with a 33.2% decrease from 2.82 to 1.91 inhabitants per unit. A similar trend was observed in Kraków, where the overall density decreased by 2.1% from 2.39 to 2.34 inhabitants per unit. In the post-industrial area of Zabłocie, the density decreased by 24.1% from 2.45 to 1.86 inhabitants per unit (Table 2).

Table 2. Changes in the population density per dwelling unit in Wrocław and Kraków and their selected post-industrial areas: 2000–2020

Area/year	number of people per dwelling unit		
	2000	2020	2000–2020
Wrocław (total)	2.44	2.32	-4.9%
Wrocław (Kleczków)	2.82	1.91	-33.2%
Kraków (total)	2.39	2.34	-2.1%
Kraków (Zabłocie)	2.45	1.86	-24.1%

Source: Author's compilation based on the PESEL database.

Morphological and functional changes

The morphological changes in the studied post-industrial areas of Wrocław and Kraków between 2000 and 2020 led to significant changes in the number and size of buildings. In Wrocław's Kleczków district, the number of buildings increased by 31.9% from 373 to 492, and the share of built-up areas in the district rose by 2.7 percentage points from 11.8% to 14.5%. In contrast, the Zabłocie district in Kraków, which had been extensively developed for industrial and warehouse purposes, exhibited different trends. The number of buildings decreased by 2.6% from 228 to 222, and the share of built-up areas decreased by 1.7 percentage points from 22.5% to 20.8% (Table 3).

An analysis of the share of building space by dominant function – industrial, service and residential – provides valuable insights into the morphological and functional changes in the studied areas.

Between 1998/2003 and 2022, both the Kleczków district in Wrocław and the Zabłocie district in Kraków experienced a substantial decline in the share of industrial functions, ranging from 50% to 80%. Conversely, the residential function emerged as the primary beneficiary of these changes, gaining importance during this period and increasing by 50–70% (Table 4).

Table 3. The number of buildings and changes in the share of built-up areas in the Kleczków district in Wrocław and Zabłocie in Kraków: 1998/2003–2022

Area/year	Number of buildings			Share of built-up area		
	1998/2003	2022	1998/2003–2022	1998/2003	2022	1998/2003–2022
Wrocław (Kleczków)	373	492	+31.9%	11.8%	14.5%	+2.7 p.p.
Kraków (Zabłocie)	228	222	-2.6%	22.5%	20.8%	-1.7 p.p.

Source: Author's compilation.

Table 4. Share of building space by dominant function (industrial, service, residential) in the Kleczków district in Wrocław and Zabłocie in Kraków: 1998/2003–2022

Area/year	Share of building space by dominant function:								
	Industrial			Services			Residential		
	1998/2003	2022	1998/2003–2022	1998/2003	2022	1998/2003–2022	1998/2003	2022	1998/2003–2022
Wrocław (Kleczków)	75.0%	22.8%	-52.2 p.p.	10.8%	10.6%	-0.2 p.p.	14.2%	66.6%	+52.4 p.p.
Kraków (Zabłocie)	88.5%	9.8%	-78.7 p.p.	6.2%	13.4%	+7.2 p.p.	5.3%	76.7%	+71.4 p.p.

Source: Author's compilation.

The scale of changes is presented on land use maps of the study areas for 1998/2003, and 2022 (Figure 5).

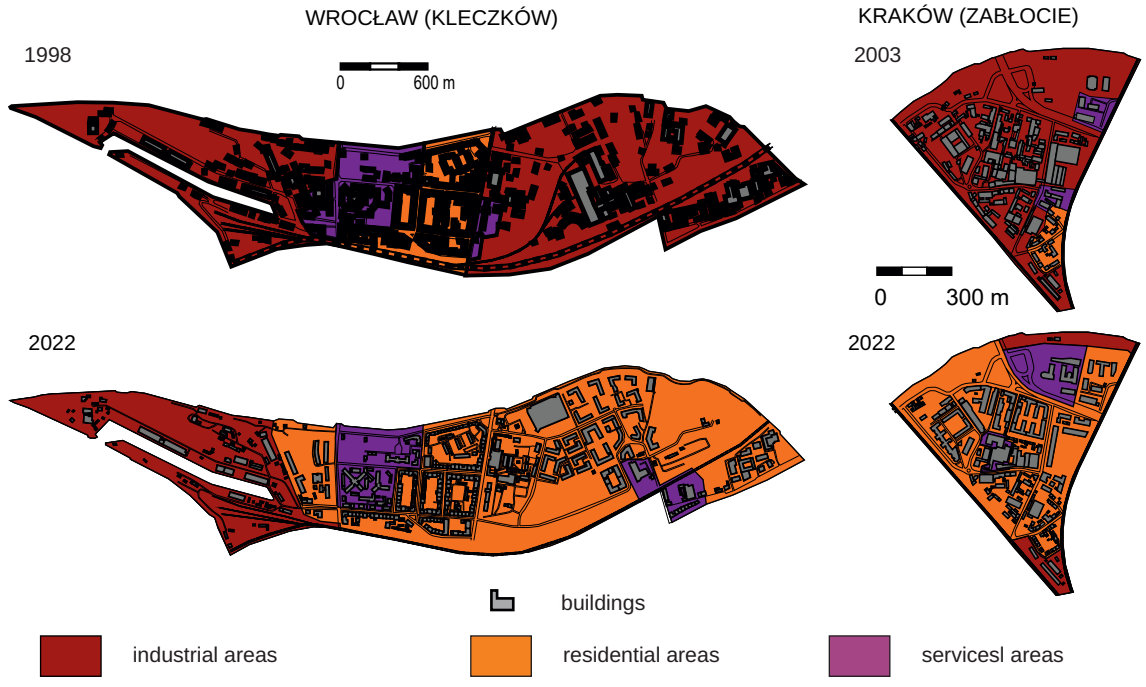

Figure 5. Changes in land use and function for post-industrial areas of Wrocław and Kraków: 1998/2003–2022

Source: Author's compilation.

The transformation process in the studied areas also led to significant changes in their physiognomy (physical appearance). The process primarily involved the demolition of existing industrial buildings, followed by new developments with dominant residential and service functions. Examples of such transformations include the demolition of the Cosmetics Factory Miraculum in Zabłocie, which was replaced by the Atal Residence Zabłocie apartments, as well as the construction of Pasaż Podgórski on the site of former factories related to the iron products industry. Similarly, in Wrocław, the ZNTK production facilities were demolished, and the Promenady Wrocławskie housing estate was constructed. Furthermore, both studied areas have seen the construction of gated communities, which can have negative social and spatial impacts. These developments contribute to the progressive privatisation of space, aligning with the phenomenon of ghettoisation and fostering social segregation.

The physiognomic transformations of the former industrial areas rarely pay homage to their industrial heritage. The inventory of both study areas reveals that when such references are made, they often take the form of fragments of industrial buildings or infrastructure, such as chimneys, tracks, and small-scale industrial architectural features. Additionally, the area's industrial history is acknowledged through commemorative information boards, murals and the naming of new spaces that reference its former industrial functions. Examples of this include the naming of landmarks such as Wisła Station Park and Restaurant Emalia (Enamel), as well as streets such as Przemysłowa (Industrial), Ślusarska (Locksmith), and Zakładowa (Production Facility) (Figure 6).

Figure 6. Examples of current developments in Kleczków in Wrocław (upper) and Zabłocie in Kraków (lower)

Source: Photos by the authors.

Selected implications observed during field research

The demographic changes mentioned above (an increase in inhabitants) and morphological and functional transformations (changes in the number of buildings, their size and function) in former industrial areas have had far-reaching consequences for the functioning of these areas (Table 5).

The population growth, shift in age structure, and extensive development of residential buildings in these areas have given rise to two concerning issues. Firstly, the existing institutional infrastructure is insufficient to cater to the changing demographic needs, with a notable lack of public educational and primary healthcare facilities, such as primary schools and general practitioner clinics, in both areas. In contrast, a range of private services, including those related to childcare, education and healthcare, as well as premium amenities for leisure, entertainment and dining, are available. Secondly, the expansion of new developments, coupled with the rapid increase in users and modernisation of infrastructure, has been accompanied by a lack of corresponding investment in new transportation infrastructure. This has led to significant traffic congestion in these districts during peak hours, as observed in field research. The existing single-lane roads, which provide access to these areas, have proven inadequate to accommodate the surge in users, resulting in frequent congestion and parking difficulties for both residents and visitors. However, Zabłocie has been less affected by these issues due to the local government's revitalisation efforts in the early 21st century, which have improved its connectivity to other parts of Kraków. This has been achieved through the construction of new and modernised road infrastructure, including roads, bridges and footbridges, as well as the development of railway infrastructure, such as the Kraków Zabłocie railway station, and the introduction of convenient public transport connections, including the Kraków Fast Tram.

The functional transformations in the studied post-industrial sites have had a dual impact. On one hand, they have enhanced the image and prestige of the areas, making them more attractive as locations to live, invest and visit. On the other hand, gradual gentrification has led to increased polarisation and the emergence of social conflicts between the residents of new developments (such as modern residential blocks) and those living in older established areas (characterised by 19th and 20th-century tenement houses).

Table 5. Selected positive and negative effects of post-industrial area transformations in Wrocław and Kraków

Sphere	Positive Effects	Negative Effects
Functional sphere	• Enhanced aesthetics and spatial order, with consideration for cultural heritage preservation • Improved road and street conditions, including sidewalks, particularly in new developments • Enhanced area image, making them attractive to residents, visitors and investors • Creation of high-quality public spaces accessible to diverse social groups	• Pressure from investors and developers to maximise space utilisation through increased building density • Inadequate adaptation of transportation infrastructure to increased vehicle traffic, insufficient parking and limited bicycle paths • Creation of gated communities, leading to spatial segregation • Disruption and inconvenience caused by ongoing construction and renovation • Insufficient allocation of green areas
Economic sphere	• Emergence of innovative and modern services, including those from the creative sector	• Introduction of exclusive services and products catering to a limited number of affluent residents, a consequence of gentrification • Potential increase in the price of real estate, services, products and cost of living
Social sphere	• Influx of new, young and entrepreneurial inhabitants • Increased attractiveness of the studied areas • Improved living conditions, encompassing aesthetics, safety, and other aspects	• Gentrification, potentially leading to local conflicts and social segregation • Increased population density • Growth in urban traffic due to new residents and visitors • Lack of public places facilitating resident integration • Selective establishment of primary public social institutions, leading to gaps in essential services (e.g. medical clinics and primary schools)

Table 5. – cont.

Sphere	Positive Effects	Negative Effects
Cultural sphere	• Partial preservation of the historical and cultural heritage of the studied areas, including commemorative plaques, nomenclature, revitalisation of select buildings and construction of new ones in the industrial style • Revitalisation and adaptative reuse of industrial buildings for the development of the creative sector • Development of cultural initiatives, such as murals and events, driven by the local community's interest in the areas' history • Creation of a unique character and atmosphere in modernised industrial-style spaces	• Inadequate preservation of the areas' historical and cultural heritage, with only partial revitalisation of select buildings and widespread demolition and replacement with new developments • Partial erasure of the industrial past, compounded by insufficient informational, educational and promotional activities related to the areas' industrial heritage

Source: Author's compilation.

Discussion

The research findings and their implications are consistent with those observed in numerous post-socialist cities in Central Europe, where significant transformations have reshaped their post-industrial areas (e. g. Cudny et al., 2022; Sýkora, 2009; Stanilov, 2007). A distinctive aspect of this research is its use of specific housing estates as case studies, providing a more comprehensive understanding of these changes.

In the aftermath of 1989, many post-socialist cities of Central Europe experienced large-scale suburbanisation, leading to stagnation or slow depopulation. Examples of these demographic trends can be seen in cities such as Łódź, Poland (Marcińczak & Ogrodowczyk, 2014), Pécs, Hungary (Lux, 2022) and Ostrava, Czechia (Rumpel et al., 2014), among others.

However, suburbanisation and depopulation do not unfold uniformly, and in specific areas of these cities, contrasting trends can be observed. This is indeed the case in the post-industrial areas of the two large Polish cities under study, where rapid population growth was recorded between 2000 and 2020 (Figure 3). A characteristic feature of demographic change in these areas is the increase in the number of inhabitants in pre-working and working-age groups, with a higher proportion of these categories compared to the city average (Figure 4). Concurrently, the population growth was accompanied by an increase in the number of buildings and the growing importance of the residential function (Tables 3 and 4). The extensive development of buildings in the studied post-industrial areas led to a decrease in residential population density (Table 2). Nevertheless, caution is advised when interpreting these results, as they should be understood in a local context (specific to a district or housing estate) rather than being extrapolated to a broader scale (the entire city).

According to many researchers, population growth in post-socialist cities has slowed down or even stagnated in recent decades, and this trend is likely to continue (Turok & Mykhnenko, 2008; Stryjakiewicz et al., 2014). As a result, a further increase in average age, a decline in the proportion of working-age individuals relative to those of post-working age, and a shift in migration patterns can be expected (European Commission, 2005). This trend is anticipated to hold true for Wrocław and Kraków. Research by Sikorski (2019) has shown that post-industrial areas in Wrocław account for only 4.0% of the city's total area. Although the demographic changes in these areas are significant and diverge from general urban trends, they are unlikely to reverse the broader demographic shifts occurring in the cities.

The analyses of morphological and spatial functional transformations of these areas in Wrocław and Kraków reveal an intriguing picture. Initially, in the 1990s, the functional changes in these areas, as in other post-socialist cities, were largely spontaneous, bottom-up and unplanned (Gasidło, 1998; Piech, 1999; Białka, 2005; Sikorski, 2013). However, as the transformation of post-socialist cities progressed, their post-industrial areas began to be transformed more deliberately, driven by

revitalisation programmes initiated by local government authorities (Kaczmarek, 2001). Currently, private developers are a primary driving force behind many of these transformations, focusing primarily on developing residential or commercial functions (Gyurkovich & Gyurkovich, 2021). Municipal authorities also play an important role, often striving to activate and revitalise these areas by promoting academic or cultural functions (Jarczewski & Huculak, 2010). While the overarching goal of these processes is socio-economic revitalisation (Kovács et al., 2013; Kaczmarek & Marcińczak, 2013), The actual outcomes are complex, with both positive and negative effects, and the expected gentrification of these areas does not always occur. Despite the efforts of various stakeholders, the transformation of post-industrial areas remains a complex process that is not always successful (Gasidło, 1998).

The morphological and functional changes observed in the post-industrial areas of Wrocław and Kraków reflect characteristics common to many similar transformations in other post-socialist cities across Central Europe. The progressive deindustrialisation of these cities has resulted in functional transformations of former industrial areas, contributing to increased social differentiation and gentrification, and the introduction of new services and land use patterns. The involvement of multinational companies, developers and foreign direct investment has become a driving force in transforming local economies and urban geography, often resulting in radical changes to urban landscapes and panoramas (Sýkora, 2009). A similar pattern was observed in the districts of Wrocław and Kraków, where the entry of new investors, frequently backed by foreign capital, has typically served as a catalyst for changes that culminate in nearly complete transformations.

Conclusion

In the post-socialist cities of Central Europe, the use and management of space have not always been rational. This issue largely stems from a legacy of the socialist period, during which spatial management was heavily restricted, followed by a sudden release of space after the socio-economic transformation that lacked adequate control mechanisms or specific development plans. As a result, considerable spatial chaos ensued, particularly in post-industrial areas.

Initially, in the 1990s, transformations in post-industrial areas occurred spontaneously and chaotically. As various companies and functions emerged in these areas, they often leveraged existing infrastructure without significant oversight or regulation, resulting in a lack of control over who occupied these areas and how they transformed the existing space. As a result, formerly bland industrial spaces were revitalised into vibrant, diverse and occasionally gaudy urban spaces, offering a wide range of services and activities (Sikorski, 2013).

As Central European countries have developed and made socio-economic progress, the approach to managing the spaces of former industrial areas has also evolved. Increasingly, transformations in these areas are being conducted with greater respect for their cultural and historical heritage (Gyurkovich & Gyurkovich, 2021). However, awareness among decision-makers and residents regarding the importance of preserving this heritage during the transformation process has been inconsistent. Research indicates that the transformations implemented in post-industrial areas of large post-socialist cities have only been partially successful. These transformations have resulted in numerous adverse effects and consequences in the studied areas in Wrocław and Kraków (Table 5).

An examination of contemporary transformations, particularly in light of field observations, reveals that these changes are primarily driven by the commercialisation of space for services and housing, as observed in both Zabłocie and Kleczków. Consequently, only a few sites from the industrial era have been preserved within the revitalisation programmes, while densely arranged service and residential buildings that mimic industrial styles are often constructed around them. Meanwhile, remnants of former industrial activity are sparsely preserved and only occasionally visible in the landscape. As a result, the space in these areas is becoming increasingly overwhelmed, resembling a “sea of concrete” that, as it develops, becomes less accessible and less attractive to both inhabitants and visitors.

There is no single ideal concept for transforming urban space that can fully satisfy every stakeholder, including residents, visitors and other users. However, the experience of these cities

suggests that when transforming post-industrial areas, the primary goal should be to preserve the site's industrial heritage. This can be achieved by developing a comprehensive revitalisation programme that incorporates social consultations and adheres to decisions made through a participatory process. Positive references to industrial history can be made by introducing informational and promotional elements in public spaces, as well as through social initiatives that disseminate knowledge, such as guided tours, workshops, thematic meetings, and publications. Conversely, the transformation of former industrial areas should be guided by a process that resists the pressure exerted by potential investors, who often prioritise maximising their benefits over preserving the area's heritage and culture.

Post-industrial areas in the post-socialist cities of Central Europe hold considerable development potential, while also boasting a rich historical and cultural heritage. However, effectively harnessing the opportunities and strengths of these areas to achieve rational and beneficial socio-economic and spatial development – while also protecting, preserving and promoting their intangible assets – presents a challenge in reconciling the diverse interests of various social groups. However, when activities are planned with a forward-thinking perspective and a consideration of long-term effects, they can foster a collaborative approach that engages all stakeholders, including authorities, residents, local entrepreneurs, investors and developers. Consequently, it is essential to continuously monitor changes occurring in post-industrial areas to ensure that they align with the principles of sustainable development while also preserving the valuable cultural heritage of these sites.

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